



NJD-iScience

№167

The Norwegian Journal of Development of
the International Science





№167/2025

Norwegian Journal of development of the International Science

ISSN 3453-9875

It was established in November 2016 with support from the Norwegian Academy of Science.

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Norwegian Journal of development of the International Science

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AGRICULTURAL SCIENCES

THE LAW OF AGRICULTURAL LAND RECLAMATION IN MODERN REALITIES: MISSION AND DEVELOPMENT TRENDS

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<https://doi.org/10.5281/zenodo.17492553>

Abstract

Based on a retrospective analysis of the mission and development trends of agricultural land reclamation, within the context of assessing crop water demand standards within the «impact-change-consequences» triad, trends and directions of changes in natural processes were identified. Within this ideological framework, a law of agricultural land reclamation and four of its most important consequences for understanding ways to ensure the environmental sustainability of agricultural lands were formulated. These consequences open the possibility of conducting a comprehensive assessment of the state of river basin watersheds, which are the spatial bases for population and economic activity, and developing a unified program for their improvement within the context of the triad: ecology (ensuring the quality of the human habitat), economy (increasing the purchasing power of society), and society (improving the well-being of the population).

Keywords: melioration, agricultural land, water consumption, agricultural crops, law, consequences, soil, means.

Introduction. Science is a system of organized knowledge, the validity of which is verified and continually refined through social practice. Within its framework, the world is understood through concepts and categories, using logical thinking based on the materialist theory of knowledge. Concepts reveal the essence of natural phenomena and processes, generalizing their essential characteristics across temporal and spatial dimensions, where the most general and essential properties, structures, and interrelations of phenomena of reality and knowledge are reflected in the fundamental categories of science.

The history of the development of nature management science is a path of self-knowledge in a changing world, an understanding of the driving forces behind its development, and a unique marketing of its potential for the development of human civilization, which is formed and functions on the basis of the laws of the philosophy of «negation of negation», which is one of the fundamental laws of dialectics, characterizing the direction, form, and results of development processes.

Concepts and categories form the logical framework of the scientific theory of nature management and conservation, within which its empirical focus-the reclamation of agricultural land-is formed and functions, defining a system of values and designating the object of influence. Such values are currently humans and their habitat, and the object of influence is the soil, as the main component of the landscape biosphere as a whole and as the primary means and object of labor in agricultural production [1], with recognition of their equal importance in terms of the triad: ecology (ensuring the quality of the human habitat), economics (increasing the purchasing power of society), and society (improving the well-being of the population) [2].

The reality highlighted here for cognition and practical activity, as follows from A.N. Kostyakov's definition, is viewed exclusively through the prism of

the «problem-solution» and «goal-means» relationships. The problem is unfavorable natural conditions, its solution is their radical improvement; the goal is the most efficient use of land resources, and the means is a system of organizational, economic, and technical measures. [3]

The combination of three possibilities - a clear expression and delineation, on the one hand, and on the other, the expansion of the «fields» of values for Man, allows A.N. Kostyakov to take another important step - to give the melioration of agricultural lands a pragmatic status, as a geo-ecological limitation - «it is necessary to keep nutrients in the biological cycle in every possible way and in no case allow the acceleration of the geological cycle of water and chemical elements, thereby preventing pollution and deterioration of the natural environment» [4].

Within the framework of this ideological view, methods for regulating the biological water consumption of agricultural crops were developed, based on a comprehensive accounting of the input-output elements of the water balance in the «soil-plant and surface layer of the atmosphere» system, as a reflection of the law of conservation of energy, since the process of heat and moisture exchange at a specific point in space over a known period of time is characterized by a balance of energy input and output.

The total biological water consumption of agricultural crops, including water consumption for plant transpiration and physical evaporation from the soil surface, which is the main element of the water balance in the «soil-plant and surface layer of the atmosphere» system, is determined using empirical models as a function of climatic indicators [5-11]:

$$BWCAC_i = BC_i \cdot f(AT_i; RB_i; AHD_i; WSE_i) \quad (1)$$

where $BWCAC_i$ is the total biological water consumption of agricultural crops, mm; BC_i is the biological coefficient; AT_i - air temperature, °C; RB_i - radiation balance, kJ cm⁻²; AHD_i - air humidity deficit, mb; WSE_i

- evaporation from the water surface (mm), determined for individual months using N.N. Ivanov's formula:

$$WSE_i = 0,0018 \cdot (25 + AT_i)^2 \cdot (100 - RAH_i), \quad (2)$$

here RAH_i - is the relative air humidity, %.

In this regard, it is necessary to pay attention to one most important condition, which is practically not taken into account in the melioration of agricultural lands - this is the activity of the total biological water consumption of agricultural crops ($BWCAC_i$), namely the deficit of biological water consumption of agricultural crops ($\Delta BWCAC_i = BWCAC_i - AP_i$, where AP_i is atmospheric precipitation, mm), which perform important environment-forming, transforming and partially ecological functions, and cannot be arbitrary, but is always limited by the action of laws, the totality of which forms a set of fundamental provisions for the melioration of agricultural lands.

In the process of active development of agricultural land reclamation in certain regions of the world, a paradoxical situation has arisen, related to the fact that the development of irrigation, as an environment-forming system, has been considered for thousands of years a powerful stimulus for the well-being of the population of arid territories, and in Central Asia in the 20th century, it was irrigation that became the cause of the activation of the process of secondary salinization, which led to the deterioration of the environmental and economic situation in the region.

The characteristic feature of the development of agricultural land reclamation, as one of the most important factors in the intensification of agricultural production in the 20th century in Central Asia, required a radical solution to combat secondary salinization of irrigated lands. In 1964, the Resolution of the All-Union Scientific and Technical Conference on the issues of combating salinization and improving the melioration state of irrigated lands in Central Asia was adopted, based on the construction of drainage and a leaching irrigation regime, recognized as the main measure to combat salinization on irrigated lands [12], which provided for the creation of a leaching irrigation regime on irrigated lands, with an intensity of 20-30% of the net irrigation norm, ensuring the creation of downward flows of moisture in the aeration zone for desalination

$$SAN_i = BPC_i \cdot MC_i \cdot \sum_{i=1}^N SAHD_i - (PRMS_i + APGS_i); \quad (4)$$

$$SAN_i = BPC_i \cdot MC_i \cdot \sum_{i=1}^N SATD_i - (PRMS_i + APGS_i); \quad (5)$$

$$SAN_i = BPC_i \cdot MC_i \cdot \sum_{i=1}^N WSE_i - (PRMS_i + APGS_i), \quad (6)$$

where BPC_i and BLC_i - biophysical and biological coefficients of water consumption of agricultural crops; MC_i - microclimatic coefficient; $SAHD_i$ - sum of average daily air humidity deficits for the calculation period, mb; $SATD_i$ - sum of average daily air temperatures for the calculation period, mb; WSE_i - evaporation for monthly time intervals according to N.N. Ivanov, mm; N_i - duration of the billing period, days or months;

$$SAIN_i = IRISIL_i = (IRFHSR_i - WCIF_i \cdot CGWCAC_i \cdot CGSM_i) / RCSSSR_i, \quad (7)$$

where $IRISIL_i$ - irrigation rate ensuring the meliorative well-being of irrigated lands, $m^3 ha^{-1}$; $IRFHSR_i$ - irrigation rate (net) under favorable hydrological and soil-meliorative conditions, $m^3 ha^{-1}$; $WCIF_i$ - total water consumption by the irrigated field, $m^3 ha^{-1}$; $CGWCAC_i$ - coefficient taking into account the share of possible participation of groundwater in water consumption of

of the upper soil layer, and drainage was supposed to ensure the removal of the leaching part of the irrigation norm and maintaining the groundwater level at a depth of 2.5-3 meters [13], but this measure had a serious side effect, since the indicated circumstances are not causes, but consequences, and the fight against consequences inevitably leads only to a worsening of the situation.

Thus, the change in worldview in the field of standardization of total water consumption of agricultural crops ($WCAC_i$), namely the deficit of water consumption of agricultural crops ($\Delta WCAC_i$), opened a «Pandora's box», which is a source of grief and misfortune, which led to the formation of a pyramid of water consumption standards for agricultural crops in the 20th century in time aspects:

- the first period before 1960, where highly productive meadow-gray soils and gray soil-meadow soils with a close occurrence of groundwater were used for irrigation of lands, which ensured the preservation of the natural hydromorphic regime and full water circulation, which made it possible to reduce to a minimum the values of irrigation norms and the impact on the natural environment, which is determined by the formula of A.N. Kostyakov [3]:

$$SAN_i = CYAC_i \cdot SWCAC_i - (PRMS_i + APGS_i); \quad (3)$$

where $CYAC_i$ is the yield of agricultural crops, $t ha^{-1}$; $SWCAC_i$ - specific water consumption of agricultural crops, $mm t^{-1}$; $APGS_i$ - atmospheric precipitation during the growing season, mm; $PRMS_i = APNV_i \cdot ARCAP_i \leq SMRLMC_i$ - productive reserve of moisture in the soil at the beginning of the growing season, which can be used by plants, mm; $APNV_i$ - amount of precipitation outside the growing season, mm; $ARCAP_i$ - coefficient of accumulation and preservation of precipitation in the soil by the beginning of the growing season; $SMRLMC_i$ - moisture reserve in the meter-thick soil layer corresponding to the lowest moisture capacity, mm;

- the second period (1960-1965), when there was an intensive growth in total and specific water consumption, with the aim of creating «comfortable» conditions for obtaining a «record» harvest from agricultural crops, that is, the concept of «biological irrigation norm» (SAN_i) appeared [6; 8; 9]:

- the third period (1965-1975), where, in connection with the development of low-productivity and secondary saline lands, in order to regulate and manage the salt regime of the soil of irrigated lands, it was recommended to increase the biological irrigation rate by 20-30%, that is, the concept of «soil-reclamation irrigation rate» ($SAIN_i$) appeared [14], which is determined by the formula of F.F. Vyshpolsky:

agricultural crops; $CGSM_i$ - coefficient taking into account the size of permissible participation of groundwater in subirrigation when its mineralization changes; $RCSSSR_i$ - melioration coefficient, taking into account the degree of salinization and salt release of soils in the aeration zone;

- the fourth period (1975–1995) was characterized by the conversion of automorphic soils into hydromorphic and semi-hydromorphic ones, which contributed to the activation of secondary salinization on irrigated lands. The discharge of drainage water into rivers led to an increase in the mineralization of river water in the

$$MLIR_i = (BWCAC_i - AP_i) \cdot \{[1/(1 - \overline{GM}_i)] \cdot \{[(\overline{IWM}_i - 1)/\overline{GD}_i] + 1\}\}; \quad (8)$$

$$\overline{GM}_i = GM_i / PSSM_i; \overline{IWM}_i = (IWM_i / PSSM_i) \quad (9)$$

$$\overline{GD}_i = GD_i / (HDP_i \cdot SP_i); \quad (10)$$

where GM_i is the groundwater mineralization; $PSSM_i$ is the permissible mineralization of the soil solution; IWM_i is the mineralization of irrigation water; GD_i is the depth of groundwater; HDP_i is the hydrodispersion parameter; SP_i is the soil porosity;

- the fifth period since 1995, a decrease in the overall and a sharp increase in specific water consumption, against the background of the desire to stabilize

$$ETAL_i = (RBAL_i - THF_i - HFIS_i) / IHVO_i \rightarrow \quad (11)$$

$$ETAL_i = RBAL_i / IHVO_i \rightarrow \quad (12)$$

$$\Delta ETAL_i = (RBAL_i / IHVO_i) - (PRMS_i + APGS_i), \quad (13)$$

where $ETAL_i$ is the reference evapotranspiration of agricultural land; $RBAL_i$ - radiation balance of agricultural land; $IHVO_i$ - latent heat of vaporization; THF_i - turbulent heat flux; $HFIS_i$ - heat flux into the soil.

Thus, a retrospective analysis of the scientific basis for agricultural water requirements shows that, in the pursuit of record crop yields by creating favorable conditions for plants as objects of reclamation, science and practice have violated the fundamental principles of water conservation in nature management. Instead of seeking ways to prevent geological cycles in total water consumption, they have always sought to increase it, with the caveat of comprehensively regulating key environmental factors. As a result, having gained unprecedented power through agricultural land reclamation and, by defying the laws of nature, humans have driven themselves into a dead end, depriving themselves of prospects for development within the framework of modern civilizational paradigms. Irrigated lands have entered an active stage of "succession," where crop water requirements serve a destructive function.

The aim of the study is to substantiate the law of agricultural land reclamation based on the materialistic theory of knowledge and natural scientific concepts of modern ecological and economic mechanisms for the use of natural resources.

Materials and methods of research. Research materials are based on the analysis of the experience of agricultural land reclamation in previous years, within the framework of a comprehensive assessment of their activities in terms of the triad «impact - change - consequences», allowing to identify the trend and direction of activity-natural processes.

The research method is based on the materialistic theory of scientific knowledge, which recognizes socio-historical practice as the basis of knowledge and the criterion of truth, and generalizes the methods and techniques of science (experiment, modeling, analysis and synthesis).

Research results. Systematization and analysis of the research base demonstrate that agricultural land reclamation serves not only as a cognitive object with spe-

Central Asian region, which required an increase in biological irrigation rates to enhance the leaching regime by 40–60%. Thus, the concept of «meliorative-leaching irrigation rate» ($MLIR_i$) [15] was introduced, which is determined by the formula of S.F. Averyanov:

specific water consumption on the basis of environmental regulation of water requirements of agricultural lands [16; 17; 18], based on the principle of energy balance of heat, moisture and nutrients, taking into account natural regimes, which is determined by the formula of M.I. Budyko [19]:

cific properties, nor is it limited to the territorial organization of water use and the interaction of system elements. It should also be considered an integral resource embodying the inherent attributes of the territory, a unique formation within the geosystem capable of self-organization and performing environment-forming, resource-containing, and resource-reproducing functions.

However, in the science of agricultural land reclamation in the last century, the main attribute of the fundamental nature of science was considered to be the presence of its own material object of knowledge, which would exist independently in a certain dialectical form of the movement of matter, which allowed the emergence of the terms «biological norm of water demand», «soil-reclamation water demand of agro-landscapes for the complex regulation of the main factors of plant life» and «reclamation-washing water demand of agro-landscapes for the regulation of the hydrogeochemical regime of soils and groundwater» in the technological processes of agricultural land reclamation, and taking into account the mineralization of irrigation water [20]. On the basis of these concepts, the «Enhanced standards of water demand for irrigation in the natural and climatic zones of the USSR» [21], «Irrigation standardization in the water management basins of Kazakhstan» [22] and «Assessment of the prospects for sustainable development of the states of the Aral Sea basin using model calculations» were developed, carried out in the Scientific Information Center (SIC) of the Interstate Coordination Water Management Commission (ICWC) [23], as well as the technology of irrigation of agricultural crops [24; 25], that is, these regulatory documents do not comply with such basic principles of agricultural land reclamation as «Increasing the biological and preventing the geological cycle of water and chemical substances» and, corresponding to the classification of the outstanding physicist Lev Landau, unnatural laws of nature and principles of nature management [26].

As a striking example of such a transformation of relations, we will pay attention to the drift of the concept of «water consumption standards for agricultural

land or crops», which is fundamental in the empirical wing of agricultural land reclamation:

- the biological norm of water demand of agricultural crops is the volume of water consumed by an agricultural field for transpiration of plants and physical evaporation from the soil at a specific point in space over a known period of time, taking into account their biological characteristics;

- the ecological norm of water demand for agricultural land is the volume of water consumed by an agricultural field for soil formation, corresponding to the radiation balance at a specific point in space for a known period of time, characterizing the balance of energy and substances that ensure a balanced flow of biochemical and geochemical processes;

- the soil-ameliorative norm of water demand for agricultural land is the volume of water consumed by an agricultural field for the complex regulation of the main factors of plant life in the «soil-plants- surface layer of the atmosphere» system at a specific point in space for a known period of time;

- the melioration and leaching rate of water demand for agricultural land is the volume of water consumed by an agricultural field to regulate the hydrogeochemical regime of soils and groundwater in the «soil-groundwater-plants- surface layer of the atmosphere» system at a specific point in space over a known period of time.

Understanding and systematically understanding the laws governing the functioning of soil as an object of reclamation, as well as plants as biological entities interacting with the soil-their habitat-combined with intuitive knowledge, can lead humanity to a deeper understanding of natural processes and to the development of a concept for managing the present based on predicting the future. This approach is key to ensuring the survival of not only human civilization but also the preservation of biological diversity on the planet.

Soil, considered an object of reclamation, must be perceived by plants as their environment and a primary factor in their life support, thus acting as a natural partner in biospheric interactions.

In this regard, it's necessary to address a crucial condition that's largely ignored in agricultural land reclamation. Its essence is as follows: any transformation of nature cannot be arbitrary, but is always constrained by objective laws, the combination of which forms a system of fundamental principles for agricultural land reclamation in the form of laws limiting its activities.

The Law on Agricultural Land Reclamation states:

«Any transformation of agricultural land must ensure the preservation of nutrients in the biological cycle with the goal of progressively increasing soil fertility and, under no circumstances, accelerate the geological cycle of water and chemical elements, thereby preventing pollution and deterioration of the natural environment». According to Zh.S. Mustafayev, this law has four key consequences that determine ways to ensure the environmental sustainability of agricultural land.

- the value guidelines for any transformation of agricultural land are people and their environment, and

the object of influence is the soil - as the main component of the biosphere and the landscape as a whole, as well as the main means and object of labor in agricultural production.

- the interaction of the material and energy resources of the natural system, which determine the standards for water consumption of agricultural lands, should ensure an energy balance of heat, moisture and nutrients, taking into account natural regimes aimed at the targeted regulation of the direction and intensity of soil-forming processes;

- Any transformation of agricultural land is relatively irreversible and causes responses that affect its ecological and biological potential. Its increase is possible only if the lower threshold of the maximum permissible level of water demand ($ETAL_{mini}$) - plant transpiration, which ensures the formation of biological masses (PT_i) - and the upper threshold of the maximum permissible level of water demand ($ETAL_{maxi}$) - ecological standards for the water demand of agricultural lands ($ESWCAL_i$), ensuring the targeted regulation and management of soil-forming processes on irrigated lands are observed.

- any change in the water requirement of agricultural land, taking into account the cyclical nature of crop cultivation in crop rotation (crop rotation) and climate change, should not exceed the ecological water requirement standards of agricultural land ($ESWCAL_i$), ensuring the preservation of their ecological and economic potential.

This law and its consequences are crucial for the justification and practical implementation of agricultural land reclamation. They enable a comprehensive assessment of the condition of river basin watersheds, which serve as the spatial basis for population distribution and economic activity. On this basis, a unified program for improving the area is being developed, taking into account a triad of priorities: ecology – ensuring the quality of the human habitat; economics – increasing society's purchasing power; and society – improving the well-being of the population.

Based on the materialist theory of knowledge, the concept of «law» in science and philosophy reflects the existence of a necessary, essential, stable, and repeatable relationship between natural phenomena. In the field of agricultural land reclamation, this means that the patterns of natural processes can be systematized and used for the controlled transformation of land. In addition to the general laws of nature, such patterns include the law of agricultural land reclamation formulated by A.N. Kostyakov and Zh.S. Mustafayev, which specifies the principles of interaction between humans and the natural environment in agricultural landscapes.

Conclusions. In conclusion, it should be noted that the established agricultural land reclamation mission is reviving the law of agricultural land reclamation. However, the conclusions reached within the study do not claim to exhaustively cover all aspects of modern environmental management and conservation issues; they are largely debatable and intended primarily to provide scientific support for agricultural land reclamation. These approaches should form the basis of an updated system of regulatory and methodological

documents governing the environmental justification of the design, construction, and operation of next-generation hydro-agrolandscapes.

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ARCHITECTURE

LIGHT AND SHADOW AS EXPRESSIVE MEANS OF ARCHITECTURE

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<https://doi.org/10.5281/zenodo.17492555>

Abstract

Light and shadow are fundamental expressive means in architecture, shaping the emotional, spatial, and symbolic perception of a building. This article explores the role of chiaroscuro contrasts in architectural composition, examining the philosophical, aesthetic, and technological aspects of their interaction. Particular attention is paid to the historical evolution of the perception of light—from the sacred meanings of antiquity to the rationalism of modernism and the dynamic light-based plasticity of the digital age. Examples of 20th- and 21st-century architects are analyzed, in whose works light becomes not simply a physical phenomenon, but a tool for the semantic and emotional organization of space. The paper identifies the synergy of light and shadow as categories in the artistic language of architecture, defining the image, atmosphere, and identity of space, and emphasizes their significance as a universal tool for the interaction of form, matter, and spirit.

Keywords: architecture, perception, composition, space, chiaroscuro

Introduction: Light and shadow are not simply physical phenomena, but categories that define the very essence of architectural thinking. In every era, architecture has sought not only to create material form but also to convey the immaterial sense of space that arises from the interplay of light and darkness. The architect works not with stone and concrete, but with the way these materials refract and reflect light, generating emotional meanings. Light brings architecture to life, revealing volume and structure, while shadow creates depth, mystery, and drama in perception. Their dialogue forms the visual language through which architecture can speak to people, evoking a sense of time, movement, and peace.

The historical development of architecture shows that the attitude toward light has always reflected the worldview of an era. In antiquity, sunlight symbolized the order of the cosmos and the harmony of existence; in Gothic architecture, it symbolized divine energy, propelling space upward; and in the era of modernism, it symbolized rationality, purity, and functionality of form. In the 21st century, light is becoming a communication medium, combining digital technology, materiality, and environmental interactivity. Architecture is becoming a living system, responding to human movement and natural changes.

Chiaroscuro shapes not only the visual perception of a building but also its psychological impact. Bright

daylight enhances dynamism and openness, soft, diffused light creates intimacy, and deep shadows evoke a sense of peace or mystical tension. This is why an architect manipulates light like an artist manipulates a palette—creating rhythm, emphasis, and emotion.

The purpose of this article is to examine the phenomenon of light and shadow as expressive means in architecture, determine their role in shaping spatial and artistic imagery, and identify patterns of historical evolution and contemporary trends in the interpretation of these categories. The study draws on the principles of architectural phenomenology, the aesthetics of perception, and the analysis of the compositions of prominent architects of the 20th and 21st centuries. Light and shadow are presented here not as antipodes, but as a unified system of expression, revealing the depth of architecture—its ability to create space imbued with meaning, energy, and inner light.

• Theoretical foundations of chiaroscuro composition in architecture

Light and shadow are inseparable categories of architectural perception, forming not only the visual but also the emotional foundation of space. Architecture does not exist in isolation, but in constant interaction with streams of light, which reveal its structure, materiality, and scale. It is through light that a person “reads” architectural form, sensing its depth and meaning. Shadow, in turn, is not the absence of light—it is

its continuation and boundary, creating the necessary tension between the visible and the hidden, making architectural space vibrant and dynamic [3, pp. 121–125; 7, pp. 17–19].

The phenomenon of light and shadow has long been considered in aesthetics and philosophy as a means of comprehending the harmony of the world. Even Plato in *Timaeus* associated light with the idea of form, and shadow with the material embodiment of the idea, believing that the visible world is only a reflection of the supreme light of truth [15, pp. 42–45]. During the Renaissance, Leon Battista Alberti wrote that light is the “soul of architecture,” giving it measure and rhythm, while shadow “bestows it with peace.” In modern philosophy, light begins to be interpreted as a symbol of reason, order, and enlightenment—as opposed to chaos and the darkness of ignorance. In the 20th century, the phenomenology of architecture (Norberg-Schulz, Heidegger, Merleau-Ponty) considers light as a mediator between man and space, transforming abstract geometry into a sensually perceived place [11, pp. 66–69; 20, pp. 41–44]. Thus, chiaroscuro becomes not just a physical phenomenon, but an ontological tool for understanding space.

The architectural perception of light is inextricably linked to the physical and psychological aspects of illumination. Fluctuations in brightness, direction, and temperature of light determine the mood, rhythm, and emotional richness of a space. Soft, diffused light creates a feeling of coziness and contemplation, while sharp contrasts of light and shadow evoke a sense of tension, movement, and drama [6, pp. 97–99]. The psychology of perception proves that people are instinctively drawn to illuminated spaces, associating them with safety and openness, while shadow is perceived as a symbol of depth and mystery. This reveals the archetypal nature of chiaroscuro—it not only structures space but also influences the subconscious, awakening emotional memory. This is why architects, from the masters of the Gothic to Tadao Ando, strive to use light not as a technical factor, but as a means of spiritually experiencing architecture [19, pp. 58–60; 22, pp. 12–14].

Light in architecture functions as a structural element, shaping volume, scale, and rhythm. It reveals proportions and emphasizes the tectonics and plasticity of form. Depending on the angle of the light, a building can appear light and floating or heavy and stable. For example, in the work of Louis Kahn, light becomes a “material of form”: it organizes space in the same way as concrete or stone, creating a rhythmic structure of shadows in which the internal logic of the composition is discernible [7, pp. 24–27]. Light axes, refractions, and reflections become unique “architectural accents,” guiding human perception and forming emotional focal points.

Shadow, in turn, is an equally significant expressive element. It shapes form, lends it depth, and creates movement and drama. An architect manipulates shadow as an artist manipulates strokes, defining the character of a composition. In modernist architecture, shadow becomes a means of revealing structure: strict geometric forms, interacting with light, create contrast

and rhythm, emphasizing the rationality and constructiveness of the image. In the architecture of Ando or Kahn, shadow becomes a poetic element, enhancing the emotional silence of space. It does not conceal, but reveals architecture—making it alive, changeable, and perceptible over time.

Thus, the dialectic of light and shadow in architecture represents a harmony of opposites, in which one cannot exist without the other. Light reveals form, while shadow defines its boundaries; light creates movement, while shadow creates stillness; light reveals meaning, while shadow imparts depth. This relationship is not only an aesthetic but also a philosophical category, expressing the duality of human perception of the world—the desire for clarity and contemplation. Chiaroscuro in architecture is not simply a play of brightness, but a language of spiritual plasticity through which the architect expresses the invisible: the breath of space, the metaphysics of form, and the silence of light.

• The historical evolution of the use of light and shadow

The evolution of attitudes toward light and shadow in architecture represents not only a journey of artistic discovery but also a reflection of philosophical, religious, and scientific changes in worldviews. Throughout history, light has become a symbol of truth, divine revelation, or rational clarity, while shadow has become a metaphor for mystery, depth, and spiritual quest. The history of architecture shows that the use of chiaroscuro contrasts has never been random: it has always expressed the worldview of its time, whether it be the cult of the sun in Ancient Egypt, the mysticism of Gothic architecture, or the technological rationality of the 20th century.

In the architecture of the Ancient East and classical antiquity, light had a primarily sacred significance. Egyptian temples, oriented toward the sun, became instruments of astronomical and religious synthesis. Narrow beams of light penetrated dark spaces only on certain days of the year—for example, during the solar equinox, when the sun's disk illuminated the statue of a deity in the depths of the sanctuary. Here, light was not only a physical phenomenon but also a sign of the presence of the divine. In the temples of Amun-Ra at Karnak and Abu Simbel, architects deliberately used the contrast between bright sun and deep shadow to emphasize the transition from the mundane to the sacred. In classical architecture, light becomes a tool for revealing proportions and harmony. Greek masters, striving for perfect symmetry, perceived sunlight as a natural instrument for measuring beauty. Light glided softly across the columns of the Parthenon, revealing their entasis, and the play of shadows on the flutes created a sense of the breathing of form. For antiquity, light was a manifestation of the mind of the cosmos, and shadow was the boundary of its ordered manifestation.

The Middle Ages saw a profound shift in the understanding of light—it became a metaphysical category, a symbol of God's presence in the material world. Gothic architecture embodied the idea of mystical light as a path to spiritual perfection. The enormous stained-glass windows of cathedrals transform the sun's rays

into streams of colored radiance, filling the interior with an atmosphere of divine mystery. Light, refracted through glass, loses its materiality and becomes the light of revelation. As Abbot Suger, the architect of Saint-Denis, wrote, "light is the visible image of the invisible God." Shadow, on the other hand, is used to create depth, transitions, and inner rhythm, contrasting earthly and heavenly principles. Gothic cathedrals—Chartres, Reims, Notre-Dame de Paris—are not only engineering but also spiritual structures, where the vertical aspiration toward light becomes a symbol of the soul's ascension.

The Renaissance restored light's naturalness and rationality. It once again became a tool for understanding and perceiving form, as it had been for the ancient masters, but now through the prism of a humanistic worldview. Architects such as Brunelleschi, Alberti, and Palladio used light to reveal the harmony of proportions and the structure of a building. Light served not so much a mystical as an intellectual ideal: it emphasized symmetry, clarity, and geometric order. Meanwhile, in the Baroque era, light became a dramatic element of architecture. It ceased to be neutral and became an active participant in the composition, evoking emotional effects. In the works of Bernini and Borromini, light and shadow create dynamism, tension, and theatricality. Contrasts of light and darkness emphasize movement, illusion, and spiritual expression—the Baroque transforms light into the scenography of a divine spectacle.

In modernist architecture, light once again acquires functional and philosophical significance. Twentieth-century architects viewed light not only as an artistic but also as a structural material, defining the spatial logic of a building. Le Corbusier called architecture "the skilful, correct, and magnificent play of volumes under light." For him, natural light is not decoration, but a way to reveal the essence of a structure. At the Bauhaus, light becomes part of a new technical thinking—rational, pure, and economical. Constructivists use it to delineate functional zones and organize space. Tadao Ando, Louis Kahn, Alvar Aalto, and Mies van der Rohe introduced the concept of "living light"—light that interacts with materials, reflects, changes throughout the day, and thereby enlivens architectural volumes. In their work, shadow acquires the meaning not of opposition to light, but of a partner, creating an emotional balance between the revealed and the hidden, between the rational and the spiritual.

21st-century architecture is rethinking light and shadow composition in the context of digital technology and environmental awareness. Light is becoming dynamic, interactive, and programmable. Contemporary facades respond to changes in illumination, temperature, and human movement, transforming into living surfaces. The use of LEDs, optical fibers, and kinetic screens allows for the creation of architecture that can change appearance depending on the time of day and the mood of the environment. An example is the Institut du Monde Arabe in Paris (architect Jean Nouvel), where the facade consists of hundreds of photosensitive diaphragms that regulate the flow of light into the building. The digital age has given rise to the

concept of "living shadow"—an effect in which computer systems simulate the movement of natural light, creating a sense of natural variability. Light now not only reveals form but also becomes a language of communication between architecture and people: it reacts, communicates, and expresses mood.

Thus, the path of light and shadow in architecture is the history of human consciousness and its dialogue with space. From the sacred rituals of antiquity to the parametric facades of the digital age, light remains a constant mediator between man and the meaning of form, between the material and the spiritual. The evolution of chiaroscuro solutions demonstrates that architecture is not simply the art of building, but the art of seeing: seeing not only walls and volumes, but also how time flows through them, reflected in a beam of light and in the depths of shadow.

• **Light as a tool of architectural expression**

Light in architecture is not simply a physical phenomenon, but a universal language of artistic expression capable of conveying emotional states, revealing the structure of form, and creating semantic accents. It transforms static matter into dynamic space, making visible what would otherwise remain mere geometry. Light is the breath of architecture, its temporal dimension, and a means of expressing the architect's artistic will. Through the interplay of light and shadow, a building becomes a living organism, engaging in dialogue with nature, time, and humanity [4, pp. 35–38; 7, pp. 21–24].

Natural light has always been the architect's primary tool for interplaying form and texture. Sunlight, changing throughout the day, transforms facades into fluid surfaces that reveal the structure of materials—stone, concrete, glass, wood. Louis Kahn wrote that "light is the creator of all materials," and indeed, only in its presence does texture acquire depth and tactility. In the classical buildings of antiquity and the Renaissance, light emphasized proportionality and symmetry; in modernist architecture, it emphasized the simplicity and honesty of construction. Natural light cannot be completely controlled, but this is precisely what gives it vibrancy: the building "breathes" with the sky, and the play of highlights and reflections transforms it into part of the natural rhythm. In Ando's architecture, a beam of light piercing a concrete wall becomes a metaphor for the presence of time, a manifestation of spiritual silence and peace. Light here does not decorate—it expresses the essence of being, interacting with matter as with its opposite [19, pp. 59–63].

With the development of technology, artificial lighting has become no less an expressive tool than sunlight. Contemporary architects use artificial lighting not only for functional purposes but also to create artistic compositions. A lamp ceases to be a technical element and becomes part of a spatial design. Warm light enhances coziness and intimacy, while cool light emphasizes austerity and scale. The combination of different light sources allows for the creation of rhythm, direction, and spatial contrasts. In the era of postmodernism and high-tech, light becomes an atmospheric medium: neon and LED systems create symbols of movement, technology, and urban dynamism. The works of Zaha

Hadid and Jean Nouvel demonstrate how light can construct space, dissolving the boundaries between reality and illusion. In 21st-century architecture, thanks to intelligent lighting systems (smart lighting), light has become controllable, adaptive, and sensory, capable of responding to human presence and altering the emotional environment of a building [14, pp. 43–47].

Light in architecture also plays a role as a compositional element, creating rhythm, emphasis, and perspective. Through light, the architect constructs a hierarchy of perception: it highlights key axes, focuses attention, and shapes the movement of the eye. The rhythmic alternation of illuminated and darkened areas is perceived as spatial music, where pauses and silence are no less important than sound. The contrast of light and shadow establishes the temporality of perception, creating a dramatic effect. In Gothic architecture, this principle manifested itself in a vertical striving toward the sky; in Baroque, in the theatrical plasticity of light; and in Modernism, in the strict tectonics of structures. In modern museums and public spaces, lighting often becomes the primary carrier of an emotional message, guiding the visitor's movement and regulating psychological response. Light becomes an architectural tool that connects a static composition with the passage of time.

Interior lighting plays a special role in interior architecture, where its purpose extends beyond its utilitarian function. It shapes the emotional environment, influencing the perception of space and a person's psychophysiological state. Soft side lighting can expand space and create a sense of airiness, while a directional spotlight can focus attention on details and create tension. Twentieth-century architects such as Le Corbusier, Alvar Aalto, and Luis Barragán actively used interior lighting to express the spirituality and intimacy of architecture. Barragán called light "the soul of space," emphasizing that it transforms an interior into an emotional experience. Contemporary interior design utilizes a combination of natural and artificial light, creating a dynamic and flexible perception. Lighting scenarios become part of the architectural concept, allowing the emotional state of a space to be transformed depending on the time of day and its purpose.

Light, finally, is a means of symbolism, carrying spiritual, cultural, and philosophical meanings. It can signify openness, movement, purification, or spiritual ascension. In the Christian tradition, light symbolized the presence of God; in Islamic architecture, it symbolized the reflection of divine wisdom; in Japanese culture, it symbolized the harmony of nature and emptiness. Contemporary architects continue this tradition, using light as a metaphor for human consciousness and inner balance. For example, in Tadao Ando's Church of Light, light penetrates space in the form of a cross, symbolizing the union of the earthly and the heavenly. In museum complexes such as the Louvre Abu Dhabi (architect Jean Nouvel), light becomes a tool for creating a "meditative atmosphere," where shadow mediates between spirit and matter. Light in architecture is thus not limited to aesthetics—it becomes a form of spiritual expression, through which the architect expresses their understanding of the world, humanity, and time.

Taken together, all these aspects—natural, artificial, compositional, and symbolic—demonstrate that light is not just a visualization tool, but the semantic structure of architecture. It unites the material and the immaterial, the rational and the sensual, construction and emotion. Light is the language in which architecture speaks of harmony, beauty, and time, transforming space into a poetic act of human interaction with the world.

• Shadow in architecture as a means of artistic contrast

In architecture, shadow is not simply the absence of light, but an active component of the artistic image, shaping the depth, scale, and emotional tension of space. It makes visible that which remains unlit, revealing the structure of form through contrast and negation. Shadow is the "other side of light," thanks to which architecture acquires drama, rhythm, and internal dynamism. As Louis Kahn wrote, "shadow is the trace of light, its memory." In this sense, architecture is born precisely at the border of light and darkness, where visible form and a sense of space emerge [7, pp. 24–26; 11, pp. 70–72].

Shadow serves as a means of revealing volume and spatial form. It reveals the true plasticity of architecture, since without shadow, geometry remains abstract. Only shadow gives substance to volume, imbuing it with weight and contour. It helps the eye discern boundaries, depth, and proportions, creating a sense of three-dimensionality. In ancient and classical architecture, the play of shadow on columns and cornices enhanced the sense of tectonics and harmony. In modernism, shadow becomes minimalist, but no less expressive: it emphasizes the purity of structures, highlighting the intersections of lines and planes. Thus, shadow is not the opposite of light, but its formative element, transforming architecture from an idea into a tangible reality.

The architectural dramaturgy of shadow is manifested in its ability to set the emotional tone of a space—from soft poetry to stern tension. Depending on the shape and direction of the light, shadow can be light and fluid, or, conversely, sharp, creating a sculptural and austere effect. In Baroque architecture, shadow becomes a theatrical instrument: it creates the illusion of movement, enhances rhythm and contrast, and emphasizes the pulsation of forms. In the works of Bernini, for example, shadow models drama and emotional outburst, transforming the architectural space into a stage where light and darkness play the roles of actors. In Gothic architecture, shadow evokes a sense of mystical presence, enhancing the vertical aspiration and metaphysical depth of the cathedral. In Modernist and Minimalist architecture, the dramaturgy of shadow takes on a philosophical character: it expresses inner silence, concentration, and balance between the material and the spiritual. In the works of Tadao Ando and Ken Goetts, shadow is used as a means of emotional reduction, allowing one to clear perception of excess and direct attention to the essence of space.

Materials and textures in architecture play an important role in conveying the character of shadow. Stone, concrete, wood, and metal interact with light in

different ways, creating unique shades and degrees of contrast. Rough textures enhance the play of tones, while smooth surfaces create clear silhouettes. In traditional Japanese architecture, for example, wood and paper are used to soften the light and create "diffused shadow," which gives the space intimacy and tranquility. Junichiro Tanizaki, in his essay "In Praise of Shadow," wrote that true beauty lies not in bright brilliance, but in the soft twilight where the soul of the material is revealed. Contemporary architecture continues this line: the combination of concrete and glass allows for the formation of shadow as an artistic element—not an outer shell, but part of the concept of form. For example, in the works of Louis Kahn, shadow "glides" across the surface, revealing the structure of the structure and creating a rhythmic texture in which the architecture reveals its materiality [19, pp. 61–63; 22, pp. 15–18].

The character of a shadow depends on the direction and intensity of the light, making it mobile and alive. Morning and evening light create long, soft shadows, revealing the plasticity and depth of the façade; daylight creates a contrasting graphic effect that emphasizes the vertical and silhouette. The architect, like an artist, manipulates light as a stroke, modeling space through the angle and intensity of illumination. In Gothic and Baroque styles, light axes were subject to a strictly defined orientation, while modern architecture utilizes dynamic lighting, creating shifting shadows that respond to the rhythm of time. In museums, theaters, and religious buildings, lighting is often arranged so that directional light accentuates key elements, while shadow emphasizes their context. Thus, shadow becomes a temporal dimension of architecture, allowing one to perceive space as a living process rather than a static object.

The conceptual use of darkness and halftones is particularly significant. Darkness in architecture is not a denial of light, but a state of concentration, immersion, and contemplation. It allows one to sense the presence of form through its absence. Halftone—the transitional state between light and shadow—symbolizes movement, breathing, and gentle balance. In contemporary architecture, the concept of "architecture of silence" (Louis Kahn, Peter Zumthor) is based precisely on working with halftones, where light does not blind but reveals through restraint. In such spaces, darkness becomes not a threat but a means of spiritual concentration. In museums, churches, and libraries, halftones enhance the sense of depth and peace, helping one perceive architecture not only with the eyes but also with the inner sense. Shadow becomes a philosophical category, expressing the presence of the invisible and imbuing space with meaning.

Thus, shadow is not a passive aspect of light, but an equal element of architectural composition, capable of shaping the emotional structure of a building. It makes space not only visible but also sensory, not only material but also metaphysical. In architecture, shadow becomes the boundary between the rational and the poetic, between the visible and the hidden, creating a special depth of perception without which true artistic form is impossible. It is in this harmony of light and darkness

that the supreme power of architecture is revealed—its ability to unite the visible and the invisible in a single spatial breath.

• Synergy of light and shadow in modern architecture

Contemporary architecture has entered an era in which light and shadow are no longer merely the result of external natural conditions—they have become a conscious tool for shaping spatial experience. The synergy of these two categories is expressed in the architect's desire to unite artistic and technological principles, nature and artificial intelligence, the energy of light and the poetics of darkness. In the 21st century, the balance of light and shadow is evolving into the language of sustainable and emotionally charged architecture, where space responds to the rhythms of time, climate, and human presence [4, pp. 35–39; 14, pp. 48–50].

Modern, eco-friendly, energy-efficient buildings are constructed using principles of rational use of natural light and passive solar control. Sustainable architecture strives not to suppress nature, but to interact with it through light. The use of "smart façade" systems allows for the control of lighting intensity depending on the time of day and the building's orientation, reducing energy consumption and creating an optimal microclimate. In bioclimatic architecture, shade becomes an element of ecological design: canopies, lattice screens, blinds, and sun protection panels create natural light-shadow filters that regulate temperature and visual comfort. An example is Al Bahar Towers in Abu Dhabi (architected by Aedas Architects), where the façade consists of movable geometric modules that open and close depending on solar activity. Here, shade is not simply a result of light, but its functional partner, creating an architecture that "breathes" with the climate [20, pp. 75–77].

One of the most revolutionary trends has been the use of digital technologies—BIM, 3D rendering, and virtual reality (VR)—in the design of lighting systems. These technologies allow architects to do more than simply calculate illumination; they can simulate light as an artistic medium. Using parametric programs, it is possible to predict how light and shadow change throughout the day and year, and how it interacts with materials, texture, and color. Virtual reality makes it possible to perceive architecture before it is built, allowing the designer to adjust the emotional and symbolic effect of lighting. In this digital environment, light becomes not a physical phenomenon, but a material for simulating emotion. 21st-century architecture is increasingly being created at the intersection of algorithms and intuition: the digital program sets precision, and the architect imbues it with poetics. This is precisely the modern form of synergy between light and shadow—rationally calculated, yet emotionally perceived [12, pp. 136–138; 19, pp. 62–64].

Light and shadow in contemporary architecture also serve an identifying function, shaping the image and character of a building. In the context of globalization, when forms and materials are becoming standardized, chiaroscuro compositions allow architecture to acquire individuality. Each city, each culture, perceives

light in its own way: northern diffused lighting creates soft, half-tone facades, while the southern sun creates sharp shadows and expressive silhouettes. Architects work with light as an element of cultural code. For example, Scandinavian architecture—Aalto, Snøtta—gravitates toward calm gradations of light, symbolizing natural harmony, while Japanese architecture—Ando, Kurokawa—strives for contrasts and meditative shadow. Light and darkness become elements of the cultural identity of a space, connecting architecture with its place and context [11, pp. 67–70; 15, pp. 58–60].

A new stage in the development of architectural expression is associated with the emergence of interactive facades and the concept of "living architecture," where light and shadow are dynamic, changeable, and controllable. "Smart surface" and media skin technologies enable architecture to respond to movement, sound, and temperature, creating visual scenarios that change in real time. Light becomes the carrier of information, and shadow its context. For example, in The Broad Museum (architects Diller Scofidio + Renfro), light penetrates the cellular shell of the facade, creating the effect of breathing space. In the Institute du Monde Arabe project (architect Jean Nouvel), the facade functions as a giant diaphragm, transmitting light at varying intensities, creating a constantly changing luminous atmosphere within. These examples demonstrate that contemporary architecture has entered a phase of kinematic light, where chiaroscuro ceases to be static and becomes a flow—in time and perception.

The works of great masters such as Tadao Ando, Louis Kahn, Zaha Hadid, and Jean Nouvel occupy a special place in the understanding of chiaroscuro synergy. For Ando, light is a spiritual substance, the stuff of contemplation. His Church of Light in Ibaraki is a symbol of architectural minimalism, where a single beam pierces the darkness, creating a sense of absolute silence. Louis Kahn used light as a structural metaphor for order: his buildings are constructed as "temples of light," where every shadow is subordinated to the logic of space. In contrast, Zaha Hadid interprets light dynamically—as a force emphasizing the movement and fluidity of form; in her architecture, shadow becomes a line describing the energy of space. Jean Nouvel, on the contrary, uses light as a philosophy of atmosphere – his projects (Louvre Abu Dhabi, Lyon Opera Theatre) are built on a play of transparency, reflections and glare, where the boundary between light and shadow is blurred, and space is perceived as a pulsating organism [17, pp. 132–135; 22, pp. 19–22].

Contemporary architecture thus transforms light and shadow into intellectual categories—tools for thinking, designing, and perceiving. Light has become digital, controllable, and conscious, while shadow has become philosophical, emotional, and symbolic. Their synergy expresses not just an aesthetic effect, but the holistic worldview of an era striving to unite technological progress with spiritual depth. Light and darkness are no longer antagonists: their interaction gives birth to a new architectural aesthetic—an aesthetic of living

space, where every form breathes, moves, and is understood in a beam of light passing through matter and time.

Conclusion

Architecture has always been an art of light and shadow—a dialogue between the visible and the hidden, the rational and the poetic. Throughout human history, light has served as a measure of truth, and shadow as its depth. From the temples of the ancient East to the parametric facades of the 21st century, architects have sought not simply to use lighting but to mentally shape space through light, creating an emotional and philosophical structure that brings a building to life.

The modern understanding of light and shadow goes far beyond aesthetics: it is a system of meanings and interactions that reflects the worldview of the era. Light ceases to be merely a physical flow—it becomes a mediator between man and space, a source of spiritual experience. Shadow, in turn, becomes a metaphor for presence, a boundary where the essence of form is revealed. Their interaction creates not just a visual effect, but an emotional and intellectual atmosphere in which one feels a connection to architecture.

In the age of digital technology and environmental responsibility, architecture is restoring light and shadow to their original meaning. Light becomes programmable, adaptive, and environmentally friendly; shadow—regulated and artistically meaningful. Together, they create architecture capable of responding, breathing, and thinking, transforming the building into a living organism, and space into an emotional and spiritual experience.

Thus, light and shadow are not simply expressive means, but ontological categories of architecture, defining its language, energy, and philosophy. It is in their harmony that true poetry of form is born, capable of combining technological precision and spiritual depth. Architecture, built on the balance of light and shadow, becomes not only an object of aesthetic perception but also a space for inner illumination—a silent dialogue between man and eternity.

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ARCHITECTURAL AND PLANNING PRINCIPLES FOR THE OPTIMIZATION OF OPEN SPACES IN RESIDENTIAL AND PUBLIC DEVELOPMENT

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Abstract

The article analyzes modern architectural and planning principles for optimizing open spaces in residential and public developments. Drawing on international experience from cities such as Copenhagen, London, and New York, it explores strategies for creating comfortable, inclusive, and sustainable urban environments. Particular attention is given to academic frameworks by Jan Gehl, Matthew Carmona, and the Project for Public Spaces (PPS), emphasizing human-centered design and social engagement. The quality of open spaces is shown to depend on accessibility, functionality, social interaction, and adaptability to change. The paper formulates a comprehensive set of principles ensuring a balanced and sustainable approach to urban open-space design.

Keywords: architectural planning, open spaces, public space, inclusivity, sustainable development, urban design, social interaction.

Problem Statement. Open spaces are an integral component of the urban environment, serving as the setting for a significant portion of public life within the city. Parks, squares, courtyards of residential complexes, and public gardens provide venues for recreation, walking, meetings, and social interaction, while also facilitating human contact with nature within the urban context. Properly designed open spaces generate multiple social, economic, and ecological benefits for communities [1]. Social benefits include improved public health and well-being, stronger social cohesion, and increased safety; economic benefits involve higher property values and enhanced attractiveness of areas for business and tourism; ecological benefits include urban climate mitigation, reduction of the heat island effect, and preservation of biodiversity [1]. However, many cities experience issues related to the quality and sufficiency of open spaces ranging from a shortage of usable areas and fragmentation of green zones to poor accessibility and misalignment with the needs of diverse social groups.

The challenge of increasing the efficiency of existing open spaces within dense residential and public developments is particularly relevant today. Urbanization and city densification result in high-rise residential buildings increasingly replacing traditional low-rise structures, thereby reducing available recreational areas for residents [4]. Studies show that the level of public space utilization in high-rise residential complexes is significantly lower than in medium- and low-rise neighborhoods [4]. The underlying causes include inadequate spatial configuration and zoning, the disconnection of open areas from residents' needs, and poor landscape and amenity quality in peripheral courtyards [4]. Often, such spaces remain "residual" – lacking clear function, poorly connected to their surroundings, and unattractive for everyday use. Furthermore, the absence of inclusive design approaches often excludes large segments of the population particularly people with disabilities, the elderly, and other mobility-limited

groups from fully using public open spaces [4]. Therefore, there arises the problem of developing effective architectural and planning principles aimed at optimizing both existing and newly created open spaces within residential and public development, to make them more functional, accessible, safe, and comfortable for all users

Task Definition. The aim of this study is to formulate architectural and planning principles for optimizing open spaces within residential and public developments, based on an analysis of international experience, contemporary scientific concepts, and current trends in urban design.

Analysis of Recent Studies. The methodological foundation of the research draws upon the works of M. Carmona, J. Gehl, Y. Han, J. Li, Q. Li, and D. Tang, whose studies explore the interaction between spatial configuration, social behavior, and environmental performance in urban public spaces.

Research Methods. The study employs a comprehensive methodological framework that reflects the interdisciplinary nature of the topic. The primary approach is the method of analysis and synthesis of scientific literature, applied to examine theoretical models and previous research findings in architecture and urban planning related to public open spaces. A review was conducted of English-language academic sources – including monographs, journal articles, and policy reports – as well as regulatory and methodological documents issued by leading international institutions (e.g., UN-Habitat, CABI), indexed in scientometric databases such as Scopus and Web of Science.

A comparative method was used to contrast international experiences of open-space design across cities and countries, identifying universal principles and context-specific features. The systemic approach enabled examination of open spaces as integral elements of the urban structure, interacting with other components such as the built environment, transportation systems, engineering infrastructure, and the social milieu. Additionally, a structural-typological analysis was employed to

classify different types of open spaces courtyards of residential blocks, public squares, parks, and adjacent areas and to identify distinctive planning features.

The integration of these methods resulted in the development of a generalized framework of architectural and planning principles for open-space optimization, applicable both to domestic design practice and in the broader international context.

Main Text. Global urban planning experience offers numerous examples of successful integration of high-quality open spaces into the structure of residential and public development. Many cities deliberately implement public space development strategies, considering them a key to the sustainability and comfort of the urban environment. UN-Habitat experts have developed global approaches to urban development, one of which is the concept of the “Five Principles of Sustainable Urban Neighborhood Planning.” This framework advocates for compact, mixed-use, and socially balanced neighborhoods with a well-organized network of streets and public spaces [3]. Within the UN-Habitat program “Global Public Space Toolkit” (2015), the universal value of public spaces is emphasized, accompanied by numerous best-practice examples from various countries [3]. The document underscores that free and equal access to high-quality open spaces is a shared principle among successful cities, and that the development of corresponding policies and regulatory frameworks is a joint responsibility of both local authorities and national governments [3].

A notable example of such success is Copenhagen (Denmark), where for several decades the city has consistently implemented the “City for People” policy under the guidance of urbanist Jan Gehl. Through the gradual expansion of pedestrian zones, redevelopment of squares and waterfronts, and the improvement of conditions for outdoor stay and movement, the city has witnessed a remarkable revitalization of urban life. As Gehl notes, each enhancement of urban public space quality directly leads to its greater use by residents – essentially, “improvements literally create space for a wider range of human activities” [2]. For example, the transformation of Copenhagen’s central streets into pedestrian areas during the 1960s–1980s was accompanied by a several-fold increase in pedestrian and cyclist activity, while city squares evolved into constant venues for gatherings and events. This experience demonstrated that creating attractive and comfortable conditions for pedestrians and outdoor activities can invigorate even a northern climate and encourage people to spend more time outdoors.

Another representative case is London (United Kingdom), where since the 1980s, public open spaces – from small pocket parks to large urban squares – have become an integral component of urban regeneration programs [1]. Throughout neighborhood redevelopment processes, significant efforts have been directed toward creating high-quality pedestrian areas, landscaped inter-building zones, accessible playgrounds, and social spaces designed for interaction among various demographic groups.

In the United States, urban design has traditionally emphasized large parks and residential courtyards;

however, in recent decades, cities such as New York, San Francisco, and Portland have actively adopted the principles of placemaking the creation of “places” with a unique character, community involvement in the design process, and an emphasis on multifunctional use of space. Between 2007 and 2010, New York City implemented the “World Class Streets” program in collaboration with Jan Gehl’s team, resulting in the creation of new pedestrian plazas (e.g., the transformation of Times Square into a pedestrian zone) and numerous small urban spaces (parklets, “pocket parks”) repurposed from former parking lanes. The outcomes included a notable increase in pedestrian activity, improved traffic safety, and the revitalization of local businesses in adjacent districts [2].

Such global cities demonstrate that open-space optimization can be achieved through both large-scale interventions (such as the development of new parks, waterfronts, and pedestrian streets) and incremental tactical approaches temporary public spaces, street furniture installations, and greening initiatives that gradually integrate into the permanent urban fabric. Despite contextual differences, successful cases share key features: open spaces are well-connected to their surroundings, possess clear functional purpose, diverse programming, and a human-centered orientation.

International standards recommend that parks and green squares be located within walking distance of residential areas, framed by active frontages building facades “facing” the public realm and integrated into pedestrian and cycling networks [5]. The experience of Western European countries confirms that every square meter of open space should be functionally justified and visually engaging; even small green areas or plazas must be purposefully designed and incorporated into the city’s spatial network [5]. Conversely, “accidental” green patches or paved courtyards disconnected from pedestrian flows tend to remain underused and impose maintenance burdens [5]. Therefore, global practice emphasizes the importance of strategic planning of open-space systems at both the citywide and neighborhood levels, alongside the detailed human-scaled design of each space according to community needs.

From an academic perspective, the foundational understanding of public spaces as social environments originates from classical studies by Jan Gehl, William Whyte, and Jane Jacobs, among others. In “Life Between Buildings” (1971), Gehl introduced the concept of necessary, optional, and social activities within open spaces (pps.org). He demonstrated that the quality of the physical environment most strongly influences optional (leisure-related) activities: “The better the space, the more optional activity takes place, and even necessary activities last longer” [2]. In other words, when a courtyard, street, or square is attractively designed with comfortable seating, a pleasant microclimate, and stimulating visual details people not only pass through it (necessary activity) but also choose to stay voluntarily (optional activity), which naturally fosters spontaneous social interaction.

This concept underpins the paradigm of human-centered design, according to which architects and urban planners must design environments based on the

behavioral scenarios of people, rather than merely on abstract spatial dimensions or circulation patterns.

Contemporary academic research further develops and specifies the principles of open-space design. For example, Matthew Carmona (University College London) in his 2019 article proposed a normative framework of ten principles for the design and management of public spaces [1]. He divides these into three strategic (planning) principles and seven design principles that define spatial quality in detail.

The strategic principles include: (1) Evolutionary character of public space – embedding spatial development within the broader urban context and ensuring adaptability to change; (2) Diversity – rejection of standardized approaches and recognition of local specificity and the needs of different groups (the principle of a “city for all,” derived from Henri Lefebvre’s concept of the right to the city) [1]; (3) Publicness and freedom of access – guaranteeing genuine openness and preventing hidden privatization or social segregation of spaces, in other words, maintaining “truly public space” free from discrimination or barriers [1].

These three foundational principles form the framework conditions for spatial policy: at the city scale, there should be a coherent strategy for the network of open spaces, including their financing, maintenance, and development, to avoid fragmentation and “ownerless” areas with no clear responsibility.

The architectural and planning (design) principles, according to Carmona, are expressed through seven quality criteria for specific spaces [1]. In summary: first, clear identity and boundaries the design should emphasize that a space is public and distinct from private zones (“clearly defined public space”), preventing the creation of “no man’s lands” with ambiguous status [1]. Second, active surroundings and engaging functions the area should be bordered by active ground floors, entrances, commercial or cultural “activity magnets” to ensure vibrancy and continuous use (“active/engaging space”) [1]. Third, meaningful content and amenities inclusion of features that make the place both distinctive and comfortable, such as public art, interesting landscaping, play areas, and water elements [1].

A crucial additional principle is facilitation of social interaction. Spatial planning should encourage various forms of social activity from large public gatherings to spontaneous encounters. This requires “social magnets”: sufficient and diverse seating options (benches, curbs, steps since “the quantity and variety of seating are often underestimated” [6]), a pleasant atmosphere (e.g., greenery and water), and opportunities for people-watching (such as outdoor cafés). William Whyte (1980), in his observations of New York City plazas, noted that the presence of convenient seating and food options significantly increases occupancy rates people enjoy sitting and watching others, which promotes longer stays and greater social engagement [6]. Thus, comfort and sociability are inherently inter-related.

Another key aspect is the balance between pedestrian and vehicular movement, especially for open spaces adjacent to streets [4]. Car dominance high

speeds, extensive parking undermines the social attractiveness of spaces. Therefore, design must ensure pedestrian safety and minimize traffic disruption. A successful example is the concept of “shared streets” in European cities, where curbs are removed, pedestrians have priority, and vehicle movement is intentionally slowed. This approach, implemented in residential neighborhoods across the Netherlands and Germany, has proven effective in enhancing both livability and community interaction.

The final two principles concern comfort and resilience. The comfort principle includes both physical and psychological aspects: protection from crime through natural surveillance, and comfort from climatic conditions shade, wind protection, and adequate lighting [4]. A good public space is one in which people feel relaxed, unthreatened, and at ease. Recent literature also stresses the need for inclusive design, taking into account gender, age, and physical ability safe spaces are those where women, children, and the elderly feel equally comfortable and visible [6].

Finally, the resilience principle refers to the adaptability and longevity of design [4]. A successful open space is one that can perform multiple functions over time without losing its appeal. This is achieved through the use of flexible elements (modular furniture, convertible platforms), durable materials, and well-considered landscaping that enhances environmental quality as it matures.

In addition to the aforementioned theoretical principles, professional literature provides numerous practical recommendations and design standards. For example, the Essex Design Guide (2019) in the United Kingdom highlights several key principles for open spaces: ensuring natural surveillance (parks should face building frontages rather than being hidden behind structures), which enhances the sense of safety; locating smaller public spaces along main pedestrian and cycling routes to ensure accessibility and logical integration into the neighborhood structure; and equipping resting areas with supportive infrastructure benches, shaded areas (trees or canopies), trash bins, lighting, and restrooms considering the needs of the elderly and people with limited mobility [5].

When planning residential complexes, it is recommended to aggregate open areas combining several small parcels into a larger park that is easier to maintain and offers a wider range of uses [5]. At the same time, small local spaces (such as playgrounds or green courtyards) remain important for environmental diversity, but they must be designed with the same attention to quality and multifunctionality as larger parks [5]. These guidelines align closely with academic principles, enriching them with practical and technical detail.

Equally significant is the model developed by Project for Public Spaces (PPS) an organization that has studied thousands of public spaces worldwide. According to PPS, a successful place is characterized by four core components: accessibility, activities, comfort (and image), and sociability [6]. These dimensions encompass most of the principles discussed above. Accessibility refers to both physical and visual openness, seamless connectivity to surrounding pedestrian routes, and

the absence of barriers for different social groups [6]. Activities denote the variety of available uses and scenarios that give people reasons to come and stay [6]. Comfort includes both subjective feelings of safety and pleasantness, and tangible features cleanliness, order, sufficient seating, and options for sun or shade. Sociability reflects whether people come in groups, interact with one another, and invite others a sign that the space has become a true “third place” for social connection [6].

This PPS model has become a widely used evaluation tool, placing the human experience of space at the center of urban design practice. It bridges research and application by emphasizing that successful public spaces are not just physical voids between buildings but living environments shaped by comfort, inclusivity, and everyday use.

Conclusions. Thus, academic analysis allows for the formulation of a comprehensive set of principles for optimizing open spaces: strategic and contextual integration (embedding within the urban system and responding to local conditions); diversity and inclusivity (designing for multiple user groups and scenarios, avoiding monofunctionality); publicness and accessibility (ensuring openness to all and strong connectivity within the urban network); activity and richness (providing functions and stimuli that attract and retain people); comfort and safety (offering both physical and psychological well-being); social integration (fostering interaction, events, and community building); balance with transport (prioritizing pedestrians and minimizing negative vehicular impacts); and flexibility and resilience (adaptability to change, material durability, and ecological sustainability).

These principles are embedded in many contemporary urban design frameworks and guidelines, forming the conceptual and methodological foundation for the creation of high-quality, human-centered, and sustainable open spaces in residential and public developments.

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ARTS

THE PROBLEM OF THE RELATIONSHIP BETWEEN THE AUTHOR AND ARTIFICIAL INTELLIGENCE

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ПРОБЛЕМА ВЗАИМОДЕЙСТВИЯ АВТОРА И ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

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Abstract

This article explores the relationship between the author and artificial intelligence through the prism of theatrical art. The authors analyze the positive and negative aspects of the impact of innovative technologies on contemporary art. They examine the influence of artificial intelligence on various aspects of art perception across generations. They discuss the use of the stage as a new tool for artistic expression and the impact of modern technologies on it. Keywords: literary property, artificial intelligence, stage space, means of artistic expression. They offer their vision for solving the problem of the relationship between the author and artificial intelligence.

Аннотация

В статье исследуются взаимоотношения автора и искусственного интеллекта через призму театрального искусства. Авторы анализируют положительные и отрицательные стороны синтеза инновационных технологий и современного творчества. В статье описывается влияние искусственного интеллекта на различные аспекты восприятия художественного произведения разными поколениями. Обсуждается использование сценического пространства как нового инструмента художественного выражения и его связь с современными технологиями. Предлагают своё видение решения проблемы взаимосвязи автора и искусственного интеллекта

Keywords: artificial intelligence, literary property, means of artistic expression, stage space

Ключевые слова: искусственный интеллект, авторское право, средства художественной выразительности, сценическое пространство.

Сцена является пространством для реализации синтетических видов искусства, таких как театр и балет. Таким образом сценическое пространство можно рассматривать как материально-пространственную структуру, в которой разворачивается действие спектакля. Поскольку сцена не всегда выступает главным местом действия, в дальнейшем в данном контексте будет использоваться термин «сценическое пространство». Это соответствует определению Патриса Пави, что «реальное пространство сцены, где действуют актеры, находятся ли они собственно на сцене или среди зрителей» [1, с. 366].

В современном театре режиссёры и балетмейстеры используют сценическое пространство не только как физическое, но и как художественное. В

него включается свет, звук, видеоматериал, расположение артистов в пространстве, реакция зрителя. Всё это формирует новые аспекты средств художественной выразительности, которые активно применяются в современном театре. При таком подходе пространство сцены «оживает» и способно влиять на сюжет. Контрастная смена световой партитуры, декораций или звукового оформления используется как инструмент перенаправления внимания зрителя и создания эмоциональных акцентов. Таким образом сценическое пространство становится связующим звеном между зрителем и внутренним состоянием персонажа или всего спектакля. Подобные приёмы вовлекают аудиторию в психоэмоциональную составляющую представления, усиливая эффект катарсиса. Передвижения са-

мих артистов внутри этого пространства также может выполнять выразительные и смысловые функции. Направление движения массы или солиста, его основные точки на которых разворачивается действие подчеркивает «важность» этого события в контексте сюжета. Активная смена «рисунка» в хореографии усиливает внутренние чувства персонажей, в особенности если работает масса. Наиболее сильный результат возникает при синтезировании всех средств художественной выразительности, когда слово утрачивает необходимость. Сценическое пространство начинает «говорить» само погружая зрителя в мир автора.

Подобный подход предполагает наличие качественного технического оснащения сценического пространства, что обуславливает тесную взаимосвязь театра с инновационными технологиями. В современном театре, помимо традиционных технических инструментов, таких как софиты, прожекторы, «пистолеты» и иное сценическое оборудование, всё чаще рассматривается использование искусственного интеллекта. Если традиционная техника требует постоянного участия человека в процессе управления, то современные исследования в области искусственного интеллекта направлены на развитие «самостоятельности» технологии. Что позволяет находить новые художественные решения. Например, «Театры Бродвея и «Современника» используют нейрографику — системы, создающие 3D-пространства через проекторы с ИИ-рендерингом. В постановке «1984» Нью-Йоркской оперы стены сжимались в такт музыке, их текстура менялась в зависимости от эмоций актеров» [2]. На основе подобного опыта уместно предположить, что у искусственного интеллекта есть большой потенциал в сфере сценографии.

Исследовательский проект «ETH Zurich — AIXStage». был направлен на разработку системы, способной к запоминанию и обучению, которая управляет видеопроекциями в зависимости от положения артиста на сцене и эмоционального содержания спектакля [3]. Подобные технологии уже нашли практическое применение в постановках Цирка дю Солей «Cirque du Soleil», где в Канаде и Австрии использовались системы «Zactrack Smart» и «BlackTrax». Во время репетиций данные системы проходят процесс обучения, что позволяет им автоматически настраивать освещение и видеопроекции в режиме реального времени, реагируя на движения артистов и динамику сценического действия. Таким образом, внедрение искусственного интеллекта в сценографию спектаклей «это не просто технологический эксперимент — это новая глава в истории человеческого творчества» [2].

Побочным эффектом вышеупомянутой интеграции инновационных технологий в творческую деятельность режиссёра можно определить, как, ускорение темпа-ритма готового художественного продукта. В погоне за вниманием современного зрителя, которое в следствии переизбытка доступной информации стало очень уязвимым, автор рискует «потерять» часть аудитории более старшего

поколения. «У поколения Z концентрация внимания на 25% ниже, чем у их предшественников. Миллениалы способны удерживать внимание 12 секунд, а центениалы — всего 8» [4].

Подобные изменения прослеживаются при сравнении любых двух художественных произведения последнего 10-тилетия и конца предыдущего века, будь то спектакль, книга или фильм. Темп развития сюжета, наличие вспомогательных сюжетных «веток», количество эмоциональных акцентов растёт в геометрической прогрессии, что создает сильные отличия восприятия художественного произведения зрителем разного поколения. Если для современной молодёжи подобный темп является привычным или даже необходимым для удержания внимания, то аудитория более старшего поколения воспримет как нечто непонятное с переизбытком акцентирующих на себе деталей. Это фундаментальная разница в восприятии художественного произведения формирует конфликт интересов, что для одних бессмысленный набор художественных «картин», для других целостный спектакль с захватывающим сюжетом.

В газете «The New York Times» театральный критик Майкл Полсон отмечает: «Технологии стали неотъемлемой частью сценических постановок. Это ответ на ожидания поколения, что выросло на коротких роликах с TikTok и Instagram» [5].

Развитие искусственного интеллекта и его участие в творческой жизни автора (режиссёра, балетмейстера) усугубляет разрыв восприятия. Раннее невозможные технические аспекты сценического оформления в настоящее время реализуется в пару «кликов». Также следует упомянуть сокращение количество работы для «живых» сотрудников, безусловно искусственный интеллект на нынешней стадии развития не способен полностью заменить человека в сфере искусства. Но вместе с его прогрессией возникают новые вопросы этической стороны проблемы.

«Кому принадлежит авторское право проекта созданного с помощью искусственного интеллекта?». У подобного художественного произведения есть как «живой» автор, так и «искусственный» соавтор. Или же он только инструмент для воплощения человеческой идеи? Ответ мы видим в том, что «ИИ» не способен создать что-то новое, он использует готовые данные из доступных источников. Синтезируя множество информации, основываясь на полученных от автора запросе и контексте, «ИИ» создает «новый» неузнаваемый вариант художественного проекта. Далее автор исправляет некорректные детали, уточняя направление своей мысли. Спустя некоторое количество попыток совместная работа приносит желаемый результат. Будет ли он воплощать первоначальный замысел? Или искусственный интеллект действительно стоит «вписать» в соавторы.

Искусство всегда отражает главные принципы и идеи человечества своего времени. В XXI веке этой идеей служит технологический прогресс. Вся повседневная жизнь современного поколения сосредоточена вокруг инновационных технологий,

постепенно они начинают интегрироваться не только в утилитарные сферы жизни, но и в творчество.

Современному автору сложно игнорировать эту тенденцию, оставаясь при этом востребованным специалистом. Поэтому важно уделять отдельное внимание изучению проблематики взаимосвязи автора и искусственного интеллекта, его влияние на развитие и восприятие художественных произведений. Некоторые компании уже начали задумываться о регламенте использования их технологий в творческих проектах, возможно и автору стоит задуматься о степени внедрения инновационных технологий в свои произведения. Чтобы осуществить свою идею без риска «подмены» содержания и морально-этических принципов своей работы. На наш взгляд Искусственный интеллект должен быть инструментом для воплощения идеи автора, который помогает осуществить её физическую оболочку без вмешательства в смысловую структуру.

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CHEMICAL SCIENCES

TECHNOLOGICAL ASPECTS OF ECDYSTERONE EXTRACTION FROM *Silene praemixta*: COMPARISON OF METHODS AND PROCESS OPTIMIZATION

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ТЕХНОЛОГИЧЕСКИЕ АСПЕКТЫ ЭКСТРАКЦИИ ЭКДИСТЕРОНА ИЗ *Silene praemixta*: СРАВНЕНИЕ МЕТОДОВ И ОПТИМИЗАЦИЯ ПРОЦЕССА

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<https://doi.org/10.5281/zenodo.17492561>

Abstract

The article presents the results of a study on methods for extracting ecdysterone from the aerial parts of *Silene praemixta* aimed at optimizing the technological process. The efficiency of the methods was evaluated based on ecdysterone yield (at least 95% of the content in the raw material), solvent consumption, and extraction time. Comparative analysis revealed that extraction with forced circulation and stirring provided the shortest process duration. However, the stirring method was characterized by a 2.1-fold higher solvent consumption, uncontrolled temperature increase, and difficulties in separating the extract due to excessive grinding of the raw material. Extraction using a Soxhlet apparatus was the most solvent-efficient but was slower and had limitations for industrial application due to its complex design and large equipment size. Based on the results, a three-stage extraction method with forced circulation of the solvent was selected for process intensification.

To optimize ecdysterone extraction from *Silene praemixta* using forced circulation, an experimental design approach based on a 3×3 Latin square was employed. The highest ecdysterone yield (60.8%) was achieved under the following conditions: raw material-to-solvent ratio of 1:5, solvent circulation rate of 70 L/h, and raw material particle size of 8 mm. The optimal extraction process consists of three cycles: soaking the raw material in 90% ethanol (1:5 ratio) for 1 hour, followed by a first extraction lasting 4 hours, and second and third extractions of 3 hours each. The ecdysterone yield reached 96.7% of the content in the raw material over three cycles.

Аннотация

В статье представлены результаты исследования методов экстракции экдистерона из надземной части растения *Silene praemixta* с целью оптимизации технологического процесса. Эффективность методов оценивалась по выходу экдистерона (не менее 95% от содержания в сырье), расходу экстрагента и времени экстракции. Сравнительный анализ показал, что экстракция с принудительной циркуляцией и с перемешиванием обеспечивают минимальную длительность процесса. Однако метод с перемешиванием отличается увеличенным в 2,1 раза расходом экстрагента, неконтролируемым повышением температуры и сложностями с отделением экстракта из-за чрезмерного измельчения сырья. Экстракция в аппарате Сокслета была наиболее экономичной по расходу экстрагента, но уступала по скорости и имела ограничения для промышленного применения из-за сложной конструкции и больших габаритов оборудования. На основании результатов для интенсификации процесса выбран метод трёхкратной экстракции с принудительной циркуляцией экстрагента.

Для оптимизации экстракции экидистерона из *Silene praemixta* методом принудительной циркуляции использован подход математического планирования эксперимента по схеме латинского квадрата 3×3 . Максимальный выход экидистерона (60,8%) достигнут при следующих параметрах: соотношение сырья и растворителя — 1:5, скорость циркуляции экстрагента — 70 л/ч, степень измельченности сырья — 8 мм. Оптимальный процесс экстракции включает три цикла: набухание сырья в 90%-ном этаноле (соотношение 1:5) в течение 1 часа, первая экстракция — 4 часа, вторая и третья — по 3 часа. Выход экидистерона составил 96,7% от содержания в сырье за три цикла.

Keywords: *Silene praemixta*, ecdysterone, extraction, optimization.

Ключевые слова: *Silene praemixta*, экстракция, оптимизация.

Введение

Среди разнообразия лекарственных препаратов, применяемых для профилактики и лечения, особую популярность приобретают природные адаптогены. Эти вещества, благодаря своим уникальным свойствам, широкому спектру терапевтического действия, минимальному количеству побочных эффектов и ограниченному числу противопоказаний, становятся важным инструментом в медицинской практике. Они способствуют повышению устойчивости организма к стрессам, улучшению общего состояния и поддержанию здоровья. Одним из ярких представителей таких природных адаптогенов является экидистерон, который эффективно применяется в терапии и профилактике различных заболеваний, помогая организму адаптироваться к неблагоприятным условиям и укрепляя его защитные механизмы [1, 2]. Показаны анаболические, адаптогенные и тонизирующие свойства экидистерона и на его основе создан препарат экидистен, который получают из корневищ с корнями *Rhaponticum carthamoides* (Willd) Iljin (левзея сафлоровидная). В Институте химии растительных веществ из корней и корневищ растения *R. carthamoides* производит субстанцию экидистена по описанной технологии, приведенной в литературе. Экидистен – белый с кремоватым оттенком кристаллический порошок. Умеренно растворим в 96% спирте, малорастворим в воде, практически не растворим в хлороформе. Слегка комкуется, без запаха. Содержание экидистерона (2 β ,3 β ,14 α ,20R,22R,25-гексагидрокси-5 β -холестен-7-он-6) в субстанции экидистена в пересчете на сухое вещество должно быть не менее 96.0% и не более 103.0% [3, 4].

Одним из перспективным источником сырья для получения экидистерона служит *Silene praemixta* М. Пор. (смолёвка смешанная), которая относится к одному из наиболее распространенных видов рода *Silene* в Центральной Азии. *S. praemixta* — многолетнее растение высотой 40–60 см, произрастающее в Средней Азии (Западный Тянь-Шань). Авторы подтверждают наличие экидистерона в растении *Silene praemixta* М. Пор. (смолёвка смешанная) и рекомендуют его использование как сырья для производства экидистена [5]. Помимо экидистерона, *S. praemixta* содержит другие экидистероиды, включая силеностерон, премиксистерон, 2-дезоксид- α -экидизон, 2-дезоксидэкидистерон, 22-О- β -D-глюкопиранозид-2-дезоксид- α -экидизон, 2-дезоксидэкидистерон 3-ацетат, 2-дезоксидэкидистерон, 26-гидроксиполипидин В, интегристерон А, а также силенозиды А и D [6–10].

Ранее нами была разработана промышленная технология производства субстанции экидистена из надземной части (н/ч) *S. praemixta*. Определены оптимальные параметры, влияющие на процесс экстракции экидистерона из надземной части (н/ч) *S. praemixta* в статических условиях. Установлены следующие условия экстракции: экстрагент — 80%-ный этиловый спирт, размер частиц сырья 1–5 мм, температура процесса — 20–30 °С и пятикратная экстракция. Для удаления гидрофобных и гидрофильных примесей из полученного экстракта предложена трёхкратная обработка дихлорметаном, за которой следует восьмикратная экстракция экидистерона смесью бутанола с экстракционным бензином в объёмном соотношении 1:1. Для получения субстанции экидистена, соответствующей требованиям фармакопейной статьи, рекомендована хроматографическая очистка на оксиде алюминия с последующей кристаллизацией из смеси этанола с ацетоном в объёмном соотношении 1:7. Для хроматографической очистки предложены следующие условия: соотношение высоты сорбционного слоя к диаметру колонки — 5:1, скорость элюирования — 45 л/(м²·час), соотношение массы вносимой в колонку субстанции и сорбента — 1:15 [11].

Основным процессом, применяемым при приготовлении лекарственных форм из растительного сырья, является **экстрагирование**. Практически каждый технологический цикл, связанный с их производством и независимо от условий, при которых он протекает, включает экстракцию действующих веществ из соответствующего растительного сырья [12].

Все существующие способы экстрагирования классифицируют на статические и динамические.

Экстракцию **в статических** условиях осуществляют в условиях комнатной температуры, предварительно заливая измельченное растительное сырье необходимым количеством экстрагента.

В настоящее время изыскиваются и внедряются новые формы экстракции с максимальной динамизацией всех видов диффузии (**динамические** экстрагирования). При производстве фармацевтических препаратов используют различные методы экстрагирования, такие как перколяция, реперколяция, мацерация с перемешиванием, непрерывное экстрагирование и др. Все эти способы позволяют получить хороший результат, благодаря гидродинамическим условиям, в этих способах экстрагент движется относительно сырья. Преимущества динамической экстракции включают ускорение массопереноса между сырьём и растворителем; сокращение времени экстракции

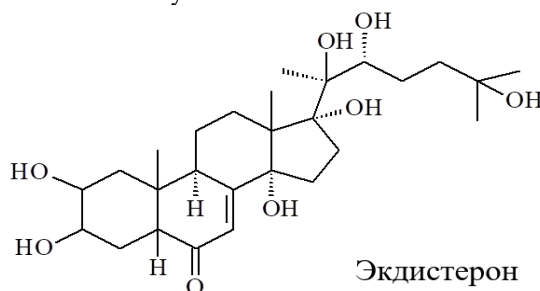
по сравнению со статическими методами; более полное извлечение целевых компонентов; повышение производительности при масштабировании [13, 14].

Цель исследования. Оптимизация извлечения экдистерона из надземной части *Silene praemixta* в условиях динамической экстракции.

Экспериментальная часть

Заготовку сырья н/ч *S. praemixta* для проведения экспериментов осуществляли во время бутонизации культивированной в ботаническом участке

ИХРВ АНРУз (г. Ташкент). Заготовленное сырьё состояло из стеблей, листьев, бутонов и соцветий и имел следующие показатели: содержание экдистерона ($C_{27}H_{44}O_7$, т. пл. 240-241°C) – 0,9%, влаги – 8%, золы общей – 6%, золы нерастворимой в 10% растворе хлористоводородной кислоты – 0,7%, частиц органической примеси – 1,1%; минеральной примеси – 0,7%.



Учитывая, что действующим веществом субстанции экдистена является экдистерон, при проведении исследования в качестве изучаемого вещества выбран экдистерон. Количественный анализ экдистерона проводили методом ВЭЖХ в условиях, приведенных в литературе [11, 19].

Условия хроматографирования: хроматограф с насосом высокого давления, позволяющим создавать градиент концентрации элюента, с УФ- детектором с переменной длиной волны, колонка Zorbax

Eclipse XDB-C18 с внутренним диаметром 3 мм, длиной 15 см, размер зернения сорбента 3,5 м или аналогичная.

Хроматографирование проводили при комнатной температуре. УФ-детектирование осуществлялся при длине волны 247 нм. Подвижной фазой служил градиент растворителей, который приведен в табл. 1.

Таблица 1

Наименование растворителя	Градиент растворителей					
	Время, мин					
	0.00	15.00	30.00	35.00	40.00	45.00
Вода	100	95	15	0	0	100
Ацетонитрил	0	5	85	100	100	0

Время анализа - 45 мин.

Скорость потока – 0,5 мл/мин.

Объем нанесения проб - 20 мкл.

Содержание экдистерона (X) вычисляли по формуле 1:

$$X = \frac{C_{\text{эк}} \cdot P_{\text{ст}}}{C_{\text{обр}}}; \quad (1)$$

где: $C_{\text{эк}}$ – концентрация экдистерона в растворе образца, определенное хроматографом, калиброванным по внешнему стандарту, в мг/л; $C_{\text{обр}}$ – концентрация испытуемого раствора, в мг/л; $P_{\text{ст}}$ – содержание экдистерона в стандартном образце, в процентах.

Для приготовления раствора стандартного образца экдистерона, около 0,01 г (точная навеска) стандартного образца экдистерона помещали в мерную колбу вместимостью 25 мл, прибавляли 20 мл спирта 50% и растворяли, доводя объем раствора до метки тем же растворителем и перемешивали (0,4 мг/мл, раствор А).

2,5 мл раствора А помещали в мерную колбу вместимостью 25 мл и доводили до метки спиртом 50% (0,04 мг/мл, раствор Б).

Для приготовления испытуемого раствора,

около 0,01 г (точная навеска) испытуемого образца помещали в мерную колбу вместимостью 25 мл, прибавляли 20 мл спирта 50% и растворяли, доводя объем раствора до метки тем же растворителем и перемешивали (0,4 мг/мл, раствор А).

2,5 мл раствора А помещали в мерную колбу вместимостью 25 мл, доводя до метки спиртом 50% и перемешивали (0,04 мг/мл, раствор Б).

Выход экстрактивных веществ определяли следующим образом: точную навеску (100 мг) спиртового экстракта помещали в предварительно высушенный и взвешенный бюкс. Бюкс с экстрактом помещали в сушильный шкаф и сушили при температуре 60 °С. При высушивании открытый бюкс вместе с крышкой помещали в эксикатор для охлаждения на 50 мин, затем закрывали и взвешивали. Первое взвешивание проводили после сушки в течение 2 ч. Последующие взвешивали после каждого часа дальнейшего высушивания. Процесс сушки проводили до постоянной массы. Массовую долю сухого остатка (в %) вычисляли по формуле 2:

$$W = \frac{m_2 - m_1}{m} \cdot 100; \quad (2)$$

где: m – навеска, г; m_1 – масса чаши, г; m_2 – масса

чаики с остатком после высушивания, г.

С целью изучения влияния способа экстракции на выход сухого экстракта из н/ч *S. praemixta* и содержание экдистерона в целевом продукте образцы экстракта получили следующими способами экстракции [13, 14]:

Способ 1. Ремацерация. В экстрактор объёмом 10 л помещали 1 кг воздушно-сухого сырья *S. praemixta*, измельчённого до частиц размером до 5 мм, заливали 4 л 90%-ного этилового спирта и проводили экстракцию при 20 °С в течение 6 часов. Экстракт сливали, а процесс экстракции повторяли ещё 4 раза, используя по 3 л спирта для каждой стадии. Объединённый спиртовой экстракт (16 л) фильтровали и концентрировали до объёма 0,5 л. Концентрат разбавляли 0,5 л воды, а гидрофобные примеси удаляли трёхкратной обработкой дихлорметаном (по 1 л). Экдистерон извлекали из очищенного водного раствора восьмикратной экстракцией смесью н-бутанола и экстракционного бензина (1:1) по 1 л. Полученную густую массу высушивали при температуре до 60 °С, измельчали, просеивали и анализировали.

Способ 2. Экстракция в аппарате Сокслета. В аппарат Сокслета загружали 0,1 кг сырья, в экстракционную колбу заливали 500 мл, а в сборник экстракта — 100 мл 90%-ного этилового спирта. Сырьё набухало в течение 2 часов, после чего проводили экстракцию до полного извлечения экстрактивных веществ. Объединённые экстракты концентрировали, очищали от примесей, извлекали экдистерон и высушивали по методике, аналогичной способу 1. Сухую массу измельчали, просеивали и анализировали.

Способ 3. Экстракция с принудительной циркуляцией. Эксперименты проводили в экстракторе объёмом 50 л с паровой рубашкой и взрывозащищённым насосом. В экстрактор загружали 10 кг воздушно-сухого сырья *S. praemixta*, заливали 40 л 90%-ного этилового спирта и проводили экстракцию при комнатной температуре с циркуляцией экстрагента (60 л/ч) в виде душа. Каждые 20 минут отбирали пробы для анализа содержания сухой массы. После достижения фазового равновесия экстракт сливали, а процесс повторяли ещё дважды с 30 л свежего спирта. Объединённые экстракты фильтровали, концентрировали, очищали, извлекали экдистерон и высушивали по методике спо-

соба 1. Сухую массу измельчали, просеивали и анализировали.

Способ 4. Экстракция с перемешиванием. В экстрактор объёмом 50 л с лопастной мешалкой (30 об/мин) загружали 10 кг воздушно-сухого сырья *S. praemixta* и заливали 80 л 90%-ного этилового спирта. После набухания сырья в течение 1 часа экстракцию проводили при комнатной температуре с перемешиванием до достижения фазового равновесия, контролируя содержание сухого остатка каждые 20 минут. Экстракт (65 л) сливали, а процесс повторяли ещё дважды с 65 л свежего спирта. Далее экстракты обрабатывали по методике способа 1: концентрировали, очищали, извлекали экдистерон и высушивали. Полученную сухую массу измельчали, просеивали и анализировали.

В процессе проведения экспериментов анализировалось изменение содержания экдистерона, переходящих в 90%-ный этиловый спирт, под влиянием каждого контакта фаз экстракции с течением времени. На основании полученных данных определили динамику экстракции экдистерона из н/ч *S. praemixta*.

Результаты и их обсуждение

Так как во всех Способах эксперименты проводили до выхода экдистерона более 95% от содержания в сырье, эффективность способов оценивали по расходу экстрагента и времени экстракции. Наилучшие результаты по времени показали экстракция с принудительной циркуляцией и с перемешиванием. Однако при перемешивании расход экстрагента в 2,1 раза выше, чем при принудительной циркуляции. Кроме того, перемешивание вызывало повышение температуры процесса, что затрудняло её регулирование, а интенсивное перемешивание увеличивало степень измельчения сырья, усложняя отделение экстракта от шрота. Экстракция в аппарате Сокслета была наиболее экономичной по расходу экстрагента, но уступала по времени циркуляционному и перемешивающему методам. Применение аппарата Сокслета в промышленности ограничено из-за сложной конструкции, больших габаритов и трудностей с загрузкой/выгрузкой сырья.

С учётом вышеизложенного, для интенсификации экстракции экдистерона из н/ч *S. praemixta* в динамических условиях выбран метод трёхкратной экстракции с принудительной циркуляцией экстрагента (рис. 1).

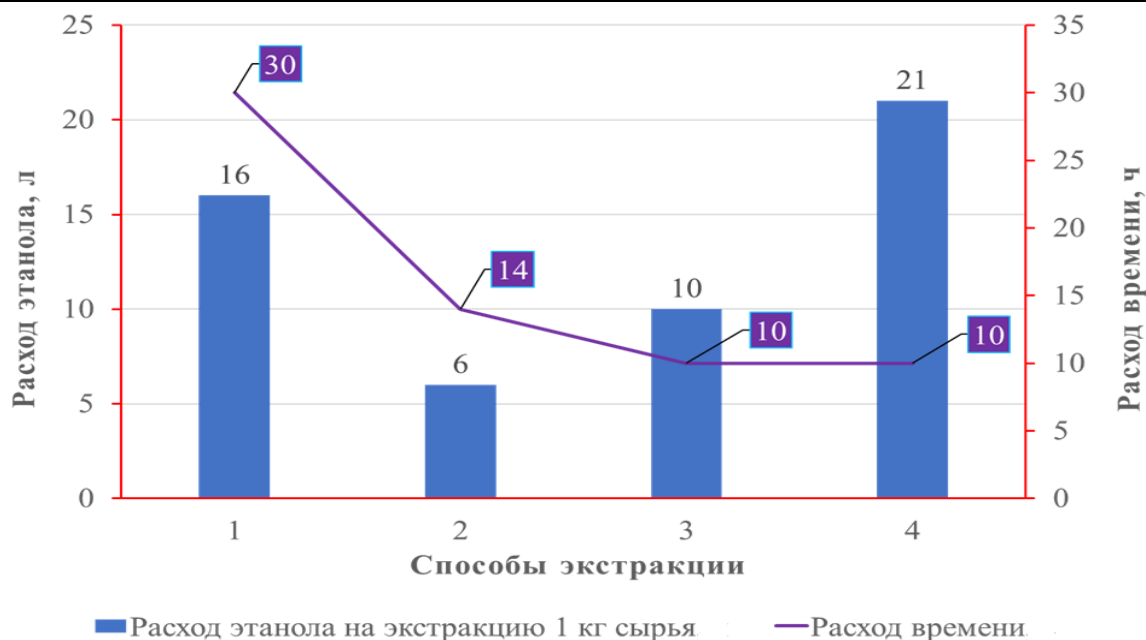


Рис. 1. Влияние способа экстракции экидистерона из н/ч *S. praemixta* на качественные параметры готового продукта и технологические показатели процесса

Исследование технологических процессов — трудоёмкий и длительный экспериментальный процесс, поэтому важно получать максимум информации при минимальном числе опытов. Оптимизация экспериментов на всех стадиях технологического цикла значительно повышает эффективность научной работы. В последние годы для оптимизации и прогнозирования химико-технологических процессов всё шире применяются методы математического планирования эксперимента, включая методы Бокса-Уилсона, Бокса-Бенкена и схемы латинских квадратов (3×3, 4×4 и др.) [16-20]. Для оптимизации экстракции экидистерона из сырья *S. praemixta* методом принудительной циркуляции экстрагента эксперименты проводили по плану латинских квадратов 3×3.

В качестве факторов изучали следующие:

A — соотношение сырья и растворителя: $A_1=1:3$; $A_2=1:4$; $A_3=1:5$.

B — скорость циркуляции экстрагента: $B_1=70$ л/ч; $B_2=80$ л/ч; $B_3=90$ л/ч.

C — степень измельченности сырья: $C_1=4$ мм; $C_2=8$ мм; $C_3=12$ мм.

Опыты проводили по плану, приведенному в табл. 1.

Во всех опытах количество сырья и метод выделения были идентичными. В опытах использовали по 1,0 кг воздушно-сухого сырья. Параметром оптимизации служил выход экидистерона от содержания в сырье при первом контакте фаз. Результаты опытов представлены в табл. 1.

Таблица 1

План эксперимента и результаты эксперимента (среднее из двух значений)								
План экспериментов				Результаты экспериментов			Число опы- тов	Повторность опытов
Факторы	A ₁	A ₂	A ₃	Выход экидистерона, % от содер- жания в сырье				
B ₁	C ₁	C ₂	C ₂	42,3	38,2	60,8	N = 9	f = 2
B ₂	C ₂	C ₃	C ₁	20,9	40,8	55,8		
B ₂	C ₁	C ₁	C ₃	18,9	20,5	23,2		

Для установления значимости факторов провели дисперсионный анализ результатов эксперимента. Для этого в начале найдены суммы показателей каждого фактора по формуле 3:

$$T = \sum T_{ij}; \quad (3)$$

Для этого в начале рассчитали суммы показателей каждого фактора (T_{ij}) и их средние значения (табл. 2).

Таблица 2

Сумма каждого фактора и их средние значения									
Искомые значения	Фактор А			Фактор В			Фактор С		
	A_1	A_2	A_3	B_1	B_2	B_3	C_1	C_2	C_3
Сумма T_{ij}	82,1	99,5	139,8	141,3	117,5	62,6	118,6	119,9	82,90
Среднее	27,36	33,16	46,60	47,10	39,16	20,86	39,53	39,96	27,63

Данные, представленные в табл. 2, были использованы в формуле 3 для расчёта суммарных показателей влияния каждого фактора:

Результат: $T = 321,4$.

Дисперсию квадратов показателей всех наблюдений анализировали по формуле 4:

$$S^2 = \sum Y_{ij}^2; (4)$$

Результат: $S^2 = 13475,96$.

Суммы квадратов каждого фактора вычисляли по формуле 5:

$$S_a^2 = \frac{1}{n} \sum T_{ij}^2; S_b^2 = \frac{1}{n} \sum T_{ij}^2; S_c^2 = \frac{1}{n} \sum T_{ij}^2; (5)$$

Результат: $S_a^2 = 12061,57$;

$S_b^2 = 12563,57$;

$S_c^2 = 11771,46$.

На следующем этапе определены средние значения суммы квадратов T/N , затем общие значения суммы квадратов рассчитали по формуле 6:

$$SS_{\text{общ}} = S^2 - \frac{T^2}{N}; (6)$$

Результат: $T/N = 11477,55$.

$SS_{\text{общ}} = 1998,41$.

Суммы квадратов группы факторов вычисляли по формуле 7:

$$SS_a = S_a^2 - \frac{T^2}{N}; SS_b = S_b^2 - \frac{T^2}{N}; SS_c = S_c^2 - \frac{T^2}{N}; (7)$$

Результат: $SS_a^2 = 584,02$;

$SS_b^2 = 1086,02$;

$SS_c^2 = 293,91$.

Затем остаточную дисперсию рассчитали по формуле 8:

$$SS_{\text{ост}} = SS_{\text{общ}} - SS_a - SS_b - SS_c; (8)$$

Результат: $SS_{\text{ост}} = 34,47$.

Средний квадрат каждого фактора вычисляли по формуле 9:

$$S_a = \frac{SS_a}{f}; S_b = \frac{SS_b}{f}; S_c = \frac{SS_c}{f}; (9)$$

где: $f = n - 1$

Результат: $S_a = 292,01$;

$S_b = 543,01$;

$S_c = 146,95$.

Остаточную дисперсию среднего квадрата каждого фактора вычисляли по формуле 10:

$$S_{\text{ост}} = \frac{SS_{\text{ост}}}{f}; (10)$$

где: $f = (n - 1)(n - 2)$

Результат: $S_{\text{ост}} = 17,23$

Дисперсионные отношения вычисляли по формуле 11:

$$F_a = \frac{S_a}{S_{\text{ост}}}; F_b = \frac{S_b}{S_{\text{ост}}}; F_c = \frac{S_c}{S_{\text{ост}}}; (11)$$

Результат: $F_a = 16,94$;

$F_b = 31,51$;

$F_c = 8,53$.

Табличное значение критерия Фишера $F_{\text{табл.}}(2,9) = 4,3$ [21].

Коэффициент считается значимым, если его дисперсионное отношение превышает значение критерия Фишера. На основании результатов анализа все выбранные факторы признаны значимыми.

Наибольший выход экидистерона получен при условиях $A_3B_1C_2$ (60,8%) и, соответственно, влияющие факторы были выбраны следующим образом: соотношение сырья и растворителя – 1:5; скорость циркуляции экстрагента – 70 л/ч; степень измельченности сырья – 8 мм.

Дальнейшие исследования были направлены на определение оптимальных условий экстракции экидистерона из н/ч *S. praemixta* методом экстракции с принудительной циркуляцией экстрагента. Результаты представлены в виде диаграммы на рис. 2.

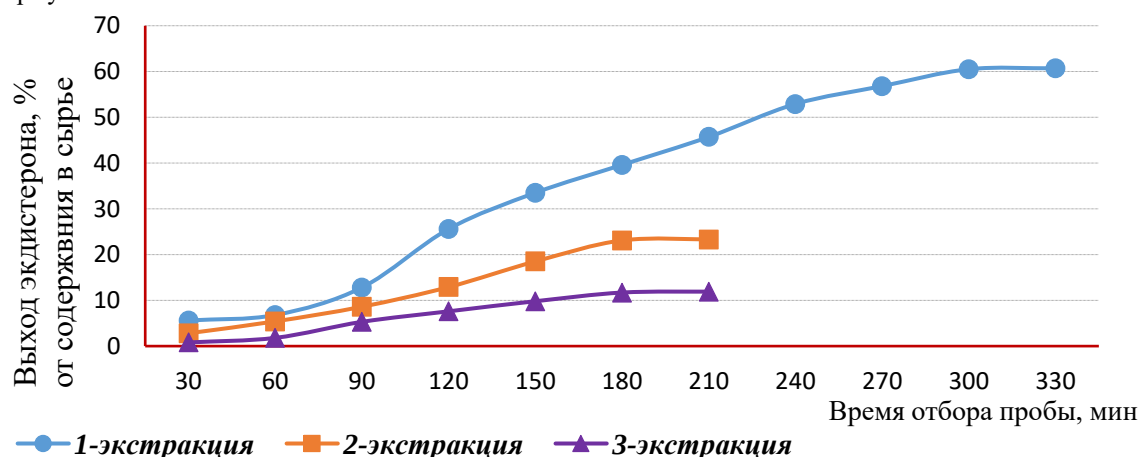


Рис. 2. Динамика извлечения экидистерона из н/ч *S. praemixta* методом экстракции с принудительной циркуляцией экстрагента с использованием 90%-ного этилового спирта

Из рис. 2 видно, что кривые экстракции представляют собой типичные изотермы, стремящиеся к равновесию. При первом контакте фаз выход экидистерона в течение первого часа низкий. Это объясняется тем, что первый час расходуется для набухания сырья.

При четвертом контакте фаз выход экидистерона незначительный, основная их часть извлекается за три слива. При этом выход составляет 96,7% от содержания в сырье. Таким образом, было установлено, что экстракцию экидистерона из н/ч *S. praemixta* методом

экстракции с принудительной циркуляцией экстрагента следует проводить трехкратно. Для этого сырье загружают в экстрактор, заливают 90%-ным этиловым спиртом в соотношении сырья к растворителю 1:5, оставляют для набухания сырья на 1 час, а затем проводят первую экстракцию в течение не менее 4 часов, вторую и третью – по 3 часа каждая.

Вывод

Исследование методов экстракции экидистерона из н/ч *S. praemixta* показало, что трёхкратная экстракция с принудительной циркуляцией экстрагента является оптимальной. Предложенный метод обеспечивает высокую эффективность и перспективность для промышленного применения при извлечении экидистерона из *S. praemixta*.

Финансовая поддержка. Данная работа финансировалась за счет средств базового финансирования Института химии растительных веществ Академии Наук Республики Узбекистан.

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CULTURAL SCIENCES

THE VOICE OF CULTURAL DIPLOMACY: THE HEYDAR ALIYEV FOUNDATION AND THE GLOBAL MISSION OF AZERBAIJANI LITERATURE AND MUSIC

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<https://doi.org/10.5281/zenodo.17492563>

Abstract

This article examines the role of the Heydar Aliyev Foundation, established in 2004, in the development, international promotion, and cultural diplomacy of Azerbaijani literature and music. The study analyzes the foundation's cooperation with UNESCO and other international organizations, translation and promotion projects of classical and contemporary literature, the worldwide presentation of the heritage of such great figures as Nizami and Mahsati Ganjavi, as well as the importance of musical events such as the "Mugham Alemi" festivals and the anniversaries of Bulbul and Shostakovich. The article shows that the Heydar Aliyev Foundation is not just a charitable organization, but an institutional cultural powerhouse that systematically promotes and preserves Azerbaijani culture. Under the leadership of Mehriban Aliyeva, the foundation has introduced Azerbaijan on the international stage with its projects combining literature and music, and has both strengthened national identity and promoted the ideals of mutual understanding and peace between peoples through cultural diplomacy.

Keywords: Azerbaijani culture, Heydar Aliyev Foundation, Cultural diplomacy, Musical iris, UNESCO cooperation.

Introduction: The Heydar Aliyev Foundation is one of the important public institutions that played a leading role in the formation of cultural and social life in Azerbaijan during the period of independence. The Foundation's activities are not limited to its charitable mission, but also aim to provide systematic support to the development of national culture, education and health, and to protect the social well-being and spiritual integrity of the Azerbaijani people. By implementing various humanitarian, scientific and cultural projects within the country, the organization has become an important tool in the formation of the modern face of Azerbaijan and strengthening its international image [7, pp. 184–190].

The Foundation's multifaceted activities also serve to deepen cultural, social and economic relations between Azerbaijan and Turkey, and to strengthen the environment of mutual understanding and cooperation [16, pp. 184–195]. The programs implemented in this direction are of strategic importance not only for the relations between the two countries, but also for the integration processes of the Turkic world as a whole [15, p. 22].

The Heydar Aliyev Foundation has made special contributions to the international promotion of Azerbaijani culture through its projects in literature, music, art and other fields. The Foundation's initiative has not only focused on collecting and promoting examples of oral and written literature, but also on preserving classical Azerbaijani music and folk art in a modern cultural environment [2, p. 138; 3, p. 20].

Education and health projects have a special place among the humanitarian activities of the organization. With the financial support of the foundation, the establishment of the Thalassemia Center in Baku, the construction and rehabilitation of a number of schools, kindergartens and hospitals, as well as steps taken to expand educational opportunities for young people, have

become an integral part of the social development strategy of Azerbaijan [4, pp. 110–113; 14, pp. 5–9].

In this regard, the Heydar Aliyev Foundation acts as a carrier of a national mission aimed not only at preserving cultural heritage, but also at passing it on to future generations. It acts as one of the main symbolic institutions in the protection of the national identity, spiritual values, and historical memory of the Azerbaijani people [8, p. 186; 9, p. 247].

- **Heydar Aliyev Foundation and its importance**

The Azerbaijan Heydar Aliyev Foundation was established on May 10, 2004 and has become one of the main leading institutions in the social, cultural and humanitarian development of the country. The purpose of the foundation's establishment was to continue the political and spiritual legacy of the national leader Heydar Aliyev, to bring his philosophy of "service to the people" to life in real projects. This mission stems from the desire to strengthen national solidarity at both the ideological and practical levels and to systematically promote the idea of "Azerbaijanism" in modern conditions [7, pp. 184–185].

The motivation for the foundation's establishment has deep socio-political roots. In the political legacy of Heydar Aliyev, the preservation of national identity, the development of culture and education were considered one of the main priorities of state policy. From this point of view, the establishment of the foundation named after him can be considered as a continuation of these ideas and their institutionalization [7, pp. 188–190; 14, p. 2]. The focus of the foundation's activities is on promoting an atmosphere of friendship, cooperation and mutual understanding both within the country and internationally.

The Heydar Aliyev Foundation has carried out wide-ranging activities in areas such as the protection of cultural heritage, support for projects in the fields of education and healthcare, and the implementation of

social welfare programs [17]. One of the main tasks of the organization is to pay special attention to the welfare and development of children, who are considered the future of Azerbaijan, and to raise them as creative citizens shaped by national values [18]. To this end, the foundation attaches importance to programs aimed at the education and upbringing of the younger generation, and considers the transfer of Heydar Aliyev's spiritual heritage to future generations a strategic priority [19].

Since its inception, the Foundation has invested in education and healthcare infrastructure, and has achieved significant achievements in the areas of school rehabilitation, hospital modernization, and scholarship programs [4, pp. 110–113]. For example, the establishment of the Thalassemia Center in Baku and the reconstruction of kindergartens and boarding schools in many regions have made concrete contributions to supporting the state's social policy [14, pp. 5–9].

In the field of culture, the foundation has paid great attention to the international promotion of Azerbaijani literature, music and art. Concerts, exhibitions and folklore events organized by the Heydar Aliyev Foundation have become an important means of presenting the national heritage to the world [2, p. 138; 3, p. 21]. At the same time, architectural monuments such as the Heydar Aliyev Cultural Center built in Baku have become modern cultural symbols of the country and have ensured the promotion of Azerbaijani culture on a global level [8, p. 186; 9, p. 247].

The Foundation's cultural projects have also played an important role in strengthening national self-awareness and feelings of patriotism. Heydar Aliyev has repeatedly emphasized that "the strength of the people lies in its cultural heritage", and the Foundation's activities are a practical confirmation of this principle [8, p. 188]. On his initiative, various grant and competition programs were implemented to support the creativity of artists, writers and musicians [20].

The Heydar Aliyev Foundation of Azerbaijan plays an active role not only in domestic projects, but also in international cooperation. The Foundation has implemented humanitarian projects in cooperation with UNESCO, ISESCO and other international organizations, organized exhibitions and presentations promoting Azerbaijani culture in various countries [6, p. 73; 12, p. 4]. This activity has served to strengthen the "soft power" mechanism of Azerbaijani diplomacy and increase the country's international prestige [16, p. 190–192].

In general, the Heydar Aliyev Foundation acts as an institution of strategic importance in the development of Azerbaijani society. Its activities provide a synthesis of state policy and civil society initiatives, maintaining a balance between social welfare, cultural heritage and national identity. In this regard, the history and significance of the foundation can be assessed not only from the aspect of charity, but also as an institutional embodiment of the modern model of the ideology of Azerbaijanianess [7, p. 189; 15, p. 24].

• **Heydar Aliyev Foundation and Azerbaijani Literature**

The Heydar Aliyev Foundation is one of the leading cultural institutions that systematically supports the development of Azerbaijani culture and literature, and carries the mission of preserving the country's spiritual values and passing them on to future generations. Since its inception, the Foundation has implemented special projects aimed at the development of literature and art, and has put forward numerous initiatives to identify talents in this field and support their creative potential [21].

One of the most important initiatives implemented by the Foundation is the recognition of the work of writers and poets who have contributed to literature through prestigious awards such as the "Heydar Aliyev Award". This initiative does not stop at celebrating literary achievements, but also encourages a culture of competition, professionalism and artistic excellence in the creative environment [3, pp. 19–22]. At the same time, the Foundation's support for the legal protection of Azerbaijani folklore and the revival of traditional literary styles confirms its consistent policy towards the preservation of national and cultural identity [3, pp. 20–24].

As a result of these activities, the Heydar Aliyev Foundation has become an important tool in the recognition of Azerbaijani literature both nationally and internationally. The Foundation makes a continuous contribution to the revitalization of the literary environment, the support of young writers, and the promotion of national literature worldwide [7, pp. 185–188]. Azerbaijani literature has rich traditions that reflect the historical experience, aesthetic sense, and spiritual values of the people. From ancient epics and folk tales to modern novels and poetry, this literature has skillfully combined the diverse cultural influences and human emotions of the people [1, pp. 268–271].

Classics such as Nizami Ganjavi, Fuzuli, and Mirza Fatali Akhundzadeh, who are the main pillars of the literary tradition, are considered symbolic figures representing Azerbaijani literature in both the Eastern and Western worlds. Their works are poetic embodiments of human values, reflecting the themes of humanity, love, justice, and wisdom, and have stood the test of time and continue to have a profound impact on readers today [1, pp. 272–275]. The legacy of these classics is evidence of the contributions of Azerbaijani literature not only to national but also to the literary thought of the Turkic and Islamic worlds.

The Heydar Aliyev Foundation has been actively involved in the protection and promotion of this heritage, and has implemented a number of important projects, particularly under the leadership of the First Lady of Azerbaijan, President of the Foundation, Mehriban Aliyeva [17]. The Foundation has initiated events to restore historical manuscripts, publish classical literature, and promote the work of contemporary writers and poets [8, p. 189; 9, p. 247]. The Foundation has also promoted Azerbaijani literature on international platforms through literary festivals, competitions, and conferences, and has provided financial and moral support to young writers and translators [20].

Within the framework of these activities, the foundation has supported the publication and dissemination

of Azerbaijani literature at the international level by establishing cooperation with both local and foreign publishing houses [31]. This systematization of literary projects has given impetus to the development of the creative environment in the country and created conditions for literature to play a more active role in the life of society [4, p. 115].

The official visit of the representatives of the Azerbaijan Writers' Union and the Azerbaijan University of Economics (UNEC) to the Heydar Aliyev Foundation on December 9, 2005, also had symbolic significance in this regard. The purpose of the visit was to commemorate the memory of the national leader and express respect for his role in the cultural and spiritual development of the country [9, pp. 244–246]. During the visit, the participants were presented with materials stored in the foundation's archives – documents, photographs and books reflecting Heydar Aliyev's childhood and youth, various stages of his statehood activities and an entire period of Azerbaijani history [7, p. 190].

Among the photographs displayed during the exhibition, the photos from the opening ceremony of the tomb of Molla Panah Vagif, one of the classics of Azerbaijani literature, and the jubilee events of literary figures were of particular interest. These exhibitions are considered a clear manifestation of Heydar Aliyev's deep concern for culture and literature [9, p. 248; 11, p. 1271].

In addition, the Heydar Aliyev Foundation plays an active role in the development of international cultural relations. For example, the Pushkin Library Project, dedicated to the memory of the classic of Russian literature Alexander Pushkin, is an example of the foundation's approach to literary heritage on an international scale. Through this project, a cultural bridge has been created between Azerbaijani and world literature, creating conditions for deepening mutual understanding and cultural dialogue [6, pp. 71–74].

Thus, the Heydar Aliyev Foundation acts as a strategic center that carries out multifaceted activities in the protection, promotion and international recognition of Azerbaijani literature and culture in general. The projects it implements are an integral part of the cultural development model of modern Azerbaijani society, both in terms of strengthening national identity and developing cultural diplomacy [7, pp. 189–190; 15, p. 23].

• Heydar Aliyev Foundation and Literary Cooperation Projects

The Heydar Aliyev Foundation has implemented a number of cultural and intellectual cooperation initiatives to promote Azerbaijani literature not only within national borders but also internationally. Among these activities, the Pushkin Library Project occupies a particularly important place. The Foundation has promoted cultural exchange and intellectual development through literature by supporting the preservation and sharing of the works of Alexander Pushkin and other classic literary works [6, pp. 71–74].

The ceremony of presenting the books of the Pushkin Library Foundation to the Heydar Aliyev Foundation on February 1, 2006, was a significant event that

served to deepen cultural dialogue and mutual understanding between Azerbaijan and Russia. This event is considered not only a symbol of friendship between the two foundations, but also an embodiment of the principle of mutual respect for different cultural heritages and sharing literary values [6, p. 73]. The event highlighted the unifying power of literature in the “human language” and emphasized the importance of cultural diplomacy that transcends borders [15, p. 22–23].

One of the important steps in this direction is the project of translating the works of Mir Jalal Pashayev into Turkish. This initiative, implemented with the support of the Heydar Aliyev Foundation, has been an important stage in strengthening literary and cultural ties between Azerbaijan and Turkey. Mir Jalal Pashayev, a famous writer, philologist and educator, is known as one of the main representatives of the realist school of Azerbaijani literature with his novel “The Resurrection Man” and other works [10, pp. 357–359]. The translation of his works into Turkish is of great importance not only in terms of sharing literary heritage at the international level, but also in terms of strengthening the spiritual ties of common Turkic culture [16, pp. 185–188].

As a result of these translation projects, the works of Azerbaijani writers and poets have been brought to a wide readership in Turkey, thus opening up new opportunities for interaction and exchange of ideas in the field of literary and artistic thought [10, pp. 369–371]. These initiatives of the Heydar Aliyev Foundation have become one of the effective models serving to deepen cultural diplomacy and mutual understanding between the two countries through literature [16, p. 190].

The Foundation has initiated cultural and educational projects aimed at promoting Azerbaijani literature and strengthening the country's intellectual and scientific potential. In this context, the 9th International Book Fair held in Baku in 2023, dedicated to the 100th anniversary of Heydar Aliyev, served as an important literary platform that brought together writers, publishers, and readers [22]. The aim of the event was to introduce representatives of contemporary Azerbaijani literature at the international level, discuss new publications, and promote reading culture among the general public [22].

Azerbaijan's membership in UNESCO since 1992 has allowed the country to expand its activities in the field of cultural diplomacy, especially in the field of literature [18]. The steps taken by Heydar Aliyev in the field of cooperation with UNESCO laid the foundation for future projects representing Azerbaijani literature and art on a global level [18]. In November 2008, an international discussion on Azerbaijani literature was organized at the Diaspora Research Center in the People's Republic of China, and the role of works written in Azerbaijani Turkish in the context of world literature was discussed at this event [15, pp. 23–25].

As a result of these initiatives, Azerbaijani literature has become recognized in a wider international context as an integral part of the culture of the Caucasus region and the Turkic world in general. The cooperation between the Heydar Aliyev Foundation and the Paris office of UNESCO is of particular importance in this regard [23]. The vice-president of the Foundation, poet

and public figure Leyla Aliyeva, has actively participated in organizing programs promoting Azerbaijani literature among the younger generation and in developing international cultural relations [23]. Her initiatives are aimed at the intellectual development of young people through literature and strengthening their sense of national identity [9, p. 248].

Thus, through its projects in the field of literature, the Heydar Aliyev Foundation has achieved not only the preservation of cultural heritage, but also its international sharing. The Foundation's initiatives have transformed Azerbaijani literature into a means of dialogue connecting it with human values and included it in the global cultural exchange system [7, pp. 189–190; 10, p. 370].

• **Heydar Aliyev Foundation and UNESCO Cooperation: Global Promotion of Literary Heritage**

The Heydar Aliyev Foundation, in close cooperation with UNESCO, has played a strategic role in the international promotion of Azerbaijani literature and culture. Events, exhibitions and literary programs organized within the framework of this cooperation have not only demonstrated the richness and diversity of Azerbaijani literature, but also strengthened the country's position in the global cultural arena [18]. Joint initiatives led by the UNESCO Paris Office have contributed significantly to the growing recognition and positive reception of Azerbaijani literature worldwide [23].

As a result of this cooperation, the translation and dissemination of the works of Azerbaijani writers and poets has been facilitated, while platforms have been created for them to communicate directly with an international audience [23]. Such sharing of literary heritage has promoted not only cultural exchange, but also mutual understanding and spiritual closeness between peoples [15, pp. 23–25]. Projects carried out within the framework of UNESCO have created conditions for a deeper understanding and appreciation of Azerbaijani culture, history and identity at the global level.

The Heydar Aliyev Foundation has contributed to the preservation and revitalization of the national literary heritage by supporting the translation of over 1,300 examples of classical and contemporary Azerbaijani literature into Azerbaijani Turkish. [24] This initiative is of great importance not only in terms of archiving cultural heritage, but also in terms of transmitting literature to future generations.

In addition to translation projects supported by the Foundation, international literary festivals, conferences, and exhibitions have also played an important role in the global presentation of Azerbaijani literature [16, pp. 192–194]. Within the framework of these events, Azerbaijani authors, scholars, and artists have participated in literary gatherings held worldwide and presented the country's literary and cultural potential.

In particular, the international jubilee event organized on September 12, 2012, on the occasion of the 870th anniversary of Nizami Ganjavi, is a vivid example of the Heydar Aliyev Foundation's activity in the field of cultural diplomacy. Nizami is one of the rare figures who combined the concepts of humanity and art with universal values in his works, and the celebration

of his jubilee at the international level increased the prestige of Azerbaijani literature [7, pp. 186–189]. The aim of the event was to emphasize the importance of Nizami's legacy not only for Azerbaijan, but also in the system of universal values.

The performance "Hamse" based on the works of Nizami Ganjavi was also presented at this event. This project, prepared under the leadership of the Foundation's President Mehriban Aliyeva, consisted of five selected poems that emphasize the poetic tradition and aesthetic depth of Azerbaijani literature [5, pp. 67–69]. The performance demonstrated the unity of poetry and visual art, giving the audience a new artistic perspective on love, spirituality, and human experiences. A special place was also given to the works of the prominent poet Ismayil bey Nagam, who continued the tradition of writing "Hamse" [5, p. 68]. His poetic language is distinguished by its spiritual and philosophical line, expressing the deep layers of the human soul, the mystery of the universe, and the eternal search for perfection.

The Heydar Aliyev Foundation also played an important role in organizing an international conference dedicated to the 900th anniversary of Mahsati Ganjavi, together with the Azerbaijani Embassy in France [25]. The event, in addition to emphasizing the place of the phenomenon of Mahsati Ganjavi in the historical development of Azerbaijani culture and women's literature, also contributed to the strengthening of Azerbaijani-French cultural relations. The conference was held at the University of Haute-Alsace of the French Republic and drew the attention of the international scientific community to Azerbaijani literature [25]. This was an important step towards the systematic promotion of the country's cultural heritage in the European academic environment.

One of the most important projects of the Heydar Aliyev Foundation is the collection of publications "The Cultural Heritage of Karabakh". This five-volume series systematically documents the contributions of Karabakh to human culture in such fields as literature, music, architecture, carpet weaving and fine arts [17]. In particular, the volume "Literature" covers the role of folk art, epics and classical poetry in the formation of the literary environment of Karabakh [17]. This publication constitutes the intellectual support for the process of revitalization and reconstruction of cultural heritage in the liberated territories of Azerbaijan.

• **Heydar Aliyev Foundation and Music**

On February 2, 2005, a strategically important project in the field of culture was launched at the initiative of the Foundation President Mehriban Aliyeva; this initiative, in particular, gave a strong impetus to the formation of the country's musical landscape, prioritizing the systematic support of the national mugham tradition [2, pp. 140–144]. Aliyeva's deep appreciation for art and her consistent work in preserving and promoting Azerbaijan's cultural heritage, while promoting a vibrant cultural environment at home, also highlighted the importance of cultural diplomacy as a tool [16, pp. 190–192].

With the initiative and organizational support of the Foundation, the "Mugham Alemi" International Festival was first held in Baku in March 2009; in the

period 2011–2015, the festival continued with concerts, an international mugham competition, and scientific symposiums in Baku and the regions, bringing together world-renowned performers and researchers [2, pp. 142–145]. This platform, in addition to demonstrating the diversity of Azerbaijani music, provided support for intercultural dialogue and strengthened the presentation of national heritage on the modern stage [13, pp. 512–516].

The foundation also provides targeted support for music education: it enables the professional development of young talents through scholarship programs, master classes, and music workshops, expands access to quality learning resources, and forms a mentoring environment [16, pp. 191–192; 4, pp. 114–118]. This approach serves not only the development of individual talents, but also the sustainability of the country's music ecosystem by forming a new generation of artists [2, pp. 145–146].

The Foundation also takes a consistent line towards the preservation and promotion of musical heritage: projects are being implemented to document the ancient professional musical genre such as mugham, to archive its performance traditions and to present them to the public [2, pp. 139–143; 13, pp. 514–517]. Within this framework, concerts, exhibitions and thematic cultural events are organized, thereby increasing public awareness and artistic appreciation of Azerbaijani musical traditions [2, pp. 144–146].

Dmitri Shostakovich and **Bulbul**, the high-level celebration of the anniversaries of iconic figures of world and national musical culture in Baku in 2005–2006 is also one of the memorable projects curated by the Foundation. Concerts, exhibitions, master classes, and various cultural performances not only expressed respect for the heritage of these artists, but also demonstrated the unifying power of music that transcends borders and generations [2, pp. 143–145; 9, pp. 244–248].

Eurovision 2012 The holding of large-scale events such as the “Azerbaijani Music Night” in Baku significantly contributed to the presentation of Azerbaijan's cultural image and tourism potential to a global audience; the Foundation's organizational and communication support increased the effectiveness of these events in terms of cultural diplomacy [4, pp. 116–118; 16, pp. 192–194]. Subsequently, international presentations such as the “Azerbaijani Music Night” increased the visibility of the national musical heritage in the European cultural space and expanded interaction with diverse audiences [2, pp. 145–146].

Overall, the Heydar Aliyev Foundation's music policy – based on the pillars of education (scholarships, master classes), heritage preservation (archiving, publishing, presentation), and international promotion (festivals, concert tours) – deepens intercultural dialogue and promotes the continued recognition of Azerbaijani music at home and abroad [2, pp. 139–146; 13, pp. 512–518; 16, pp. 190–194].

Conclusion

The Heydar Aliyev Foundation, with its belief in the unifying power of culture, literature and music, plays the role of a cultural ambassador that promotes Azerbaijan not only in the region but also throughout

the world. It preserves national memory through literature, conveys a message of peace and harmony through music, and builds bridges between peoples through cultural diplomacy. The projects implemented under the far-sighted leadership of Mehriban Aliyeva have introduced the rich heritage of Azerbaijan to the modern world, and at the same time established a system that keeps this heritage alive for future generations. In this regard, the Heydar Aliyev Foundation is not only a charitable organization, but also the spiritual breath of Azerbaijan, the modern revival of national memory and a window to the world. The Foundation's activities show that art and culture are not only aesthetic values, but also the fundamental pillars of statehood, national identity and international dialogue. By protecting and sharing these values, the Heydar Aliyev Foundation makes Azerbaijan sound like a brilliant symphony on the world cultural map.

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TRADITIONAL VIETNAMESE CULTURAL VALUES AND THEIR ROLE IN SHAPING STUDENTS' LIFE VALUE ORIENTATION IN THE DIGITAL ERA

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<https://doi.org/10.5281/zenodo.17492565>

Abstract

In the context of globalization and the profound transformations brought about by the digital era, which are exerting strong influences on cultural, moral, and social norms, Vietnamese university students - the core intellectual force of the nation - are facing significant challenges in defining and maintaining a positive and appropriate system of life values. This study focuses on analyzing the role of Vietnam's traditional cultural values - including patriotism, benevolence, respect for learning, diligence, modesty, moral integrity, and community spirit - in orienting and enhancing the life values of contemporary students.

Through an interdisciplinary approach combining cultural studies and sociology, along with an analysis of students' real-life practices, the research demonstrates that traditional values not only serve as a foundational basis for personality formation but also function as an effective "filter" that enables students to select information wisely, behave responsibly, and adapt sustainably to the rapid development of the digital environment. However, under the increasing influence of materialism, individualism, and negative tendencies emerging from social media, the preservation and promotion of traditional cultural values must be strengthened through the innovation of moral and cultural education in schools, as well as the enhancement of the role of digital communication in shaping students' awareness and behavior. The findings affirm the enduring significance of traditional cultural values in fostering a healthy, responsible, and humanistic lifestyle for the young generation of Vietnam amid the ongoing processes of international integration and digital transformation.

Keywords: traditional cultural values; Vietnamese students; digital era; life value orientation; national culture

1. Introduction

As the process of international cultural integration deepens, the spiritual life and lifestyle of Vietnamese university students have been increasingly influenced by multidimensional factors. Easy access to global sources of knowledge, new cultural models, and modern behavioral norms has broadened students' horizons and enhanced their capacity for integration. However, alongside these opportunities, there also exist considerable challenges, most notably a crisis of life values. This is manifested through moral confusion, tendencies toward materialism and individualism, and a decline in community consciousness.

In this context, Vietnam's traditional culture - comprising such values as benevolence, respect for learning, diligence, modesty, honesty, reverence for teachers and morality, and solidarity - has played and continues to play a fundamental role in shaping moral character across generations. These values not only possess historical significance but also serve as a firm spiritual foundation capable of guiding appropriate lifestyles and attitudes amid the rapidly changing social landscape.

Therefore, a systematic study of the role of traditional cultural values in orienting the life values of Vietnamese students has become an urgent necessity. The findings of such research will not only contribute to strengthening the moral foundation, cultural identity, and social responsibility of the young generation, but also provide theoretical grounds for renewing moral and cultural education in universities. In doing so, it supports the

comprehensive development of human beings in the digital age.

2. Content

2.1. Fundamental Concepts

Vietnam's traditional cultural values are understood as a system of norms, beliefs, moral principles, customs, practices, and life ideals that have been formed, consolidated, and transmitted through various historical periods of the nation. These values are not merely the "spiritual heritage" of the past but also function as a "cultural code" that shapes the ways Vietnamese people behave, build social relationships, and perceive both the world and themselves.

According to scholar Trần Văn Giàu, traditional cultural values are "*the great moral principles upon which the people of a nation, throughout different historical periods, rely to distinguish right from wrong and to determine what ought to be done in order to build the nation's independence, freedom, and progress*"¹ among these, patriotism plays the role of a "red thread" running through the entire history of national construction and defense. Similarly, Phan Huy Lê defines tradition as "*a collection of ideas, sentiments, habits of thought, lifestyles, and behavioral norms of a given community, formed throughout history, which become stable and are transmitted from generation to generation*"².

Furthermore, Resolution No. 5 of the 8th Plenum of the Central Committee of the Communist Party of Vietnam on "*Building an Advanced Vietnamese Culture Rich in National Identity*" identifies five "sustainable values nurtured throughout the long course of national

¹ Trần Văn Giàu. (1987). *The Spiritual Values of Vietnam's Traditional Culture*. Hanoi: Social Sciences Publishing House, p. 142.

² Phan Huy Lê & Vũ Minh Giang (Eds.). (1994). *Traditional Values and the Vietnamese People in the Contemporary Era*. National-Level Science and Technology Program KX.07, Project KX07-02, Vol. I. Hanoi.

history”: “(1) Ardent patriotism and strong national self-reliance; (2) Solidarity and community consciousness (linking the individual, family, village, and nation); (3) Compassion, tolerance, and respect for morality and emotional bonds; (4) Diligence and creativity in labor; (5) Gracefulness in conduct and simplicity in lifestyle”³.

Thus, traditional cultural values constitute a stable and enduring system of social norms recognized by the community and reflecting the distinctive identity of the Vietnamese nation. These values crystallize the long historical experience of the Vietnamese people in their process of nation-building and defense, encompassing benevolence, affection and moral integrity, patriotism, industriousness, respect for learning, solidarity, and humility. This value system serves both as a spiritual foundation and as an intrinsic source of strength ensuring the sustainable development of Vietnamese culture and humanity.

In the context of contemporary student life, traditional cultural values serve as a “spiritual anchor” that helps the younger generation locate their sense of self amid the constant transformations of modern society. Values such as respect for teachers and morality, benevolence, community spirit, and respect for learning continue to exert strong influence in shaping moral character and guiding social behavior. Within academic environments or across social media platforms - where cultural interactions occur intensely - the inheritance of traditional values enables students to develop the ability to select, analyze, and preserve their cultural identity against the impacts of materialism and cultural hybridization. From the perspective of cultural philosophy, traditional cultural values can be regarded as the “latent ethics embedded in the national consciousness”, functioning as guiding principles for humanistic conduct and moral action in contemporary life. The continuation and promotion of these values not only preserve cultural identity but also aim toward the comprehensive development of Vietnamese people - imbued with national spirit while possessing the capacity for global integration.

The concept of **life values** has been approached from various angles by philosophers, psychologists, and sociologists, who generally agree that it refers to the principles, goals, and ideals that orient human behavior, attitudes, and life choices. Thornberg and Oguz (2013) examined teachers’ perspectives on value education and identified two main approaches. The first, the traditional approach, emphasizes the adult’s role in transmitting moral and social norms - including values - through character education, direct instruction, and the use of rewards or sanctions. The second, the progressive or constructivist approach, highlights the learner’s active participation in constructing moral meanings through social interaction and ethical discussion⁴. In Vietnam, life values are defined as the moral and social standards that individuals pursue to determine the meaning of life and the goals to

be achieved. According to Nguyễn Quang Uẩn and colleagues, the transition from a centrally planned to a market economy, coupled with trends of international integration, has generated multidimensional impacts on education - both positive and negative. This transformation has created an urgent demand for value orientation and belief education among the younger generation to meet the challenges of the new social context⁵. This demonstrates that life values do not merely belong to the psychological-ethical domain but also play a crucial role in guiding human behavior and shaping individual lifestyles.

For university students - who are in a stage of intellectual and moral maturation - the formation of a sound system of life values is particularly significant. Life values in the student environment are reflected in their attitudes toward learning, sense of responsibility, and ways of interacting with teachers, peers, and society. In the digital era, where flows of information, values, and life models are increasingly diverse and often contradictory, identifying and orienting life values have become complex processes that require the collaboration of families, schools, and society. From a humanistic philosophical perspective, life values represent the essence of “humanity” itself and the outcome of self-awareness and continuous self-cultivation. They constitute the foundation that enables students not only to “live”, but to “live meaningfully” - pursuing true happiness, contribution, and a harmonious balance between individual and collective well-being.

Value orientation is an intentional process carried out through the combined influences of education, social environment, and individual self-awareness, aiming to help students shape a positive and balanced system of values that harmonizes personal, communal, and societal interests. In 1988, on the occasion of the 900th anniversary of the University of Bologna, the organization Magna Charta Observatory (MCO) officially promulgated the *Magna Charta Universitatum*. A decade later, in 1998, within the framework of UNESCO’s *World Conference on Higher Education*, the International Association of Universities (IAU) issued a declaration emphasizing three core values: academic freedom, institutional autonomy, and social responsibility. Both organizations have continued to promote these principles, encouraging universities not only to adopt but also to integrate them deeply into their visions and missions. Accordingly, higher education in the 21st century should aim to foster awareness and behaviors grounded in universal human values such as mutual respect, cooperation, honesty, responsibility, and compassion.

In the context of Vietnamese higher education, the orientation of students’ life values is not confined to moral education alone but constitutes an integral and continuous component of comprehensive character development. Scholar **Phạm Minh Hạc** emphasized that

³ **Communist Party of Vietnam (CPV)**. (1998). *Documents of the Fifth Plenum of the Eighth Central Committee*. Hanoi: National Political Publishing House, p. 23.

⁴ Thornberg, R., & Oguz, E. (2013). Teacher view’s on values education: A qualitative study in Sweden and Turkey. *International Journal of Educational Research*, 59, 49-56. <https://doi.org/10.1016/j.ijer.2013.03.005>

⁵ **Nguyễn Quang Uẩn, Nguyễn Thạc, & Mạc Văn Trang**. (1995). *Values – Value Orientation and Value Education*. National-Level Scientific Project, Code: KX.07-04.

*“universities must serve the development of the country’s human resources and should not operate solely for profit-oriented enrollment”*⁶, this statement underscores the need for higher education to combine intellectual training with moral and personal development, in which value orientation serves as the foundation for nurturing autonomy, creativity, and social responsibility in modern society.

The process of value orientation should be implemented systematically through three main levels. First, *cognitive education* helps students understand the meaning and significance of values. Second, *emotional education* aims to cultivate empathy and strengthen students’ belief in those values. Third, *behavioral education* focuses on forming habits and behavioral standards grounded in positive moral principles. This process requires a harmonious integration of theory and practice, as well as close coordination among schools, families, and society to establish a unified environment for guiding the life values of the younger generation.

In the context of digital transformation, value orientation faces numerous challenges arising from the online sphere, such as the infiltration of consumerist lifestyles, celebrity idolization, and the spread of misleading information. Therefore, orienting life values today must be closely linked with education in traditional culture. This connection not only helps students develop “cultural immunity” but also enables them to select, inherit, and creatively adapt traditional values in alignment with the dynamic processes of globalization.

2.2. Some Positive and Negative Impacts

The Fourth Industrial Revolution and the rapid global digital transformation are generating profound changes across all aspects of life, exerting a particularly strong influence on the younger generation - those who directly engage with, create, and apply technological innovations. In Vietnam, university students are regarded as the pioneering force in embracing and adapting to the digitalized environment. Although the digital era offers countless opportunities for expanding knowledge and fostering personal development, it also poses significant challenges to the preservation, formation, and sustainable development of students’ value systems.

Positive Aspects

Firstly, the digital age has greatly enhanced access to knowledge. With the support of the Internet and various online learning platforms, students today can easily reach global sources of knowledge, including Massive Open Online Courses (MOOCs), international academic forums, and professional research networks. According to a UNESCO report (2021), more than 80% of students in the Asia-Pacific⁷ region believe that digital technologies not only broaden their perspectives but also narrow the knowledge gap with the world. In Vietnam, the Ministry of Education and Training has emphasized that digital transformation in higher education is creating lifelong learning opportunities and establishing an open knowledge ecosystem for the younger generation.

Secondly, within the digital environment, students not only gain access to knowledge but also develop essential 21st-century competencies such as critical thinking, information literacy, and creative problem-solving. Leading universities in Vietnam, such as Vietnam National University, Ho Chi Minh City University of Technology, and Ton Duc Thang University, have implemented numerous programs such as “*Digital Skills*” and “*E-learning*” initiatives to enhance students’ technological capacity and innovative mindset. This demonstrates that the digital environment has become an “open learning space”, revolutionizing the way young people acquire and engage with knowledge.

Thirdly, the digital era has also fostered a stronger spirit of self-learning and autonomy among students. In the past, learning was often characterized by a one-way transmission of knowledge from lecturers to students; today, technology enables learners to take initiative in exploring, verifying, and applying knowledge in their own ways. A survey on students’ perceptions of blended learning revealed that a majority (79%)⁸ considered online learning essential, as it allows them greater control over their study schedules and methods. The culture of self-learning and independent research has thus become a defining feature of modern education, contributing to the formation of positive life values such as autonomy, perseverance, and a passion for intellectual exploration.

Fourthly, the digital era has opened new opportunities for global connectivity and strengthened the sense of international integration. Through social media platforms, academic forums, and online collaborative projects, students can engage with peers worldwide and participate in intercultural and scholarly exchanges. This global connectivity not only broadens their worldview but also nurtures an appreciation for cultural diversity and fosters a global citizenship mindset among youth. As Alvin Toffler observed, individuals capable of swiftly adapting to technological change are the true citizens of the new age. In this regard, Vietnamese students are increasingly demonstrating their capacity for integration by embracing universal humanistic values such as respect for diversity, cooperation, creativity, and social responsibility.

From the above analysis, it can be observed that the digital era has significantly contributed to the formation of modern, dynamic, and globally oriented life values among Vietnamese university students. These values include self-learning competence, independent thinking, creativity, global awareness, and technological proficiency. They are not only essential components in the holistic development of individual character but also serve as a foundational basis for students to effectively meet the demands of sustainable development in today’s knowledge-based society.

⁶ See: <https://giaoducthoidai.vn/gs-pham-minh-hac-sua-doi-luat-giao-duc-dh-nen-quan-tam-den-tu-chu-va-quan-tri-post281453.html>

⁷ See: <https://unesdoc.unesco.org/ark:/48223/pf0000381972>

⁸ See: <https://dangcongsan.org.vn/bocongthuong/tin-tuc-hoat-dong/thuc-trang-hoc-tap-truc-tuyen-cac-mon-ly-luan-chinh-tri-nghien-cuu-voi-truong-hop-sinh-vien-dai-hoc-bach-khoa-ha-noi.html>

Negative Aspects

Alongside its evident benefits, the digital age has also posed numerous challenges to the system of life values among students, particularly the risk of moral distortion and the erosion of social ethics.

Firstly, the frequent and often excessive exposure to cyberspace - where information spreads at tremendous speed but with little verification - has led many students to develop a virtual lifestyle detached from real-life values. Recent sociological studies indicate that more than 60% of Vietnamese university students spend at least four hours per day on social media, with most of the content they consume unrelated to learning or personal development. This trend results in declining attention spans, reduced concentration, and, more critically, the gradual erosion of moral orientation as virtual norms begin to replace authentic values. Such a lifestyle focused on the “virtual world” also fosters apathy toward social issues and weakens the sense of community responsibility. The overemphasis on self-image in digital spaces has caused a portion of students to value external appearance over inner substance, leading to the loss of core virtues such as humility, honesty, and compassion - traditional qualities long cherished in Vietnamese culture. Scholars have observed that the dominance of digital media has produced a generation that is dynamic and technologically skilled, yet fragile, hurried, and less appreciative of ethical values or sincere emotional connections in real life.

Secondly, another consequence of the influence of consumerism and Western utilitarian culture is the increasing tendency among students to pursue materialism and prioritize enjoyment over dedication and contribution. The culture of advertising, entertainment, and social-media “idolization” has fostered a mindset in which self-worth is measured by wealth, appearance, or online engagement rather than by knowledge or moral integrity. The lack of critical selectivity in consuming cultural and entertainment products has led to widespread overexposure to mass media content. This is evident in the excessive commercialization of entertainment programs, the proliferation of unregulated festivals, and the use of vulgar or sensational language and imagery in popular music - phenomena that distort aesthetic perception and negatively influence moral values. Of particular concern is the phenomenon of linguistic hybridization, which has been amplified and normalized by influential public figures, especially among the youth. The trend of adopting mixed-language stage names - such as *Hamlet Trương*, *Elly Trần*, or *Reno Bình* - reflects a cultural hybridity that compromises linguistic purity and national identity. In addition, songs featuring irrational or inconsistent linguistic mixing have become increasingly common. Examples include tracks such as “*Why it’s me?*”, “*Làm sao đây?*”, “*Trước mắt tôi là...*”, and “*Tell me...*”. This phenomenon raises serious concerns about the transformation and gradual erosion of cultural identity within the contemporary entertainment and artistic sphere. These phenomena clearly reveal a deep-seated conflict between traditional values, which emphasize introspection and

humanism, and modern values, which tend to prioritize external expression and material orientation.

Thirdly, the digital era has also led to a growing disconnection between the younger generation and traditional values, thereby disrupting the moral orientation that guides students’ behavior. In the context of globalization, university students are quick to absorb foreign cultural trends but often lack the ability to filter and critically assess them, resulting in a form of “*cultural rootlessness*”. This phenomenon is evident in their manners of communication, behavior, fashion choices, and perceptions of friendship, love, and social responsibility. Consequently, fundamental values such as compassion, honesty, loyalty, and the traditional Vietnamese respect for learning are gradually declining in the spiritual life of a segment of students. A noticeable tendency is that some young people embrace Western lifestyles excessively, distancing themselves from long-standing Vietnamese cultural norms. Traditional stages are seeing fewer young audiences, while forms of folk and classical art are being overshadowed or even distorted by modern entertainment trends. Moreover, the hedonistic “fast life”, characterized by enjoyment without effort, has become increasingly common among young people. Many prioritize material satisfaction over the values of contribution and hard work. More alarmingly, certain traditional cultural values are being disregarded - or even mocked - placing national customs and moral integrity at risk⁹. The decline in ethical consciousness, accompanied by the rise of social problems, has produced serious long-term consequences for the sustainability of Vietnam’s cultural heritage.

Fourthly, the digital era has profoundly affected social relationships and the ability to engage in direct, face-to-face communication. Excessive dependence on technology reduces real-world interaction, weakens listening and empathy skills, and fosters social isolation despite the existence of vast online networks.

Social anxiety and avoidance of real-life interaction have become increasingly common phenomena. The overuse of social media has significantly diminished the frequency and quality of interpersonal communication in everyday life. Students addicted to online platforms tend to prefer solitude, spending hours confined in their rooms browsing the Internet rather than participating in family or community activities. As a result, they gradually lose essential socialization skills and the capacity for community engagement. Empirical studies show that most members of *Generation Y* exhibit introverted tendencies, limited real-world communication, and difficulty forming connections with others. Although they can spend hours interacting with virtual friends through online games without fatigue, they often struggle to find meaningful topics of conversation when meeting family or peers in person. The issue of time wastage and distraction from academic responsibilities has also become a serious concern. Many students, engrossed in online gaming, neglect their studies - some even drop out of school to play games full-time. Rather than using digital platforms to pursue academic knowledge or practical skills, they are drawn into becoming “*keyboard warriors*” or

⁹ See: <https://www.britishcouncil.vn/sites/default/files/nghien-cuu-the-he-tre-viet-nam.pdf>

online celebrities. Additionally, the trend of posting sensational or provocative content merely to attract “likes” has become widespread, generating social fatigue and public annoyance. Social media also promotes unhealthy competition and perpetual rivalry for online validation, resulting in the loss of valuable time and focus.

Equally concerning are the mental health risks - particularly depression - that are increasingly prevalent among students who spend excessive time on social media. Recent studies have demonstrated a positive correlation between the duration of social media use and the prevalence of psychological distress. Negative or toxic comments on platforms such as Zalo or Facebook can inflict significant emotional pressure, leading to anxiety, fear, and even depression, especially among psychologically sensitive individuals.

This situation encapsulates a central paradox of the digital age: the more global connections are expanded, the more individuals experience psychological instability and inner loneliness. Thus, the dark side of digitalization lies not only in moral erosion and cultural disintegration but also in the growing imbalance between traditional and modern values, between authentic and virtual lifestyles. This presents one of the greatest challenges for reorienting the system of life values among contemporary Vietnamese university students.

2.3. The Role of Traditional Values in Orienting the Life Values of Vietnamese Students Today

In the context of modernization and deep international integration, the generation of university students - the young intellectual force with immense potential for national development - is being profoundly influenced by global ideologies, lifestyles, and value systems. However, precisely amid such fluctuations, the traditional cultural values of the Vietnamese nation play a particularly crucial role in shaping students' life value orientations, thereby fostering their comprehensive development in terms of morality, intellect, and cultural identity.

First, traditional values such as benevolence, honesty, gratitude, humility, diligence, studiousness, and respect for teachers have been cultivated over thousands of years of history, forming the ethical and humanistic foundation of the Vietnamese people. In the digital era, when individuals are easily influenced by the rapid transformations of technology and the rise of pragmatic lifestyles, traditional cultural values serve as a spiritual anchor, helping students shape appropriate behavioral norms. The 1943 Outline on Vietnamese Culture emphasized three core principles - *nationalization, scientification, and popularization* - which laid an essential foundation for the strategy of preserving and developing Vietnam's cultural heritage. Folk values, traditional arts, and festivals not only rekindle a profound sense of patriotism but also nurture the power of community solidarity, serving as a great source of motivation during national struggles for independence and defense. As the saying goes: *“Our ancestors have left us a magnificent and beautiful homeland. The responsibility of today's and future generations is to make Vietnam ever more*

*prosperous, strong, and beautiful”*¹⁰. Many Vietnamese scholars have affirmed that traditional culture is an endogenous source of strength, playing a crucial role in maintaining stability and balance in the Vietnamese personality amid contemporary challenges. On this foundation, students are better equipped to confront and resist negative influences and moral distortions in the modern environment, thereby gaining a clearer understanding of the boundaries between *right and wrong, good and evil* in the digital space. These enduring cultural values not only enhance students' professional competencies but also help them cultivate moral integrity and resilience, thereby contributing positively to the construction of a modern, humanistic, and civilized society.

Secondly, traditional values serve as the foundation for shaping individual cultural identity, especially in the context of globalization. The preservation and promotion of national cultural identity have become essential requirements for the younger generation. Cultural identity not only reflects a profound sense of patriotism but also acts as a measure of personal integrity during international integration. Traditional values such as patriotism, community consciousness, respect for others, a spirit of harmony, and compassion function as guiding principles that help students clearly define their position and self-hood amid a culturally diverse world.

According to Dr. Phạm Đình Khuê, “Vietnamese traditional culture constitutes the spiritual foundation and the very ‘soul’ of the nation; it represents an endogenous strength for national development. In the context of increasingly deep international integration, traditional cultural values are not only a precious heritage but also play a vital role in shaping national identity and affirming Vietnam's position on the global stage”¹¹. This is also a key factor enabling Vietnamese people to maintain their unique identity in global cultural exchanges - avoiding cultural assimilation while remaining open to absorbing the quintessence of other civilizations. When deeply internalized through education, these values not only empower students to integrate confidently into the world but also encourage them to cultivate creativity grounded in a strong sense of national culture.

Thirdly, traditional values play an essential role as a benchmark guiding positive behavioral orientations. Beyond their theoretical significance, these values perform a practical function in shaping students' conduct and way of life. A lifestyle that upholds virtues such as *“benevolence – studiousness – gratitude – altruism”* is considered a moral standard necessary for students to build a sustainable foundation for both intellectual and personal development. Equipping students with knowledge of Marxism - Leninism, Ho Chi Minh's Thought, and the Communist Party's guidelines and perspectives on socialism and Vietnam's socialist-oriented development path is of great importance. At the same time, the education of traditional moral values plays a pivotal role in shaping students' attitudes, thoughts, and behaviors within the learning environment - particularly

¹⁰ Nguyen Phu Trong: Building and developing an advanced Vietnamese culture imbued with national identity, National Political Publishing House Truth, Hanoi, 2024, p.20.

¹¹ See: <https://lyluanchinhtri.vn/phat-huy-vai-tro-cua-van-hoa-truyen-thong-viet-nam-trong-ky-nguyen-phat-trien-moi-6922.html>

in their interactions with nature, the surrounding environment, and themselves. The traditional moral values of the Vietnamese nation serve not only as a source of motivation but also as an inspiration that awakens the willpower and aspirations of young people in their journey of study and self-cultivation. These values make a crucial contribution to promoting national strength in the process of building and defending the country today. The 13th National Congress of the Communist Party of Vietnam affirmed: *"Strengthen education in patriotism, national pride, traditions, and national history, as well as the sense of social responsibility among all strata of the population, especially the youth"*¹². The internalization of traditional values naturally enables students to regulate their behavior and live responsibly toward themselves, their families, and society. This serves as one of the key factors in cultivating a generation of intellectuals who are not only excellent in professional expertise but also rich in moral integrity and imbued with a profound sense of responsibility toward their community and nation.

Fourthly, the role of traditional values in fostering cultural autonomy in the digital environment is of vital significance. Digital culture plays an essential role in preserving and promoting the national cultural identity of Vietnam. This perspective was emphasized by Prime Minister Phạm Minh Chính at The national online conference reviewing the first six months of 2023 on the implementation of the national digital transformation program. The conference also discussed the Project on the Development of Population Data, Identification, and Electronic Authentication (Project 06) for the period 2022 - 2025, with a vision toward 2030, aimed at advancing Vietnam's digital transformation agenda. One of the major challenges for university students today lies in their ability to exercise autonomy and discernment in navigating the online environment. Traditional culture - with its emphasis on emotional connectedness, moral principles, and the spirit of self-cultivation - serves as a foundation that nurtures students' capacity for cultural self-reliance. Through these values, students learn to analyze and evaluate information critically, distinguish between right and wrong, and avoid ethical deviations in the digital sphere. In the current era, students are not merely passive recipients of information but active agents of creativity and innovation, particularly in the field of cultural preservation. With their technological literacy, they are capable of utilizing modern platforms to develop creative cultural products such as educational games on history, learning applications centered on folk culture, or digital content - including videos, podcasts, and infographics - that explore themes related to traditional heritage. Vietnamese cultural scholars have also emphasized that traditional values constitute a solid foundation for cultural autonomy, enabling students to adapt to the rapid transformations of modern society without losing their national identity. In the digital era, where the influence of external cultural values grows increasingly pervasive, the cultivation of a "traditional cultural filter" emerges as an urgent necessity. Such a

framework allows Vietnamese students to achieve holistic development - remaining modern and dynamic while preserving the distinctive essence of their cultural identity.

The above analyses affirm that traditional cultural values are not merely legacies of the past but constitute a precious spiritual resource for the present, guiding a harmonious development between morality and knowledge, and between the individual and the community. Revitalizing and promoting these values among Vietnamese university students serves as a sustainable approach to cultivating a young generation endowed with integrity, resilience, and social responsibility in the digital age.

To promote traditional cultural values in shaping the life values of Vietnamese students, a comprehensive and systematic implementation of multiple effective solutions is required. First, universities should renew the content and methods of moral and cultural education, integrating traditional values such as benevolence, studiousness, diligence, thriftiness, and compassion into their curricula and experiential learning activities. Building a humanistic and creative learning environment is equally important, as it provides opportunities for students to participate in forums, clubs, and community projects where they can discuss, practice, and disseminate positive life values. In parallel with in-school activities, it is essential to strengthen the communication and promotion of traditional culture on digital platforms. By leveraging digital technology, humanistic stories, exemplary individuals, and the cultural quintessence of the Vietnamese people can be widely shared to form "a culturally enriched digital space." Moreover, the participation of youth organizations, student associations, and families plays a crucial role in educating students about character, tradition, and civic responsibility through practical activities such as *"learning coupled with practice"* and *"living beautifully and usefully."* A particularly promising initiative is the development of the model "Vietnamese Students – Resilient, Humane, and Creative," which harmoniously combines traditional cultural values with the spirit of the modern era. This model supports students in achieving comprehensive development - in knowledge, ethics, and cultural communication skills - within the challenging context of global integration.

3. Conclusion

In the context of the digital era, orienting students' life values must be grounded in the traditional values of the nation, which are regarded as the cultural roots that nurture character, build resilience, and enhance the global integration capacity of Vietnam's young generation. The harmonious integration between tradition and modernity - preserving the cultural essence of the past while embracing the progressive values of the present - is considered a rational pathway toward shaping a generation of students who not only possess global knowledge but also embody a distinct Vietnamese cultural identity.

Therefore, the collaborative role of higher education, society, and families in cultivating and disseminating positive life values is of paramount importance. Such

¹² Communist Party of Vietnam (CPV). (2021). *Documents of the 13th National Congress of the Communist Party of*

Vietnam. Vol. 1. Hanoi: Truth National Political Publishing House, p. 143.

synergy contributes significantly to nurturing a new generation of Vietnamese students who uphold noble ideals, moral integrity, and a strong sense of cultural identity-fully prepared to meet the demands of international integration in the twenty-first century.'

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EARTH SCIENCES

PLANKTIC FORAMINIFERA AND BIOSTRATIGRAPHY OF THE SHIRANISH FORMATION IN WELL TEL-HAJAR NO. 1, SINJAR AREA, NORTHWESTERN IRAQ

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Abstract

Eight rock samples from Well Tel-Hajar No. 1 (Sinjar area, northwestern Iraq) were analyzed for planktic foraminifera. The ~8 m succession belongs to the uppermost Shiranish Formation, with a ~2 m tongue of the Hartha Formation intercalated. The Shiranish Formation consists mainly of fossiliferous foraminiferal limestones and yields one planktic foraminiferal biozone, *Kassabiana falsocalcarata*, comprising 37 species from nine genera. These assemblages indicate a Late Cretaceous (latest Maastrichtian) age and deposition in a deep-marine setting. In contrast, the Hartha Formation contains large benthic foraminifera typical of shallow-marine environments.

Keywords: Shiranish Formation, Hartha Formation, Maastrichtian, Planktic foraminifera, Iraq

Introduction

The Shiranish Formation (Campanian–Maastrichtian) is one of the most widespread Upper Cretaceous units that crop out in northern Iraq. It was deposited during the middle to late part of the AP9 megasequence (Sharland 2001) in the Campanian–early Maastrichtian cycle. During this cycle, ophiolite–radiolarite obduction between the Iranian and Arabian plates created the Zagros foreland basin in NE Iraq (Lawa 2018) and was accompanied by a major marine transgression across Iraq. These events led to deposition of several sedimentary facies, including the Shiranish Formation, which formed in outer-shelf to deep-marine settings (Jassim & Buday 2006). The formation was first described by Henson (1940) near Shiranish Islam village, northeast of Zakho in the High Folded Zone (Bellen et al. 1959). It consists of ~228 m of thin-bedded marly limestone in the lower part overlain by blue marl in the upper part, with dolomitic and marly limestones rich in microfossils (Buday 1980). The Shiranish Formation is widely exposed in the Kurdistan Region and is an important reservoir in many Iraqi oil fields; it is penetrated in numerous subsurface wells in

central and southern Iraq, including Kirkuk (K09, K116, K117), Chamchamal-2, Injana-5, Ain Zala-16, Jawan-2 and wells in the Khana field. Its reservoir significance relates to abundant fractures, joints and secondary porosity (Ahmed 1980; Awdal et al. 2013; Baban et al. 2020). Previous work addressed the sedimentology, paleontology and stratigraphy of the formation (e.g., Ahmed 1980; Abba Hussein 1983; Al-Banna & Ghafor 1988; Bakkal et al. 1993; Sharbazheri et al. 2009, 2011; Al-Jubouri 2011; Al-Jubouri et al. 2016; Al-Hazaa et al. 2021; Hassan 2021; Al-Nuaimy et al. 2020). The studied well (Tel Hajar-1) is ~30 km southwest of Sinjar town (Kadouri 1982). Drilled in 1978 by the Iraq National Oil Company on the Tel Hajar structure near the Syrian border, it lies in the Foothill Zone (Buday & Jassim 1987) at approximately 41°32'45"E and 36°07'22"N (Fig. 1). The contact between the Kometan and Shiranish formations has been restudied in the Qamchugha Valley (Karim et al. 2008; Fig. 2) and interpreted as conformable, with rapid deposition possibly due to submarine channel switching, storms or tsunami; no evidence of subaerial erosion or prolonged hiatus was observed.

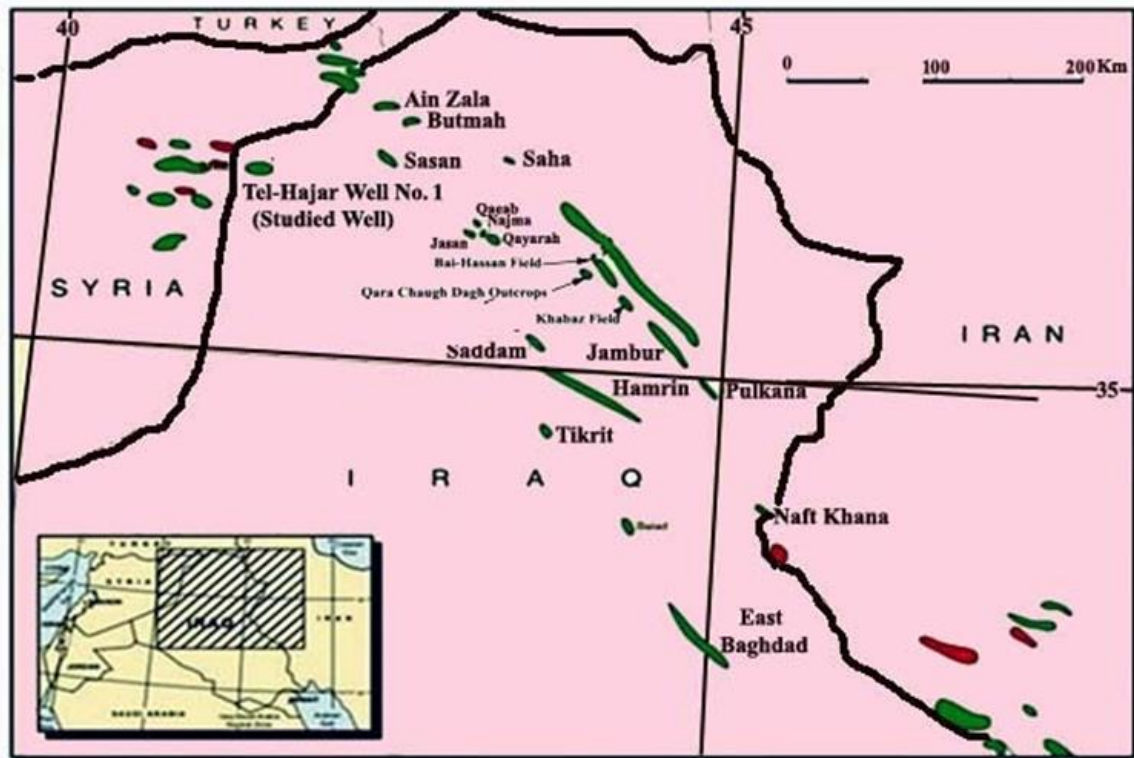


Fig. 1 Location map of the Tel-Hajar-1 well.



Fig. 2 Gradational contact between the Kometan and Shiranish formations in the Chaqchaq Valley (Karim et al. 2008).

The aim of this study is to establish the biostratigraphy and depositional setting of the upper part of the Shiranish Formation at Tel-Hajar-1.

Stratigraphy

The study area lies within the Low Folded Zone (LFZ) of the Outer Platform of Iraq (Fouad 2015), part of the Zagros fold-thrust belt formed by collision of the Arabian and Eurasian plates (Alavi 2004; Fouad 2015). The Sinjar anticline is ~80 km long and ~20 km wide, trending E–W, with a steeper northern limb (45–80°)

and gentler southern limb (15–25°). An E–W normal fault follows the northern limb; additional minor faults are present (Fig. 3). A subsidiary low-amplitude anticline along the southern limb is developed within the Sinjar Formation and is separated from the main axis by a shallow syncline. The exposed rocks range in age from Late Cretaceous (Sinjar Formation) to Late Miocene (Injana Formation) (Sissakian & Al-Jibouri 2012). A generalized columnar section is summarized in Table 1.

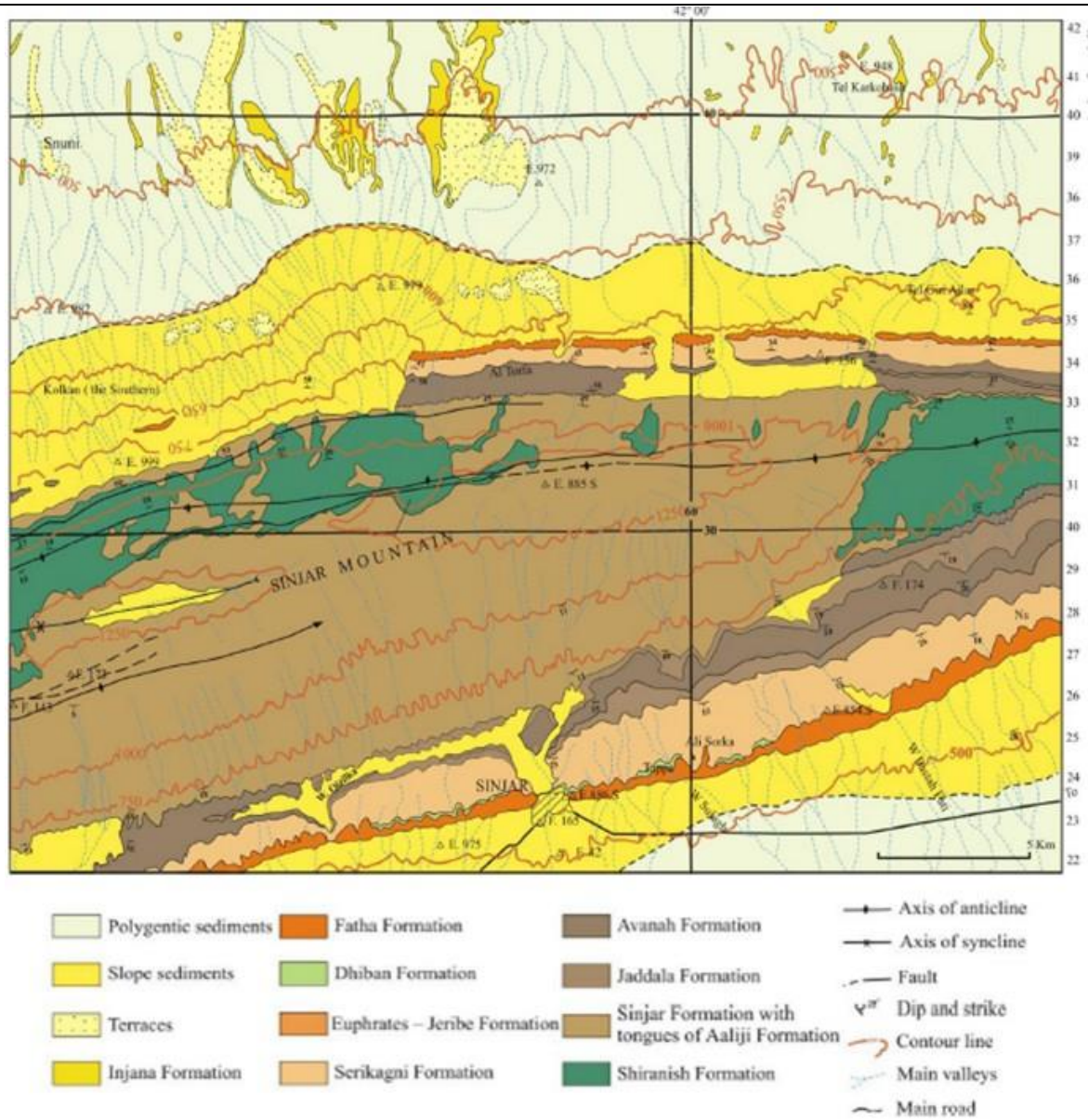


Fig. 3 Geological map of the Sinjar anticline (modified after Sissakian & Fouad 2015).

Table 1 about here — Generalized columnar section of exposed formations (after Sissakian & Al-Jibouri 2012).

Formation	Age	Thickness (m)	General Description
Injana	Late Miocene	900 – 100	Sandstone interbedded with siltstone and claystone in rhythmic cycles, all rocks are reddish-brown in color
Fatha	Middle Miocene	550 – 630	Green marl interbedded with limestone and gypsum in rhythmic cycles, in the upper cycles, reddish brown claystone occurs.
Jeribe	Miocene	100 – 125	Well bedded greyish white limestone
Dhiban	Early Miocene	5 – 100	Mainly limestone with rare limestone
Serikagni	Miocene	65 – 300	Well bedded white limestone with some marl intercalations
Avanah	Middle Eocene	85	Marly limestone interbedded with marl
Jaddala	Eocene	500 – 550	Marl interbedded with marly limestone
Sinjar	Early Eocene- Late	170	Well bedded, white and very hard limestone
Aaliji	Paleocene	50	Shale and marl
Shiranish	Late Cretaceous	565	Bluish green, papery marl, in the upper part well bedded greyish white limestone in the lower part

The area belongs to the Low Amplitude Mountainous Province (Sissakian & Fouad 2015). Apart from the Sinjar Mountain, the surrounding terrain is relatively flat but deeply incised by valleys. Elevations range from ~300 m in the southeast to 1462 m at the summit of Sinjar Mountain. A neotectonic map (Fig. 4) depicts up-warped and down-warped areas as contour lines following the methods outlined in Materials and Methods

and consistent with ATOMENERGOEXPORT (1985), Pavlides (1989), Koster (2005), Deikran & Sissakian (2008) and Sissakian & Deikran (2009). The stratigraphic position of the Shiranish Formation within the regional framework is shown in Fig. 5 (after Harland et al. 1990; El-Diasty et al. 2016).



Fig. 4 Satellite image and neotectonic contours of the Sinjar anticline (after Sissakian et al. 2022).

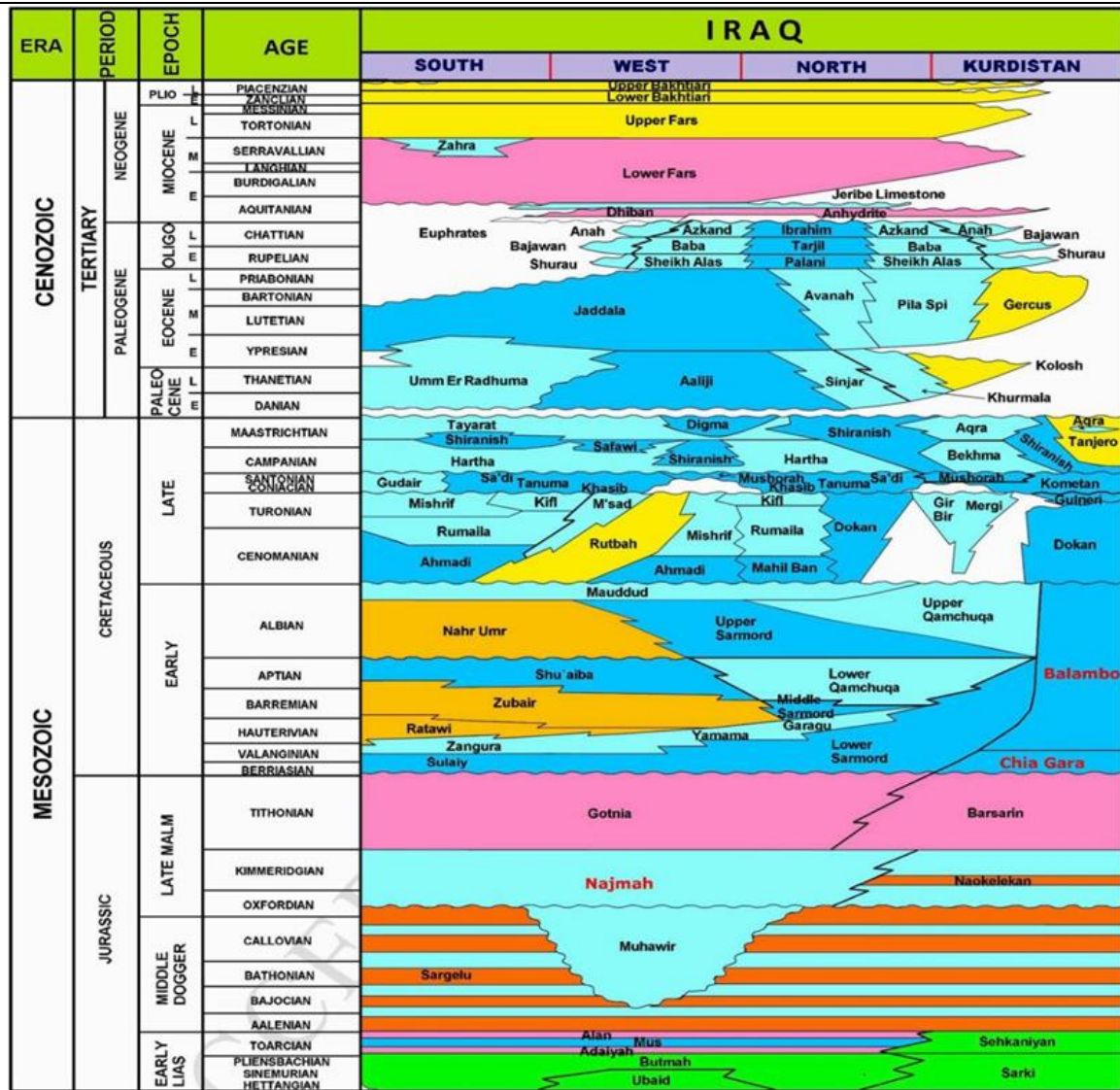


Fig. 5 Regional stratigraphic correlation including the Shiranish Formation (modified after Harland et al. 1990; El-Diasty et al. 2016).

Lithostratigraphy

The studied interval in Tel Hajar-1 comprises ~7 m of the uppermost Shiranish Formation and ~2 m of the Hartha Formation occurring as a tongue within Shiranish. Seven samples were collected between 2180 and 2175 m (depth); samples at 2177–2178 m represent

the Hartha tongue, whereas the remainder belong to the Shiranish Formation. The Shiranish lithology consists of foraminiferal calcareous clay and wackestone rich in planktic foraminifera with micrite. A simplified measured section is provided in Fig. 6.

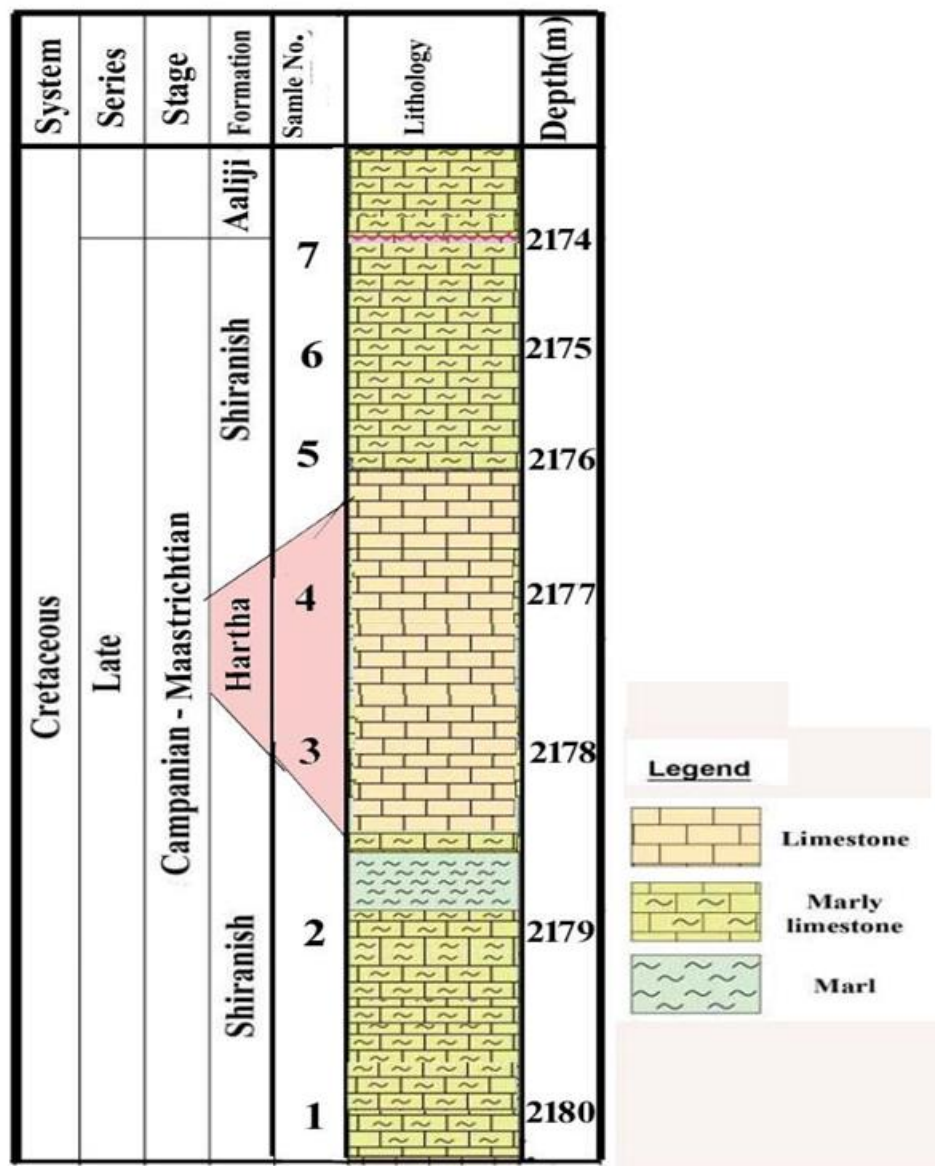


Fig. 6 Columnar section of the studied interval.

Results and discussion

Biostratigraphy

Samples from the Shiranish Formation yield rich and diverse planktic foraminiferal assemblages. Approximately 6 m of Maastrichtian strata were analyzed, documenting 32–37 species belonging to 5–9 genera. Two samples contain large benthic foraminifera characteristic of the Hartha tongue (limestones with local dolomitization), with common occurrences of *Orbitoides* spp. The two highest samples include planktic

foraminifera attributable to the Aalii Formation, including species of *Subbotina*, *Globigerina*, *Chiloguembelina* and *Globorotalia*.

One assemblage zone is recognized: the *Kassabiana falsocalcarata* Zone (Figs. 7, 8), indicating a latest Maastrichtian age. The zone is characterized by numerous species of *Pseudotextularia*, *Heterohelix*, *Pseudoguembelina*, *Globigerinelloides*, *Globotruncana*, *Globotruncana*, *Rugoglobigerina* and others. Correlation with regional schemes is shown in Fig. 9.

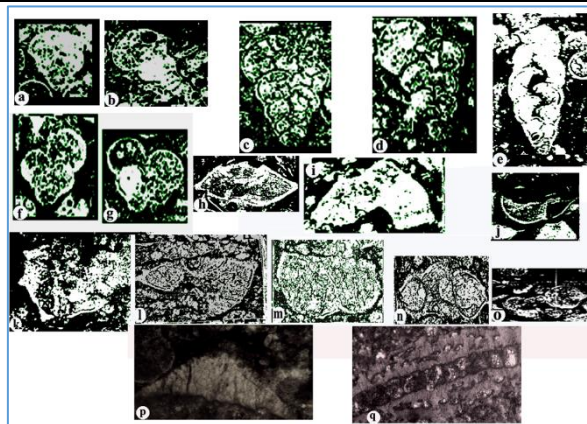


Fig. 7 Representative planktic foraminifera from the Shiranish and benthic Orbitoides from the Hartha tongue. a, *Pseudotextularia elegans* (Rzehak), 1891, (X320), Shiranish Formation, sample no. 7, b—*Pseudotextularia elegans* (Rzehak), 1891 (X320), Shiranish Formation, sample no. 3, c – *Heterohelix reussi* (Cushman), 1938, (X330), Shiranish Formation, sample no. 2., d – *Heterohelix globulosa* (Ehrenberg), 1840, (X340), Shiranish Formation, sample no. 1, e – *Pseudoguembelina costulata* (Cushman), 1838, (X290), Shiranish Formation, sample no. 7, f- *Heterohelix ultimatumedia* (White), 1929, (X360), Shiranish Formation, sample no. 7, g – *Heterohelix ultimatumedia* (White), 1929, (X390), Shiranish Formation, sample no. 7, h- *Globotruncanella stuarti* Shiranish Formation, sample no. 1, i-*Globotruncana trinidanensis* Gandolfi 1951, (X160), Shiranish Formation, sample no. 2, j-*Kassabiana falsocalcarata* Kerdany & Abdelsalam, Shiranish Formation, Late Maastrichtian, (X140), Shiranish Formation, sample no. 6, k- *Kassabiana falsocalcarata* Kerdany & Abdelsalam, Shiranish Formation, Late Maastrichtian (X130), Shiranish Formation, sample no. 1, l- *Globotruncanella stuartiformis* Dalbiez, 1955, (X360), Shiranish Formation, sample no. 7, m- *Globotruncana gansseri* gansseri Bolli, 1951, (X350), Shiranish Formation, sample no. 1, n- *Globotruncana marginata* Reuss, 1845, (X350), Shiranish Formation, sample no. 1, o-*Pseudoguembelina costulata* Cushman, 1938. (X290), Shiranish Formation, sample no. 7. P, q- *Orbitoides* sp., (X350), Hartha Formation, sample no. 3.

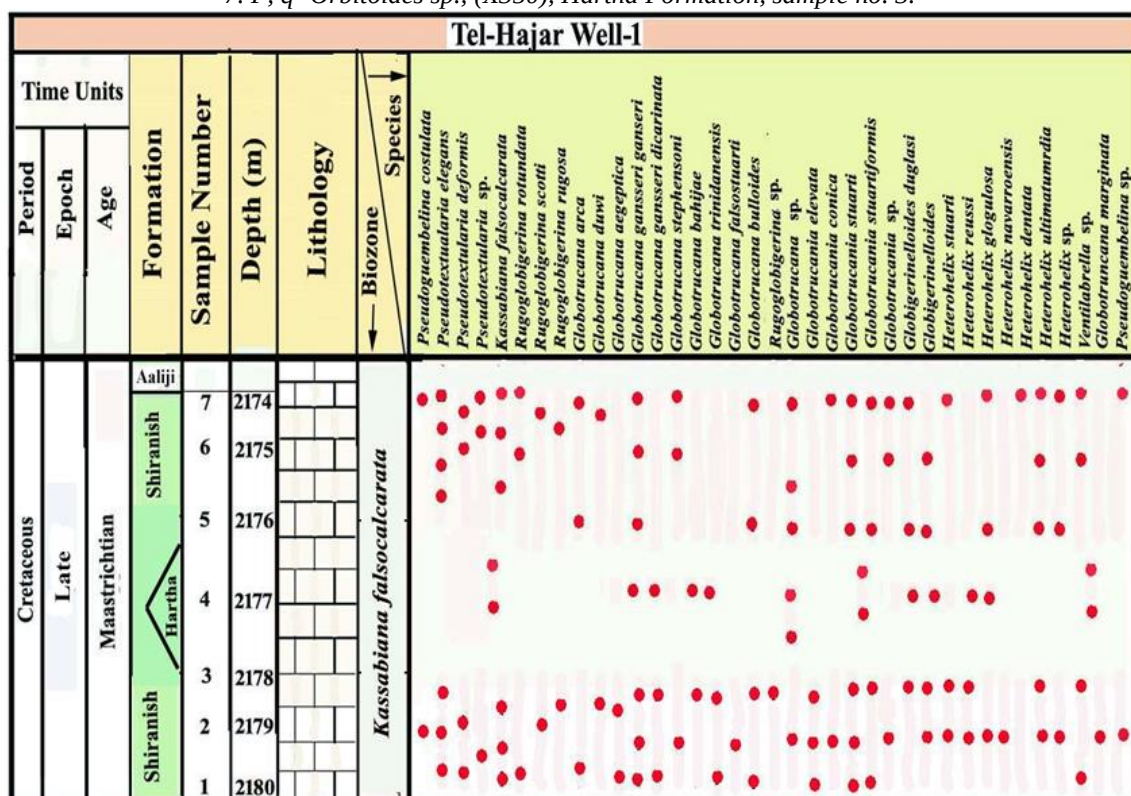


Fig. 8 Biostratigraphic range chart of planktic foraminifera in the studied interval.

Period	Epoch	Age	Bolli 1957, 1966	Kassab 1973, 1975, 1979	Ghafor 1988	Bakkhal et al. 1993	Sharbazheri et al., 2009, 2011, 2020	Keller, 1998 Keller et. al. 1995	This study
↑ Cretaceous ↓	↑ Late ↓	↑ Campanian-Maastrichtian ↓	<i>Abathomphalus mayaroensis</i>	<i>Kassabiana falsocalcarata</i>	<i>Kassabiana falsocalcarata</i>	<i>Kassabiana falsocalcarata</i>	<i>Plummerita hantkeninoides</i>	<i>Plummerita hantkeninoides</i>	<i>Kassabiana falsocalcarata</i>
							<i>Pseudoguembelina palbera</i>	<i>Pseudoguembelina palbera</i>	
						<i>Globotruncana gansseri</i>	<i>hariaensis</i>	<i>hariaensis</i>	
							<i>Racemiguembelina fruticosa</i>	<i>Racemiguembelina fruticosa</i>	

Fig. 9 Correlation of the recognized zone with other studies.

Depositional environment

Facies analysis indicates deposition of the Shiranish Formation in a pelagic (deep-basin) setting dominated by wackestone, packstone and mudstone microfacies and characterized by abundant planktic foraminifera. In contrast, the intertonguing Hartha Formation records shallow-marine conditions with large benthic foraminifera.

Conclusions

- Thirty-seven species from nine genera of planktic foraminifera were recorded from the upper Shiranish Formation at Tel Hajar-1.
- A single biozone, the *Kassabiana falsocalcarata* Zone (latest Maastrichtian), is recognized and correlated regionally.
- The Hartha Formation intertongues with Shiranish and contains shallow-marine benthic assemblages (e.g., *Orbitoides* spp.).
- The Shiranish Formation was deposited in a deep-marine environment.

Statements & Declarations

Funding: No funding was received for conducting this study.

Conflicts of interest: The authors declare no conflict of interest.

Author contributions: IMG designed the study and wrote the manuscript; AJ performed micropalaeontological analyses; RRF contributed stratigraphic interpretation.

Data availability: Data are available on reasonable request from the corresponding author.

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RECONSTRUCTION OF THE JURASSIC TECTONIC STRUCTURE OF THE KARABAKH SUBZONE BASED ON PALEOMAGNETIC STUDIES (AZERBAIJAN)

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<https://doi.org/10.5281/zenodo.17492569>

Abstract

The article presents the results of paleomagnetic studies of the Jurassic of the Karabagh uplift subzone of the Lesser Caucasus in order to determine the horizontal displacements and rotations of the part of the earth's crust within the local structure. On the basis of paleomagnetic data, the Karabagh uplift zone movement's kinematic parameters and horizontal displacements to the north, were determined. It has been established that during the Jurassic period, the region under study, located at a latitude of 20-22° N, shifted northward by approximately 20-220, or 2200-2400 = 300 km. At the same time, the average speed of forward movement is 1.3-1.5 cm per year for the entire territory. Also, based on paleomagnetic data, the block structure of the Lesser Caucasus region has been proven.

Keywords: paleomagnetism, paleo-tectonics, Jurassic formations, Karabakh tectonic subzone.

Introduction

The transverse contraction of the Alpine-Himalayan folded belt and the closure of the Mesozoic Tethys Ocean led to the formation of the tectonic structure of the Lok-Karabakh zone. The debate about the model of tectonic development of the Lesser Caucasus has not subsided to this day. In this regard, there is still no generally accepted model of the tectonic development of the Lesser Caucasus. The need to trace the history of the development of the Lok-Karabakh tectonic zone is due to the identification of patterns of placement of ore deposits (pyrite, alunite, iron ore, cobalt and other ores) in its bowels. This reflects the relevance of a detailed and comprehensive tectonic study of the territory of the Lesser Caucasus.

As is known, when rocks (volcanogenic and sedimentary) are formed in magnetic minerals, vectors of paleomagnetic directions corresponding to the geological time of their formation are fixed. Therefore, any horizontal movements of the rock masses, accompanied by their rotation, will necessarily cause corresponding rotations of the vectors of paleomagnetic directions. The paleolatitudes determined by paleomagnetic inclinations will not be consistent with the latitudes of the massifs of the studied tectonic structures. This fact indicates that the array under study has been moved. Information about the horizontal movements of the Earth's crust is obtained from two paleomagnetic parameters: the inclination of the natural remanent magnetization (NRM) and the paleolatitude ϕ_m . Determining the parameters of all types of tectonic blocks' movement in the Karabakh subzone will allow us to present a picture of tectonic development.

Based on paleomagnetic data from the Jurassic period, a paleotectonic reconstruction of the Karabakh uplift zone was performed. A quantitative assessment of the rotation of the blocks relative to the Earth's magnetic north pole was also made [4, 8].

2. Geological setting

The Karabakh uplift is the internal structure of the Gokce-Karabakh zone according to E.Sh. Shikhalibeyli [9]. In his opinion, the Karabakh uplift zone separates two negative structures (composed mainly of Cretaceous deposits) located in the northeast and southwest of the zone. In the south-east, the Karabakh uplift stretches from the vicinity of the village of Agoglan to the lower reaches of the Levchai River. In the west, the Karabakh uplift has a north-westerly extension. The structures of the Samkhito-Agdam zone are of Jurassic sediments (for example, the Dashkesan depression). The Karabakh uplift is oriented at an angle varying from 30° to 40°. The stratigraphic division of the Jurassic deposits of the Karabakh uplift has not been studied sufficiently. Since the fauna found in the structure of the Karabakh Uplift characterizes only the Upper Jurassic, the stratigraphic division of the Jurassic sediments needs more detail. Attributed to the Bathonian stage, the sediments are a fairly wide development. They form the entire axial band of the structure and are represented by various facies varieties of volcanogenic and sedimentary formations. The **Bathonian** age of this stratum is now recognized by almost all researchers of the Small Caucasus.

The entire stratum of the Karabakh Uplift's Bathonian (along the Shusha-Lachin valley) is clearly divided into two bundles: the lower bundle is mainly represented by volcanogenic formations (lower sublayer), and the upper bundle is sedimentary, represented by terrigenous (upper sublayer) formations [9]. In the Kolutag River basin, among tuff-sedimentary formations of the Bathonian's upper sublayer [2] the "*Rhynchonella*" *retrosinuata* Var., *Synsyclonema demissum* (Phill) and others were discovered and identified by T.A.Hasanov. The lower bundle (Bt₁) reaches a thickness of a little over 350 m. The section in the lower part of the lower bundle (about 180 m) is represented by lava flows (thickness from 2-3 m to 12-15 m), interspersed with tuffs (15-20 m) and thin interlayers (3-4

m) of mudstones and sandstones. Further (about 120 m), there is only an alternation of tuffs, tuffoconglomerates, and lavas. The section ends with pillow lavas (150 m). The bulk contains small crystals of pyrite and magnetite, as well as brown deposits of iron hydroxides.

Occupying the rock's volume from 45 to 70% tuffs are represented by medium- and coarse-grained materials. The composition of tuffs varies from basalts to andesite-dacites. The angular shape of the tuff grains is characterized. The cementation material is highly chloritized.

Sedimentary rock layers are characterized by fine-grained and good layering. The small fragments of quartz, chlorite, epidote, pyroxene, hornblende, and calcite are represented. Small grains of pyrite and magnetite are found.

A wide variety of sizes, from 2-3 to 30-35 cm, tuff conglomerates are characterized by well-rounded clastic material. The fragments fit very tightly to each other

and probably occupy at least 75-80% of the rock volume. Andesite-basalts and andesites are mainly represented. The cementing material is terrigenous with an admixture of tufa.

Pillow lavas are clusters of globular and cushion-shaped individuals, reaching 2-3 m in diameter. Their structure is aphyric, less often, porphyritic. The phenocrysts consist of plagioclase and pyroxene, and small sulfide individuals are present. The glassy bulk is highly chloritized.

The deposits of the upper pack (Bt₂) are exposed on the northeastern wing of the Karabakh uplift and, overlapping all volcanic formations, occupy the stratigraphically highest position among the deposits of the Bathonian.

The section was taken by the staff of the laboratory "Paleo-magnetism" on the road Shusha-Lachin. The thickness of the studied section reaches 370 m (**Fig.1**).

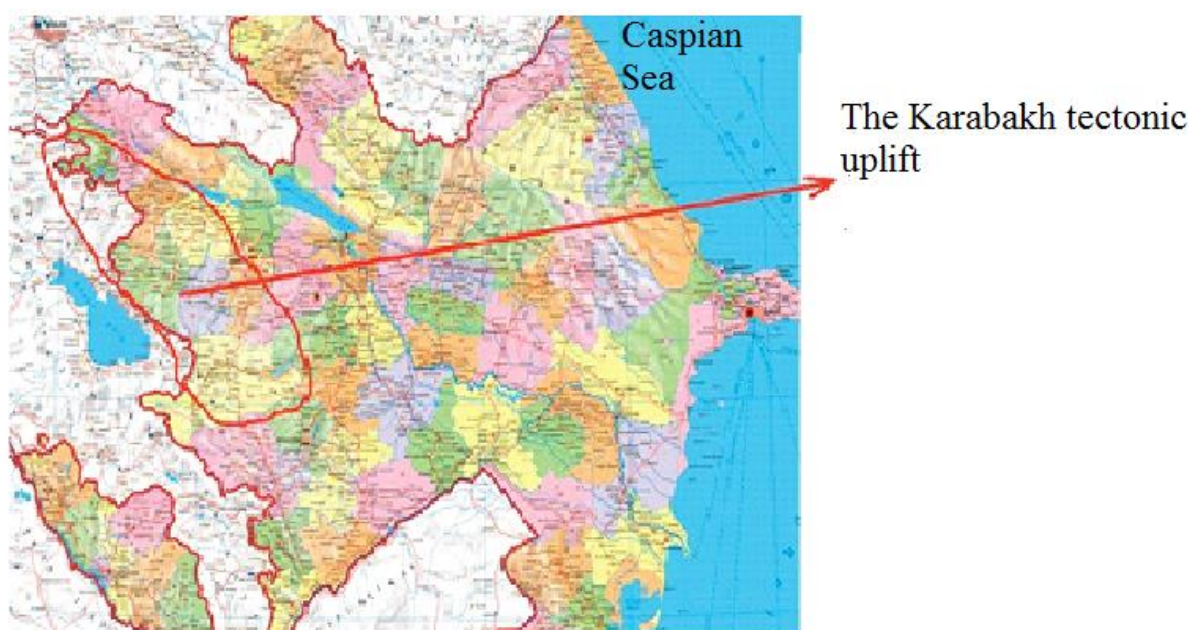


Figure 1. Contour of the area under study

The entire pack is represented by an alternation of thin (from 15-20 cm to 1.2-2.5 m) interlayers of thin-layered tuff sandstones, tuffogravelites, mudstones, sandstones, levrotuffites, and other volcanogenic. They consist of small fragments of various rocks and minerals, among which feldspar and quartz prevail.

The rocks contain small amounts of point ore minerals such as pyrite, less often magnetite, and hematite. Only in a few sections have the volcanogenic been detected. Their power ranges from 8 to 20 m.

In the contour of the Karabakh uplift, the Callowian and Oxfordian stages have development limited. They are marked only north of the middle course of the Terter River (Chapar village), as well as in the south-eastern dip of the Karabakh uplift (Doma village). Identified by similarity with other structures of facies, the Callowian and Oxfordian stages are very conditional here.

In folded regions, rock masses simultaneously participate in local and regional movements, so it is necessary to separately determine the parameters of all

types of movement in order to decipher the history of the region's tectonic development and perform palinspastic reconstructions [6, 7].

The Jurassic formations have been studied in 8 sections of the main structural elements of the Karabakh uplift of the Lesser Caucasus. These sections include Gazakh-Elchilar, Khanbulag, Dashkesan, Gushchu-Kharkhan, Sherkhan, Asrikhchay, and Arkhashan. Volcanic, volcanic-sedimentary, and sedimentary formations are involved in their geological structure [9, 10, 1].

The Jurassic formations were studied along 7 sections. Volcanic formations are involved in their geological structure [9, 10, 1].

3 Methods

Measurements of the magnitude and direction of natural residual magnetization and magnetic susceptibility of rock samples were conducted at the Geomagnetism Department of the Institute of Geology and Geophysics of the National Academy of Sciences of Azerbaijan.

3.1 Sampling

For paleomagnetic studies, oriented rock samples (volcanic, volcanic-sedimentary, and sedimentary formations) were taken from the sections mentioned above. The hand specimen samples taken were cut into oriented cubes measuring $24 \times 24 \times 24$ mm. In addition, the magnetic susceptibility was measured in the field using a Czechoslovakian kappameter KT-5 (sensitivity of 12.6×10^{-5} SI).

3.2 Methods of paleomagnetic research

Sample selection, sample measurements, and data processing were carried out using the standard methodology in paleomagnetism [11]. Measurements of natural remnant magnetization (NRM) were performed using a JR-6 spin magnetometer (AGICO, Czech Republic). The volume magnetic susceptibility (k) was measured

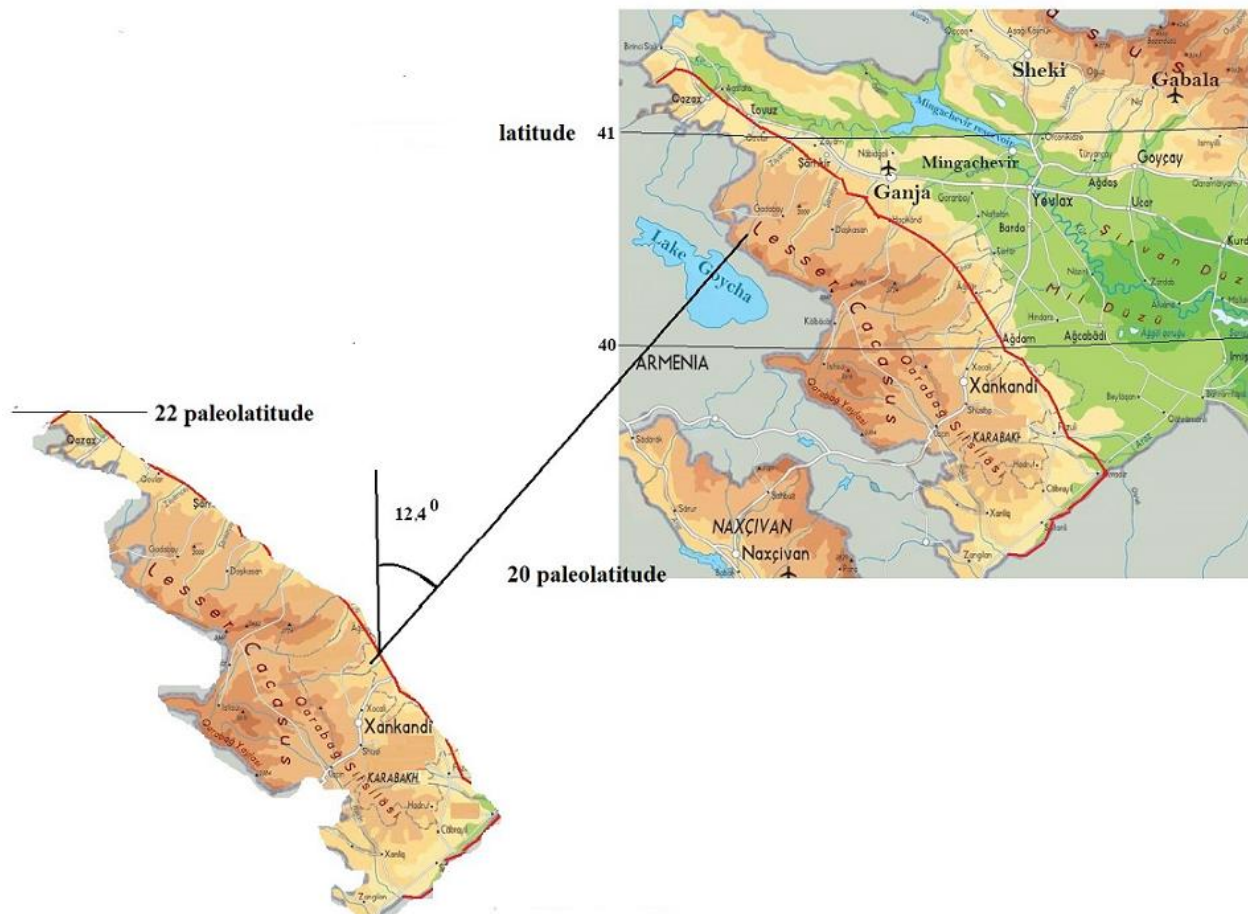


Fig.2 Position of the Karabakh Anticline during the Jurassic Period

using a Czech device called KT-5. The magnetic-mineralogical studies consisted of thermomagnetic analysis. The data for thermomagnetic analysis were obtained by demagnetizing the samples using a thermomagnetic magnetometer designed by K.S. Burakov. Data on demagnetization in an alternating magnetic field were used. The results of demagnetization were used to construct demagnetization curves and analyze the curves. Samples that exhibited significant magnetic susceptibility anisotropy were discarded. Time-based cleaning, temperature-based cleaning, and variable magnetic field cleaning were used to isolate the ancient component of the NRM. The choice of cleaning, as well as its parameters, such as temperature, amplitude of the alternating magnetic field, were determined by the degaussing curves of the EON. The type of cleaning was also determined by the course of changing the projection of the NRM vector on stereograms and by the

Zijderveld diagrams. For those sections where it was possible, a direct method for determining the direction of the ancient component was used – the method of crossing the remagnetization circles. The Tellier method and the stability parameter comparison method were used to determine the nature of the NRM. The paleo-intensity of the geomagnetic field was determined using the Tellier method and the coercive spectrum method.

4. Discussion of the results.

In paleomagnetic studies, the primary question is the primacy of natural remnant magnetization. The NRM of rocks mainly consists of two main components: In_0 -primary remnant magnetization, which is synchronous with the formation time of the rock itself, and In_h -secondary remnant magnetization, which occurs after the formation of primary remnant magnetization.

The main paleomagnetic parameter valuable for paleotectonic reconstruction is I_n - primary remnant magnetization. To date, several field and laboratory methods have been developed and are being used to determine I_n [10].

Horizontal movements of the Earth's crust are calculated by using paleomagnetic parameters such as the inclination J_0 and paleolatitude φ_m . Analysis of these parameters allows us to quantify the translational movements. The calculations showed that the inclination of the eastern part of the Lesser Caucasus in the Jurassic period was 38° on average, and the inclination of the remagnetization circles was 36° , with paleolatitude of $\varphi_m=19.9\pm 22^\circ$, respectively. Within the $\alpha_{95} = 6.8^\circ$, these values are well-consistent. Using this technique, the parameters of horizontal movements were determined. It has been established that during the Jurassic period, the region under study, located at a latitude of $20-22^\circ$ NL, shifted northward by approximately $20-22^\circ$, or $2200-2400 = 300$ km. At the same time, the average speed of forward movement is 1.3-1.5 cm per year for the entire territory.

5. Conclusion

Thus, the conducted paleomagnetic studies have shown that the paleomagnetic directions are ancient, synchronous with the time of rock formation, and can be used to analyze patterns related to the ancient magnetic field.

The results obtained allowed to clarify the history of geological development of the Lesser Caucasus's Karabakh uplift in the Jurassic period. As follows from the above, the leading role in this development belongs to the horizontal movement of lithospheric plates and microplates. The rotation of the studied region is 12.4° clockwise.

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ECONOMIC SCIENCES

CHALLENGES OF COMPLIANCE RISK MANAGEMENT IN THE GEORGIAN BANKING SECTOR

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<https://doi.org/10.5281/zenodo.17492573>

Abstract

Risk management in the financial sector has increasingly expanded to include non-financial risks, especially compliance risk, due to complex regulatory environments and rising expectations on institutions. However, in Georgia, compliance risk remains underexplored. There is a notable scarcity of academic research examining how compliance risk is defined, regulated, assessed, and managed within the country's banking sector. This gap hinders both theoretical insight and practical progress in enhancing the regulatory framework and institutional practices.

Building upon this context, the study seeks to analyze Georgia's national regulatory framework, its international obligations, and current practices in the banking sector related to compliance risk management. Accordingly, the study aims to identify potential deficiencies in both the scope of the regulator's mandate and the implementation of established regulatory requirements by commercial banks.

This research adopts a qualitative empirical approach grounded in document analysis, drawing upon existing reports, regulations, and policy documents as primary sources of real-world data. The methodology includes case studies and comparative analysis techniques to highlight key differences and uncover shortcomings. The document analysis encompasses the national regulatory framework, standards, and guidelines issued by internationally recognized organizations, relevant academic literature, and other pertinent sources, along with publicly available financial and managerial disclosures of commercial banks operating in Georgia.

Although a formal regulatory structure is in place, significant challenges remain in its effective implementation. As the findings demonstrate, gaps exist within local regulations, and banks often fail to comply due to the absence of detailed guidance, such as manuals and instructions, as well as weak enforcement mechanisms on the part of the supervisory authority. To accurately assess rising compliance risk levels within banks and understand their quantitative impact on profit, loss, and capital, the regulator must establish clear compliance risk management guidelines, including a defined risk assessment methodology.

Keywords: Compliance Risk, Risk management, Corporate Governance, Compliance Risk Assessment

Introduction

Risk management in the financial sector has increasingly expanded to include non-financial risks, especially compliance risk, due to complex regulatory environments and rising expectations on institutions. Compliance risk, as it is defined by [1], [2], [3] is a risk of non-compliance of legal or regulatory sanctions, financial loss, or reputational damage resulting from non-compliance with laws, regulations, codes of conduct, or self-regulatory standards.

Compliance risk is inherent to all businesses due to the obligation to follow laws, regulations, and standards across jurisdictions. To maintain competitiveness, efficiency, and profitability, companies may face compliance dilemmas, but organizations are nonetheless expected to uphold legal obligations alongside principles of transparency, accountability, and ethical conduct [4].

The context of compliance risk was first incorporated into the Georgian financial sector legislative framework in 2008. However, in Georgia, compliance risk and its management remain underexplored. There is a notable scarcity of academic research examining how compliance risk is defined, regulated, assessed, and managed within the country's banking sector. This gap hinders both theoretical insight and practical progress in enhancing the regulatory framework and institutional practices.

Building on this foundation, the study aims to analyze Georgia's national regulatory framework, its international obligations, and current practices in the banking sector related to compliance risk management. Accordingly, the study aims to identify potential gaps in the scope of the regulator's mandate and the implementation of established regulatory requirements by commercial banks.

This research adopts a qualitative empirical approach grounded in document analysis, drawing upon existing reports, regulations, and policy documents as primary sources of real-world data. The methodology includes case studies and comparative analysis techniques to highlight key differences and uncover shortcomings. The document analysis encompasses the national regulatory framework, standards, and guidelines issued by internationally recognized organizations, relevant academic literature, and other pertinent sources, along with publicly available financial and managerial disclosures of commercial banks operating in Georgia.

Literature Review

Academic literature often uses the terms compliance, compliance management, and compliance risk management interchangeably, though important distinctions exist [4]. Compliance management refers to a broader framework that involves establishing and maintaining adherence to legal and internal standards [5] [6]. In contrast, compliance risk management is a

more focused subset that aims to identify, assess, and mitigate risks arising from non-compliance [7], thereby protecting the organization's integrity, reputation, and regulatory standing [2].

Compliance risk management, as a specialized tool within the broader framework of Compliance Function, is a key pillar of corporate governance, ensuring that organizations operate within legal and ethical boundaries while fostering trust and long-term sustainability among stakeholders [8]. In the study titled "The Compliance Function: An Overview," J.P. Miller does not specify the precise timeline for the development of the compliance function, but links its evolution to the growing regulation of corporate governance in response to events that undermined public trust. These include the collapse of Enron, which led to the enactment of the Sarbanes-Oxley Act (SOX) in 2002, and the 2007–2009 financial crisis, which prompted a wave of reforms such as the Dodd-Frank Act of 2010 [9].

SOX was introduced to address large-scale corporate fraud, exemplified by the Enron and WorldCom cases, and aimed to enhance the accuracy, transparency, and accountability of corporate financial reporting to restore investor confidence [10]. As a result, the primary focus of the reform was to prevent corporate fraud in publicly traded companies by assigning responsibility for financial reporting to senior executives, strengthening internal controls, increasing transparency for investors and regulators, addressing conflicts of interest, enhancing ethical standards, and enforcing both corporate and criminal liability for misconduct [11].

While the Sarbanes-Oxley Act (SOX) primarily targeted corporate financial reporting and executive accountability, Dodd-Frank expanded the regulatory scope by addressing structural weaknesses in the financial sector and introducing more comprehensive compliance obligations [12]. The aim was to strengthen financial system resilience, enhance regulatory oversight, and protect consumers and investors. Its key provisions focus on reducing systemic risk, improving transparency in financial markets, and reinforcing accountability across the financial sector [13]. Accordingly, the main goal of the compliance function is to manage the risks of noncompliance by ensuring that the organization's operations, policies, and procedures align with applicable laws, regulations, and ethical standards.

In parallel with the US regulatory reforms, such as the Sarbanes-Oxley Act and the Dodd-Frank Act, international standard-setting bodies also advanced their oversight frameworks. The Basel Committee on Banking Supervision significantly enhanced global expectations for risk governance by transitioning from Basel II to Basel III [14]. Basel framework emphasized the importance of robust internal control systems and effective risk management practices, reinforcing the critical role of the compliance function in ensuring regulatory adherence and safeguarding financial stability [2], [15]. Complementing these developments, the Committee of Sponsoring Organizations of the Treadway Commission (COSO) updated its internal control framework in 2013 to place greater emphasis on risk-based thinking, accountability, and the integration of compliance into

enterprise-wide governance structures [16], [17]. Additionally, the introduction of the ISO 37301:2021 standard established globally recognized requirements for compliance management systems, highlighting the importance of leadership, continuous improvement, and a risk-based approach [18].

Collectively, these frameworks have reshaped the regulatory landscape, reinforcing the strategic role of the compliance function in promoting ethical conduct, ensuring adherence to regulatory requirements, and safeguarding institutional integrity through effective compliance risk management.

Research Questions, Methodology, and Research Procedure

Building on the reviewed literature and international standards, this study aims to examine Georgia's regulatory framework, international obligations, and the current compliance risk management practices of commercial banks operating within the country. The research is particularly focused on identifying gaps in (1) the scope of the regulator's mandate, and (2) the implementation of regulatory requirements by financial institutions.

Research Questions: To address these issues, the study is guided by two key research questions (RQ):

RQ1: What gaps and weaknesses exist in the regulatory framework governing compliance risk management in the Georgian banking sector?

Objective 1: To analyze the regulatory framework relevant to compliance risk management in Georgia's banking sector.

RQ2: Do commercial banks in Georgia effectively comply with existing compliance risk management regulations?

Objective 2: To examine current compliance risk management practices within Georgian commercial banks.

Methodology: Based on the research question, a qualitative empirical approach is used as the methodology, grounded in document analysis and drawing upon existing reports, regulations, and policy documents as primary sources of real-world data. The methodology includes case studies and comparative analysis techniques to highlight key differences and uncover shortcomings. The document analysis encompasses the national regulatory framework, standards, and guidelines issued by internationally recognized organizations, relevant academic literature, and other pertinent sources, along with publicly available financial and managerial disclosures of commercial banks operating in Georgia.

Research Procedure:

To address RQ1 and identify gaps and weaknesses within the regulatory framework governing the Georgian banking sector, relevant legislative acts were identified using the official website of the Legislative Herald of Georgia (www.matsne.gov.ge). The search was conducted by applying all available search functionalities—title-based, full-text, and advanced search. A set of predefined keywords was employed to guide the process, including compliance, compliance risk, risk management, compliance officer, corporate governance, and compliance risk assessment. Additional academic

papers, studies from international organizations, reports, conference proceedings, and other pertinent sources were sourced from the official websites of the National Bank of Georgia (NBG) (www.nbg.gov.ge), the Basel Committee on Banking Supervision (www.bis.org), the International Organization for Standardization (www.iso.org).

To answer RQ2 and examine current compliance risk management practices, this study examined commercial banks' annual financial and management reports from 2010 to 2023. Given that the NBG places particular emphasis on systemically important banks, including concerning corporate governance, the systemic nature of banks was defined as the primary selection criterion. Accordingly, the study focused on three banks designated by the NBG as systemically important since 2017: (1) JSC TBC Bank (hereinafter, TB), (2) JSC Bank of Georgia (hereinafter, GB), and (3) JSC Liberty Bank (hereinafter, LB). To ensure consistency in the analysis, data from the same banks were reviewed retrospectively for the years before their formal designation as systemically important. Notably, all three banks are publicly listed on stock exchanges,

which ensures a higher degree of transparency and access to relevant disclosures. To address the main RQ2, two supplementary questions were formulated and used to guide the analysis of information contained in the annual reports of commercial banks:

(RQ2.1) What methods does the bank use to assess compliance risk?

If the answer was positive to the first question, the following question was defined:

(RQ2.2) Does the bank manage compliance risk?

A standardized evaluation table was developed to support the analysis and ensure consistency in data processing. Each evaluation question was answered based on the analysis of the reports, with answers categorized as "Yes," "No," or "Cannot be determined." The analysis covered the following reports:

- ✓ TB: 14 annual financial reports and 6 management reports
- ✓ GB: 13 annual financial reports and 6 management reports (The 2014 financial statements are not published on the NBG website).
- ✓ LB: 13 annual financial reports and 6 management reports (The 2011 financial statements are not published on the NBG website).

Reporting year	Q2.1 Does the bank manage compliance risk?	Q2.2 What methods does the bank use to assess compliance risk?	Note
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Research limitations:

This study does not examine the full scope of compliance management functions, but rather focuses specifically on compliance risk management and the methods used for its assessment. This limitation is intentional and reflects the study's aim to address gaps in the regulatory framework and practical implementation of compliance risk management in the banking sector, where risk assessment practices remain underdeveloped and insufficiently studied.

Main Findings

Results for RQ1:

The legal basis for compliance began with the NBG's Order N71 on Risk Management in Commercial Banks in 2008. The regulation defined compliance risk as "the risk of legal and regulatory sanctions, financial losses, or reputational damage resulting from non-compliance". Banks were required to identify and analyze risk factors that could increase their exposure to compliance risk with potential quantitative impacts on profitability, capital, or financial stability. In parallel, banks were obligated to implement effective mechanisms for managing compliance risk as part of their broader risk management systems. Chapter 10 of the Regulation elaborated on compliance risk management expectations. Banks were mandated to identify and assess risk factors, such as the complexity of their operations, non-compliance incidents, and legal claims, that could adversely affect their financial stability. They were also expected to manage these risks through dedicated policies, procedures, skilled staff, and robust controls. [19].

Order No. 71 was repealed and replaced by Order No. 18/04 in 2014. According to Article 42, banks were required to establish a dedicated compliance unit, thereby formalizing expectations that had only been

implied in the 2008 framework. The responsibilities of the compliance unit were defined under Article 41 and included setting risk tolerance limits, aligning policies with the bank's strategy, assigning responsibilities across organizational levels, applying zero-tolerance policies to specific violations, and conducting regular compliance reviews [4]. It also clarified the respective roles of the Supervisory Board, Directorate, and control functions - including Internal Audit, Compliance Unit, and Risk Management Unit, emphasizing the importance of their independence and coordination. Additionally, it mandated that the organizational structure must ensure the independence of control units from departments directly involved in operational activities, and quarterly risk assessments must be conducted and corresponding reports submitted to the NBG [20]. The obligation to manage the nine key risk categories -including compliance risk-along with the supervisory responsibilities assigned to both banks and the NBG, remained unchanged from the previous regulation.

Following the signing of the Association Agreement (AA/DCFTA) with the European Union in 2014, Georgia entered a new phase of regulatory reform, assuming a formal obligation to gradually align its national legislation with EU standards, including in the area of financial sector regulation. This obligation extends to the regulation and supervision of financial services, including the adoption of internationally recognized frameworks, such as the Basel Core Principles for Effective Banking Supervision (BCP), as well as measures aimed at preventing tax evasion and avoidance [21]. These commitments are explicitly outlined in Article 323 and Annex XV-A of the Agreement, which enumerate the relevant EU legislative acts and international instruments to be adopted within specified

implementation timelines. Before 2014, Georgia's engagement with international standards, such as those developed by the Basel Committee, was voluntary and discretionary. However, the AA/DCFTA institutionalized these expectations, requiring their integration into national law. This marked a strategic shift from voluntary adoption to mandatory legislative alignment, signaling Georgia's formal commitment to strengthening its financial regulatory framework in line with global best practices [4].

According to the above-mentioned, new legislative acts concerning Compliance and compliance risk management were issued by the NBG: The Order of NBG №92/04 "the Regulation on the disclosure requirements for commercial banks within Pillar 3", 2017 and the Order of NBG №215/04 "Corporate Governance Code for Commercial Banks", 2018; At the same time, the Order of NBG N48/04, which had previously defined compliance risk and detailed the responsibilities of the compliance unit, was repealed.

Under Pillar III, commercial banks are obligated to publish both quantitative and qualitative disclosures on capital adequacy, governance, and risk management practices. Article 6 requires that banks must disclose their internal control structure, including the roles and relationships of key units: the Supervisory Board, Executive Body, Internal Audit, Risk Management and Compliance units, and Internal Audit [22]. Section 3(c) outlines disclosure components such as control mechanisms, responsibilities, and the overall risk framework, extending to compliance risk, which was first introduced in regulation in 2008 [19]. Pillar III regulation formalized transparency requirements related to compliance risk management, building on earlier obligations from 2008 and 2014, such as to disclose their compliance risk management practices and the Compliance Unit's role within the broader risk framework. While compliance responsibilities date back to 2008, the explicit requirement to establish a dedicated Compliance Unit appeared in 2014, followed by disclosure obligations in 2017 [4].

The Corporate Governance Code for Commercial Banks governs the roles and responsibilities of the Supervisory Board, risk management frameworks, and internal controls (Internal Audit, Risk Management, and Compliance units). The Code remains the only active regulatory instrument explicitly defining the framework for compliance risk management in Georgian commercial banks [4]. The Compliance Unit is formally recognized as a structural division responsible for implementing the compliance function. The responsibilities of the Supervisory Board are expanded, mandating that it ensure the Compliance Unit's independence, grant it sufficient authority, and provide it with unrestricted access to the board. Core responsibilities of the Compliance unit include: together with other units, ensure that the Bank operates in compliance with applicable laws, regulations, internal policies, and procedures, as well as identify and assess compliance-related material/potential risks, make recommendations to the Supervisory Board and Board of Directors re-

garding the management and control strategies of compliance risks, ensure employee awareness of compliance-related matters [23].

Under the now-repealed Regulation on Risk Management in Commercial Banks [20], the Compliance Unit was also tasked with human resource-related responsibilities, such as: Evaluating compensation programs from a compliance perspective; Identifying key personnel and setting rotation limits; Assessing the adequacy of training programs; Evaluating the competence of governing bodies; Defining the bank's risk tolerance in its business activities.

Results for RQ2:

1. TB: An analysis of TB's annual reports showed that in the period from 2010 to 2017, the various types of risks managed by the bank were described, and the primary risk management approaches employed; however, compliance risk was not mentioned as a separate area of focus.

The reports between 2015 and 2017 indicate that a legal compliance unit was introduced within the bank's organizational structure. This unit was responsible for overseeing AML/CFT efforts and managing compliance risks. Nonetheless, the reports do not provide details on the specific methods used for managing compliance risk.

In the subsequent period, from 2018 to 2021, compliance risk was explicitly identified for the first time as one of the bank's key risks. Responsibility for this area was assigned to the Compliance Risk Management Unit. Despite this development, compliance risk was not integrated into the bank's broader risk management framework, and no specific risk assessment methodologies were disclosed in the reports.

The 2022-2023 reports state that the Compliance Department is responsible for initiating changes to internal instructions and issuing recommendations to relevant processes. The department is also tasked with defining and monitoring the compliance risk matrix by the bank's risk appetite framework. However, as with prior years, the reports do not provide any information on the risk assessment methods applied.

The findings suggest that TBC Bank's approach to compliance risk management has been limited in scope and insufficiently integrated into its overall risk management framework. From 2008 to 2018, compliance risk was not addressed as a distinct risk category. Although reports from 2018 to 2023 acknowledge some level of engagement with compliance risk management, they do not specify whether this extends beyond AML/CFT obligations.

2. GB: From 2010 to 2017, GB's annual reports outlined the various types of risks managed by the institution and described the main approaches applied. However, compliance risk management was not mentioned during this period.

In the years 2018 to 2020, the reports began referencing compliance risk management. Nevertheless, the coverage was confined to AML/CFT measures, which reflects a narrow interpretation of compliance risk (just one regulatory act) and does not align with its broader regulatory definition.

Reports from 2021 to 2023 introduced, for the first time, a formal definition of compliance risk. This marked a shift from prior years, where no such definition was provided. However, despite this conceptual advancement, the reports still did not specify the methods used for compliance risk assessment. The focus continued to center primarily on AML/CFT activities.

The findings indicate that between 2008 and 2018, compliance risks were not managed as a distinct risk category by the Bank. While the period from 2018 to 2020 saw the introduction of compliance risk references, these were limited to AML/CFT obligations and did not reflect the full scope of regulatory compliance. Although the reports from 2021 to 2023 included a formal definition of compliance risk, they lacked any description of the methodologies employed to assess or manage it, in contrast to the more comprehensive treatment of other risk types.

3. LB: From 2010 to 2013, LB's annual reports outlined the main types of risks managed by the bank and described the methods used for their management. However, during this period, compliance risk was not mentioned or treated as a distinct category.

In the financial statements from 2014 to 2023, compliance risk is not presented independently. Instead, it is described as a component of operational risk, which the bank reports as being actively managed. This classification stands in contradiction to the standards established by the Basel Committee and the regulatory requirements of the NBG, both of which define compliance risk as a distinct and standalone risk category that should not be subsumed under operational risk. Moreover, across all years reviewed, the reports do not specify the methods used to assess compliance risk.

The analysis indicates that between 2008 and 2013, LB did not manage compliance risk as a distinct category. From 2014 to 2023, the bank continued to treat compliance risk as a component of operational risk, contrary to both international (Basel Committee) and local (NGB) regulatory standards. The reports do not indicate the assessment methods used for compliance risk.

Discussion

Identified gaps for RQ1:

The current legal framework no longer defines compliance risk or outlines how it should be assessed. The Code emphasizes risk identification and evaluation but lacks the procedural specificity that earlier regulations provided (e.g., 2008 and 2014 risk management regulations).

As the World Bank (2021) notes, the enforcement just the existence of sanctions is essential for the effective implementation of corporate governance. In Georgia, enforcement remains inconsistent, weakening regulatory impact [24, pp. 28-29].

Basel Committee guidance requires that supervisors ensure banks have a permanent, independent, and adequately staffed compliance function with board-level oversight [25, p. 67]. Georgia's framework does not provide tools to evaluate these conditions in practice. The NBG must be capable of evaluating the independence and effectiveness of compliance functions. Fulfilling Association Agreement

obligations requires more than referencing compliance in the Code; it demands a dedicated regulatory framework on compliance risk management. There is no regulatory requirement to adopt a formal compliance policy, define clear appointment procedures for the Chief Compliance Officer (CCO), and establish fixed terms and board-approved mandates for the CCO [26, p. 3], as it is used in best practices. This lack of formal requirements indicates that the regulator views the compliance unit more as a symbolic obligation under the Association Agreement than as a function requiring practical regulatory support.

The existing regulatory framework for compliance risk management does not meet the standards that can be used to determine: 1) Methods that will allow the NBG to assess the compliance risk profile, level, risk appetite, and overall quality of compliance risk management, which indicates the inefficiency of the enforcement part. 2) The role, status, functions, definition, and guarantees of independence of the control function - Compliance unit; relevant experience of the chief compliance officer, whether the CCO has sufficient authority to effectively perform the role in the bank, budget, and remuneration policy.

Identified gaps for RQ2:

The analysis reveals several significant gaps in the implementation of compliance risk management regulations among Georgian commercial banks:

- ✓ There is a general lack of practical implementation of existing compliance regulations across the sector.

- ✓ Neither the 2008 nor the 2014 editions of the regulation "On Risk Management in Commercial Banks" have been effectively enforced by the commercial banks or by the NBG in the area of compliance risk management.

- ✓ Banks apply inconsistent and, in some cases, inappropriate definitions of compliance risk. For example, LB classifies compliance risk as a component of operational risk, whereas GB and TB primarily associate compliance risk with AML/CFT obligations. This approach fails to reflect the broader scope of compliance as outlined in international best practices.

- ✓ The guidelines established by the Basel Committee on Banking Supervision (BCBS) are not being adequately considered by the Georgian banking sector.

The Basel Committee has explicitly criticized the trend of narrowing compliance functions to AML alone. In its Principles for Enhancing Corporate Governance, note 34, it states: "Compliance functions are being solely focused on anti-money laundering (AML), which is inconsistent with the Basel Committee's guidance. The Committee emphasizes that the compliance function should have a broader scope, addressing various areas as specified in their guidance" [15, p. 32].

In all three cases analyzed, compliance risk was either entirely omitted, classified under operational risk, or addressed exclusively through the lens of AML/CFT. While some progress has been observed in recent years, such as the inclusion of definitions and designation of internal compliance responsibilities, none of the banks articulate a clear or structured meth-

odology for assessing compliance risk. Moreover, integration of compliance risk into the banks' broader risk management frameworks remains limited and underdeveloped.

The findings suggest that all three systematically important banks demonstrate a narrow interpretation of compliance risk management that overlooks the broader function and scope outlined in established compliance frameworks [2], [15, pp. 32, note 34]. These frameworks - including the Sarbanes-Oxley Act [11], and the Dodd-Frank Act [12] - define compliance in terms of a wide array of regulatory responsibilities, such as conflict of interest prevention, ethical standards, executive accountability, fraud prevention, consumer protection, and corporate liability. The NBG's regulation also recognizes compliance risk as an independent and significant risk category [23].

The continued absence of clearly defined compliance risk assessment methodologies stands in stark contrast to the more structured and transparent treatment of other risk types in bank disclosures. This fragmented and incomplete approach points to a critical need for both more robust regulatory guidance from the NBG and the adoption of internal compliance practices aligned with international standards. Compliance risk must be treated as a distinct and strategically important risk area requiring dedicated resources, consistent methodologies, and meaningful integration into enterprise-wide risk management frameworks.

Conclusion

Although a formal regulatory structure is in place, significant challenges remain in its effective implementation. As the findings demonstrate, gaps exist within local regulations, and banks often fail to comply due to the absence of detailed guidance, such as manuals and instructions, as well as weak enforcement mechanisms on the part of the supervisory authority. To accurately assess rising compliance risk levels within banks and understand their quantitative impact on profit, loss, and capital, the regulator must establish clear compliance risk management guidelines, including a defined risk assessment methodology.

It is impossible to implement standards without enforcement. Before enforcement, a uniform standard must exist.

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HISTORICAL SCIENCES

THE ROLE OF ARCHIVES IN THE RESEARCH OF INTERNATIONAL RELATIONS AND DIPLOMACY

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<https://doi.org/10.5281/zenodo.17492575>

Abstract

This article analyzes the role of archives in the study of international relations and diplomacy. It examines the importance of archival documents as primary sources for reconstructing foreign policy processes, identifying hidden decision-making mechanisms, and shaping the historical memory of states. Particular attention is paid to the methodological aspects of working with diplomatic collections, including the analysis of correspondence, memoranda, and agreements, as well as the challenges of interpreting multilingual documents and contextual differences in diplomatic discourse. The paper explores the concept of "archival diplomacy" as a form of international cooperation and a soft power tool that helps build trust between countries. The influence of digitalization on the transformation of the source base for international research and the development of global digital archives is noted. It is emphasized that archives are becoming not only guardians of the past but also active participants in shaping international dialogue, ensuring a balance between historical truth, ethics, and political interests. The conclusion is that the degree of openness of archives and their integration into the global research space serve as an indicator of a state's maturity, its scientific culture, and its readiness for an honest conversation about its own history.

Keywords: Archival diplomacy, source reliability, international relations, document declassification, digitalization of archives.

Introduction: Archives are unique laboratories of history, where diplomatic documents become witnesses of eras and tools for understanding the logic of international relations. No discipline on politics and diplomacy can claim to be complete without reference to archival sources, for they allow us to reconstruct the true fabric of events, devoid of ideological noise and political interpretations. Unlike newspaper articles and memoirs, archival materials capture the real state of international communications, the hidden intentions and compromises behind grand declarations and diplomatic gestures.

Today, the importance of archives is growing exponentially. In an era of information overload and digital acceleration, archives remain the guarantor of factual accuracy and the key to an objective understanding of the past. They are becoming not only a tool for historical research but also part of contemporary memory politics, influencing the perception of international events and the formation of national identities.

Diplomatic archives are a bridge between eras, between secrecy and transparency, between scholarly reconstruction and political interpretation. By studying them, researchers engage in a dialogue not only with the document but with time itself, and every act of declassification becomes a step toward a more honest and mature world history. This is why research into the role of archives in diplomacy is today acquiring not only academic but also civilizational significance.

• The Archive as a Foundation for International Research

Archives occupy a central place in the system of historical knowledge, particularly in the field of international relations and diplomacy. They represent more

than just collections of documents, but complex institutional structures that ensure the preservation of and access to primary sources that form the basis for an objective analysis of political processes [2, pp. 45–48].

An archive, in a broad sense, is a repository of documentary evidence of the activities of states, international organizations, and individuals involved in political and diplomatic life. In the humanities, an archive fulfills two key functions: cognitive—serving as a tool for understanding historical reality—and identification—participating in the formation of society's historical memory [3, pp. 28–32]. This makes archival sources an integral element of scholarly discourse on international relations, as they allow researchers to reconstruct the cause-and-effect relationships of diplomatic events [6, pp. 14–19].

Archival documents serve as primary sources for political history, as they reflect actual processes of decision-making, negotiations, treaty-making, and conflicts of interest between states. Unlike journalistic or memoir accounts, archival materials possess a greater degree of reliability and factual accuracy, making them indispensable in the study of international crises, diplomatic missions, or the evolution of foreign policy [1, pp. 102–106; 7, pp. 41–45].

Archival analysis is based on three principles: authenticity, reliability and interpretation.

- Authenticity implies verification of the origin of the document, establishing its author, date and place of creation [2, pp. 49–51].
- Authenticity is the assessment of content in terms of factual accuracy and the context of creation.
- Interpretation is an analytical reconstruction of events and diplomatic decisions based on identified sources [9, pp. 133–136].

Contemporary archival science combines traditional source studies methods with digital technologies: the use of electronic databases, scanned diplomatic dispatches, and digital repositories significantly expands the possibilities of international research [10, pp. 87–90]. As a result, archives are becoming not only a "memory of diplomacy" but also a tool for transnational scholarly interaction, shaping a global space of documentary knowledge.

• Archives in International Relations Research

Archives represent a key foundation for reconstructing diplomatic history and studying the evolution of international relations. National archival collections contain unique documents—diplomatic dispatches, negotiation protocols, notes, memoranda, and embassy reports—that allow researchers to trace how states' foreign policy strategies were shaped and the mechanisms that influenced international decision-making [6, pp. 53–57].

The national archives of Russia, Great Britain, France, and the United States play a special role in this process. The Russian State Archive of Foreign Policy (RGVA) accumulates documents from the 18th century onwards, reflecting the activities of the Ministry of Foreign Affairs of the Russian Empire, and then the USSR and modern Russia [1, pp. 92–95]. In Great Britain, the National Archives in Kew provides wide access to diplomatic papers of the Foreign Office, which make it possible to reconstruct London's policy during the period of colonial transformations and world wars [9, pp. 142–145]. The French diplomatic archive in La Courneuve serves as a key center for the study of colonial policy and Franco-European diplomacy [10, pp. 77–81]. The US National Archives of Remembrance (NARA) contains the State Department collections, covering global conflicts, agreements, and international missions of the 20th century [8, pp. 203–207].

Researchers' access to diplomatic collections is regulated by a number of mechanisms that combine the principles of openness and the protection of state secrets. Most countries employ a "thirty-year rule," according to which diplomatic documents become available after the established secrecy period has expired [7, pp. 115–118]. However, with growing interest in historical diplomacy and the development of international research programs, states are increasingly providing advance access to materials under bilateral agreements. For example, Russian-German and French-British archival projects are creating databases of joint diplomatic documents, facilitating comparative foreign policy research [4, pp. 212–216].

Digitalization processes have radically changed the source base for international research. Electronic archives, online platforms, and databases allow scholars to access diplomatic documents remotely, conduct thematic searches, and compare data from different countries [12, pp. 33–37]. Programs such as "Memory of the World" (UNESCO) and "Digital Diplomacy Archives" are creating the conditions for the formation of a unified international research space [11, pp. 101–104].

Thus, archives in the 21st century are no longer simply "repositories of the past." They are becoming

active participants in global academic communication, providing researchers with a tool for critically analyzing international processes, strengthening mutual understanding, and fostering a new culture of open knowledge.

• Archival diplomacy and international archival cooperation

The modern era is characterized by states' desire not only for political but also for informational and cultural interaction, which is reflected in the phenomenon of archival diplomacy. This term denotes a system of international cooperation in the preservation, exchange, and interpretation of documentary heritage that is significant for the history of international relations [4, pp. 118–122]. Archival diplomacy is becoming an important area of public diplomacy, as it promotes trust between countries through the joint study of the historical past and the overcoming of ideological barriers [10, pp. 52–55].

Joint archival projects and the exchange of funds between states serve as a unique bridge between politics and scholarship. International archival agreements enable the pooling of resources and the comprehensive study of events that shaped the global political system [8, pp. 225–230]. For example, projects to declassify Cold War-era diplomatic documents, supported by the UN and UNESCO, have become not only academic initiatives but also an act of international reconciliation, facilitating a rethinking of the confrontational history of the 20th century [12, pp. 41–44]. Such projects create joint digital archives, including diplomatic notes, protocols, and embassy reports, significantly facilitating the work of researchers and promoting the transparency of historical knowledge.

Archives play a special role as a tool of "soft power," influencing the formation of a state's image through scientific and cultural interaction [9, pp. 136–139]. The publication of documents previously inaccessible to the public strengthens a country's reputation as open and democratic and demonstrates a willingness to engage in international dialogue. For example, projects to publish diplomatic correspondence, joint research collections, and exhibitions in Russia, France, and Germany are becoming part of state cultural policy [5, pp. 94–98]. Archival diplomacy thus serves as a tool for strengthening international prestige and intellectual cooperation.

Some of the most successful examples are the Russian-German archival agreements that began in the 1990s. These included the exchange of copies of documents relating to World War II and post-war relations, as well as the creation of an interstate commission for the declassification of military and diplomatic archives [6, pp. 131–135]. Similar initiatives existed between France and Great Britain, where the joint work of archival services made it possible to systematize diplomatic sources from the period 1914–1945 and publish multi-volume editions of Documents Diplomatiques Français and British Foreign Policy Papers [1, pp. 89–92].

In recent years, archival cooperation between Azerbaijan and Turkey has noticeably intensified, aimed at systematizing documents related to the history

of the Caucasus, the Ottoman Empire, and the Turkic peoples. The State Archives of Azerbaijan, together with the Directorate of State Archives under the President of Turkey, is implementing the "Ortak Tarih Belgeleri" project, which aims to digitize and publish materials related to diplomatic relations between Baku and Ankara [3, pp. 74–78]. These initiatives not only deepen scholarly ties but also strengthen the cultural and historical unity of the Turkic world, transforming archival diplomacy into a tool for strategic partnership.

Thus, international archival cooperation today extends beyond purely scientific objectives. It is becoming an element of global cultural policy, where the preservation and dissemination of documentary heritage serves to strengthen trust between nations and foster a more sustainable architecture of international relations based on the principles of historical openness and dialogue [11, pp. 63–66].

• **Methodology of using archives in diplomatic research**

The methodological basis for working with archives in the study of international relations combines approaches from source studies, diplomatic history, and political analysis. The use of archival materials requires rigorous systematization, critical analysis, and comparison with other sources—the press, memoirs, meeting transcripts, and international legal acts [2, pp. 115–118].

Diplomatic correspondence, memoranda, and agreements are key sources for reconstructing political decisions and interstate communications. Their analysis is based on a content-discursive approach, which allows us to identify not only the factual content of a document, but also the hidden political motives, emotional contexts, and strategic intentions of the parties [5, pp. 84–88]. For example, a study of diplomatic correspondence between the USSR and the United States during the Cold War reveals not only official rhetoric but also the transformation of the language of international politics, making such documents unique material for studying the evolution of political thinking [8, pp. 239–243]. From a methodological perspective, a comparative analysis of sources is of particular importance—a comparison of different versions of diplomatic documents presented in the archives of different countries, which helps minimize ideological distortions [1, pp. 107–111].

Interpreting multilingual and intercultural documents presents particular challenges. Translations of diplomatic materials often reflect not only linguistic but also conceptual differences between political cultures [9, pp. 144–148]. The same expression in a diplomatic note, for example, may convey varying degrees of formality or threatening force depending on the linguistic and cultural context. Therefore, when working with multilingual archives, researchers must consider the background knowledge of the era, the specifics of international legal terminology, and the rhetorical strategies of diplomatic style [6, pp. 161–164]. In this regard, interdisciplinary methods—philological, semantic, and contextual analysis—are particularly important, allowing for the nuances of diplomatic discourse to be revealed.

In recent years, the field of digital humanities has been actively developing, transforming traditional archival research methodology. The creation of electronic databases, digital repositories, and automated document retrieval systems makes it possible not only to preserve but also to semantically analyze vast amounts of diplomatic information [11, pp. 72–75]. International projects such as the UN Digital Library, European Diplomatic Archives, and Memory of the World (UNESCO) provide researchers with access to thousands of scanned agreements, dispatches, and government reports, thereby facilitating the globalization of archival knowledge [12, pp. 53–57]. The use of artificial intelligence technologies for automatic text recognition and metadata also opens new horizons for the analysis of diplomatic acts, making it possible to identify thematic connections and the dynamics of international processes over time [10, pp. 91–95].

Thus, the methodology of working with archives in diplomatic research is evolving toward a synthesis of humanities and digital approaches. Whereas previously researchers were limited by physical access to sources, they now become participants in a global network of documentary knowledge, where archives function as intellectual nodes of the international scholarly space, ensuring transparency, reliability, and the integration of historical information into the context of contemporary political analysis [3, pp. 125–128].

• **Ethical and political aspects of archival openness**

Contemporary archival policy is shaped by the intersection of science, ethics, and politics. In the context of global transparency and digitalization, a new dilemma arises: how to reconcile the principle of free access to information with the need to protect national interests and diplomatic secrecy. The question of archival openness is becoming not only an administrative one but also a moral and political one, as it affects society's understanding of the past and the mechanisms for building international trust [5, pp. 156–160].

One of the most important areas of archival ethics is the process of declassifying diplomatic documents. In most countries, it is regulated by the so-called "thirty-year rule"—a time limit after which documents are released into public use [7, pp. 201–205]. However, actual practices vary depending on the political culture and the degree of democracy in a society. In Western European countries, declassification is systemic and is accompanied by an expert assessment of the impact of document publication on national security [1, pp. 113–116]. At the same time, in a number of post-Soviet states, this process remains partially closed, which leads to limited research opportunities and the formation of a fragmented understanding of diplomatic history [9, pp. 149–152]. The ethical principle of archival transparency requires that the state not only preserve but also explain the context of the publication or classification of certain materials, thereby strengthening trust between the government, society, and the scientific community [11, pp. 78–81].

A major problem is the politicization of access to archives. Historically, archives have repeatedly become a tool of propaganda—for example, the selective

publication of diplomatic documents was used to justify foreign policy moves or discredit opponents [4, pp. 224–228]. The politicization of archives leads to the formation of “managed memory,” where a document loses its neutrality and becomes a means of ideological influence [2, pp. 122–126]. In international relations, such a practice can exacerbate conflicts and foster distrust of historical interpretations. Therefore, modern international organizations, including UNESCO and the Council of Europe, are demanding the depoliticization of archival access and mandatory scientific expertise before the publication of sensitive documents [12, pp. 63–67]. In this context, an archive becomes not only a repository of facts but also an arena for the struggle over the interpretation of the past, where scientific ethics acquires decisive significance.

Archives also serve as a catalyst for shaping state historical policy, determining which events and documents will be included in collective memory and which will remain on the periphery of historical consciousness [3, pp. 131–135]. States increasingly use archives to strengthen national identity and legitimize political decisions. For example, the publication of diplomatic documents on World War II in Russia, Germany, and Poland is accompanied not only by scholarly commentary but also by a symbolic emphasis on national contributions to victory or suffering [6, pp. 173–177]. In Azerbaijan and Turkey, archives are becoming a tool for restoring historical justice in relation to events related to colonialism and the international recognition of genocide [10, pp. 97–100]. In this sense, archival policy is part of an ideological dialogue between the past and the present, where each document takes on a double life: scholarly and political.

Thus, the ethical and political aspects of archival openness directly influence the nature of international interaction and the degree of trust between states. The balance between society's right to knowledge and the state's responsibility to preserve confidentiality remains fragile, but it is precisely this balance that makes archives a space not only for memory but also for dialogue—a place where history continues to be shaped through documentation. Archival openness becomes a criterion for the maturity of democracy and scientific culture, as well as an important indicator of a state's readiness to engage in honest conversations about its own past [8, pp. 245–249].

Conclusion

Archives are more than just repositories of paper and the dust of time. They are living organisms of historical memory, pulsating with the logic of international relations, the hidden motives of diplomacy, and the echoes of decisions that changed the destinies of nations. Their significance extends far beyond scholarly interest—archives become a space where the past enters into dialogue with the present, and truth gradually takes shape, freed from political interpretations.

The modern era makes the archive not only a mirror of history but also an instrument of global responsibility. Through open collections, collaborative projects,

and digital repositories, humanity is learning to see not an enemy but a partner, not a confrontation but a shared past requiring understanding. In this sense, archival diplomacy is becoming a bridge between nations, where the document serves not as a weapon but as an argument for trust.

Ethical openness, respect for sources, and international cooperation are shaping a new philosophy of archival work—a philosophy of transparency, mutual understanding, and historical integrity. States that recognize the power of archives are not afraid to make difficult chapters of their history public, because only knowledge and recognition of the past enable them to build a just future.

An archive is the silence in which history speaks. And who hears this voice and how it is heard determines whether it becomes a reminder of conflict or a testament to the maturity of a civilization.

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ARCHAEOLOGICAL STUDY HISTORY OF THE UPPER SANGZOR BASIN

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Abstract

This article analyzes the history of archaeological research in the Upper Sangzor Basin. The main objective is to review the process of archaeological investigations conducted in this region from the Soviet period to the present day, with special attention to previously unexplored and marginal areas. The study involved the examination of archival sources, scientific literature, and cartographic materials, as well as the use of GIS technologies and archaeological surveys. As a result, more than twenty new archaeological sites were identified in the Upper Sangzor Basin, and their spatial distribution and chronological characteristics were systematized.

Keywords: Upper Sangzor Basin, Nushkent, Rustoq, Molguzar Range, Sangzor River, GIS analysis, pastoralism, Soviet archaeology.

Introduction

The Sangzor Valley has been a permanent area of human settlement since ancient times. The scholar of Ustrushona studies, **M. Pardaev**, based on the scope and periodicity of sedentarization and land utilization processes, as well as ancient historical and administrative divisions, classifies the densely distributed archaeological sites in the Sangzor River basin into small cultural oases. He studies these as the **Upper Sangzor**, **Middle Sangzor**, and **Lower Sangzor** cultural zones. This classification is considered logically justified, and the present study also follows this framework [1, p. 34].

The upper parts of the valley are mountainous in nature, where **pastoralism** predominated; descending towards the plains, **irrigated agriculture** became dominant and spread as far as the Lower Sangzor. Since ancient times, such provinces and cities as **Nushkent**, **Kharkana**, and **Fagh'non (Dizak)** have existed in this region [2, p. 29]. Archaeological research demonstrates that the settlements along the Sangzor were closely associated with an advanced culture of irrigated agriculture.

Most of the previous archaeological studies in the Sangzor Valley were conducted primarily along the riverbanks and near transport routes, which led to a lack of systematic investigation in the foothill areas. However, since the main economic activity of ancient populations was closely tied to animal husbandry, people often lived precisely in the foothill zones. Therefore, conducting archaeological field surveys in these regions emerged as a scientific necessity.

In addition, certain chronological gaps are observed within the archaeological landscape of the Sangzor Valley. To fill these gaps — that is, to establish the intermediate chronological phases and reconstruct the sequence of cultural processes — targeted survey and analytical work was carried out.

During the research, **modern technologies**, particularly **GIS tools**, were extensively applied. This method, which was rarely employed in earlier studies, enabled a systematic evaluation of the territory. GIS-based analyses allowed the identification of areas with high potential for ancient habitation based on topogra-

phy, water sources, soil fertility, and the spatial distribution of known archaeological sites. This approach made it possible to discover new archaeological settlements and to gain a deeper understanding of the lifestyle of ancient populations in the Sangzor Valley.

The **main objective** of this study is to examine the historical stages of archaeological research in the Sangzor oasis, to analyze the ancient culture and way of life of its inhabitants on a scientific basis, and to determine the role of this region in the development of **Central Asian archaeology**.

To achieve this objective, the following tasks were defined:

- To describe the natural and geographical conditions of the Sangzor oasis and their significance in the formation of human settlements;
- To analyze the earliest archaeological observations and research conducted in the late 19th and early 20th centuries;
- To summarize the results of Soviet-era archaeological expeditions (1950s–1980s);
- To reveal new scientific methods applied during the independence period and in contemporary research (GIS technologies, aerial imagery, and archival analysis);
- To collect and systematize data on ancient settlements, cemeteries, architectural structures, and economic remains identified in the oasis.

Archaeological research in the Sangzor Valley began in the **late 19th and early 20th centuries**, carried out by Russian travelers and scholars. Their observations were mainly limited to collecting information about the region's natural and geographical features, the external appearance of ancient monuments, and the lifestyle of local populations.

During the **Soviet period** (particularly between the 1950s and 1980s), systematic archaeological expeditions were conducted in the Sangzor Valley. These studies led to the discovery of ancient settlements, cemeteries, and irrigation systems. The material culture artifacts unearthed during excavations provided valuable data on the socio-economic life of the oasis across different historical periods.

In the **years of independence**, archaeological studies entered a new phase. Uzbek researchers began

employing modern methodologies such as **GIS technologies, aerial photography, and remote sensing data**. As a result, a clearer understanding emerged regarding the ancient irrigation networks, urban planning systems, and settlement dynamics of the region.

Overall, earlier scholarly research played a crucial role in uncovering the rich historical and cultural heritage of the Sangzor Valley and serves as a fundamental source for present-day investigations.

Natural conditions of the upper Sangzor region. Within the hydrographic system of the Molguzar Range, the Sangzor River serves as the principal water artery. It originates on the northern slopes of the Chumqortog' Range, at approximately 3,300 meters above sea level, where the G'uralash and Jontaka streams converge [3, p. 36]. Along its course, numerous tributaries 28–59 km in length—such as Ko'kjar, Novqa, and Sutlibuloq—join the river from the northern slopes of Chumqortog'.

From the southern slopes of the Molguzar Range, the Qorashaqshaq and Shaybeksoy streams also merge into the Sangzor, contributing to the river's overall water balance. The river flows into the Jizzakh Reservoir, serving as the main source of water for the province.

The Sangzor River is primarily fed by glacial and snowmelt waters. Consequently, water levels rise during summer and decrease in winter. The average discharge rate is about 6.1 m³/s, with a total drainage basin covering approximately 2,580 km² and an overall length exceeding 120 km [4, p. 15].

Historically, the Sangzor River and its tributaries have played a crucial role in maintaining the ecological balance of the region, fostering the development of agriculture and pastoralism, and influencing the establishment of human settlements. This hydrological system remains one of the key natural and economic lifelines of the Jizzakh oasis.

Main Part

History of Archaeological Research. Early Archaeological Observations (Information from the Early 20th Century). The earliest archaeological observations in Central Asia date back to the late 19th and early 20th centuries, coinciding with the expansion of the Russian Empire into the region and its growing scientific and strategic interests. During this period, the primary focus of researchers was to collect and catalog ancient artifacts, while systematic investigation of the historical and cultural context of the territories remained secondary. Consequently, early studies were mostly limited to surface surveys and the registration of large visible finds.

Among the scholars active during this period, P. I. Lerch deserves special mention. In the 1860s, he studied and translated a white marble inscription discovered in the Ilono'tti gorge, located between the Molguzar and Nuratau ranges [5, pp. 38–39]. The inscription records, on one side, Ulughbek's victory over the Mongols, and on the other, Abdullakhon II of Bukhara's triumph over the rulers of the Dasht-i Qipchoq. This artifact remains one of the key pieces of evidence of scholarly activity from that era.

In general, archaeological research of the late 19th and early 20th centuries concentrated mainly on describing the external features of monuments—architectural remains, fortification structures, and irrigation systems—without conducting in-depth excavations or stratigraphic analyses. Rather than adopting a scientific methodology, researchers focused on collecting descriptive information, oral traditions, and local historical narratives.

Overall, the archaeological investigations of the early 20th century laid the groundwork for subsequent research in the Sangzor Valley and the wider Ustrushona region, though this stage can be considered preliminary, superficial, and not yet systematically organized. From the 1920s–1930s onward, Soviet expeditions introduced more structured and comprehensive archaeological studies across the region.

Research during the Soviet Period. The systematic exploration of Sangzor Valley's archaeology entered a new phase in the second half of the 20th century, particularly during the Soviet era. Expeditions conducted in this period aimed not only to document archaeological sites but also to determine their chronology, economic functions, and cultural development patterns.

The first comprehensive excavations were carried out in 1948 by archaeologist Ya. G'. G'ulomov, who conducted excavations in the village of Nushket in the Bakhmal district. This research is recognized as one of the first systematic archaeological investigations in the Sangzor Valley and laid a solid foundation for subsequent studies [6, pp. 57–59].

In the following years, U. A. Alimov and L. M. Sverchkov conducted archaeological surveys near the villages of Qashqasuv, Qizilmazor, and Boyqo'ng'ir. They identified stone-built graves, burial mounds, and jar burials containing human remains [7, p. 15]. These discoveries indicate that the region's inhabitants possessed complex funerary customs and developed religious concepts during that period.

In 1982, archaeologist R. A. Badakhov recorded twelve stone-covered burial mounds southwest of the Bakhmal district, along the road from Qoraqishloq to Oyqorsoy. Additionally, about 500 meters northwest of this area, a chain of nineteen burial mounds was documented. In the Oyqor area, about 500 meters west and north of the village of Sartyuzi, isolated large burial mounds were identified, around which fragments of early medieval pottery were found [8, pp. 6–7]. Furthermore, in the northern parts of Zartepa village, additional stone-encircled burial mounds were recorded [9, p. 11].

These studies revealed that during the Soviet period, the Sangzor Valley contained numerous large necropolises and burial complexes, providing valuable insights into ancient funerary rituals, belief systems, and social structures. Moreover, the findings highlight the interrelation between pastoralism, agriculture, and mortuary practices in the cultural life of the ancient population.

Overall, the Soviet-era expeditions contributed significantly to forming a scientifically grounded ar-

chaeological framework of the Sangzor Valley. The results of these studies later served as the empirical and methodological foundation for research conducted during the independence period.

New Approaches and Research after Independence. After Uzbekistan gained independence, archaeological research in the Sangzor Valley and the mountainous regions of Ustrushona entered a new stage of development. The studies conducted during this period are notable for enriching previous findings, filling chronological gaps between different archaeological complexes, and introducing modern research methodologies.

Between 2003 and 2016, archaeologist F. Toshboyev carried out large-scale excavations in the districts of Zomin, Jizzakh, Bakhmal, and others. During these investigations, the Shirinsoy, Sa'gonok, and Uchtepa burial mounds were excavated and analyzed in comparison with other sites. The resulting materials provided a deeper understanding of local populations' funerary traditions, religious beliefs, and economic activities [10, pp. 19–20].

In recent years, landscape-archaeological surveys and GIS analyses in the mountainous areas of Ustrushona, particularly within the Molguzar Range, have revealed traces of ancient nomadic pastoralist communities. According to researcher F. A. Maksudov, due to favorable natural conditions, campsites of Bronze-Age herding groups were established in these territories. Their remains were recorded at elevations of 1,100–1,800 m in the valleys of G'alchasoy, Qoratosh, Besharchasoy, Moyliqoton, and Uyqto'sh, as well as at 2,000–2,500 m on the Bedana Plateau, particularly in the Toshbuluq pastures [11, p. 17].

Studies based on archaeological predictive modeling have shown that the Molguzar Range contained ecological “niches” suitable for early pastoral habitation. According to AMS/¹⁴C radiocarbon analyses, together with the stratigraphy, spatial layout, and material culture of these campsites, nomadic pastoralists began occupying this region as early as the second millennium BCE, maintaining continuous seasonal use for nearly four thousand years.

Thus, the research conducted during the independence period not only enriched existing archaeological knowledge but, through the application of modern methods—GIS technologies, radiocarbon analysis, and landscape-archaeological approaches—provided a more comprehensive reconstruction of the ancient economic and cultural landscapes of the Sangzor Valley and the highlands of Ustrushona.

In recent years, the contribution of foreign scholars to the study of Ustrushona and the Sangzor Valley has significantly increased. For instance, in 2022, M. Frachetti, F. Maksudov, E. Henry, A. Merkle, and their international collaborators conducted extensive surveys using UAV-LiDAR technology at the sites of Tashbulak and Tugunbulak in the Zaamin region. As a result, highly precise digital elevation models (DEMs) were produced, revealing for the first time large-scale urban systems located above 2,000 m. The research documented fortification walls, road networks, residential quarters, cemeteries, and industrial areas within the

Tashbulak (12 ha) and Tugunbulak (120 ha) sites, identifying them as among the largest high-mountain urban centers of medieval Central Asia [12, pp. 1118–1124]. These findings have prompted a reevaluation of the socio-economic significance of highland regions previously regarded as “peripheral.”

Moreover, foreign researchers such as R. Spengler, P. Doumani, L. Rouse, and B. Cerasetti have investigated Bronze- and Iron-Age nomadic pastoralism and early agricultural processes in Central Asia, providing new evidence on the formation of ecological and subsistence systems. Their studies demonstrate how pastoralism, agriculture, and trade routes were closely intertwined in the Sangzor region and its neighboring territories [13, pp. 3–26].

The archaeological observations by E. Luneau and colleagues in the Nuratau Mountains have also shed light on the complexity of the region's socio-economic dynamics. Using remote sensing, drone-based aerial photography, and field surveys, they identified numerous previously unknown ancient settlements. These methods have proven highly effective and are applicable to the study of the mountainous zones of both Sangzor and Ustrushona [13, pp. 3–26].

Overall, the integration of modern technologies—including UAV-LiDAR, GIS, archaeobotanical analysis, and isotopic studies—by international research teams has elevated the study of the archaeological heritage of the Sangzor Valley and Ustrushona to a new scientific level. These advancements not only provide a deeper understanding of the region's historical development but also strengthen Central Asia's position within the global archaeological discourse.

Economic Activities of the Upper Sangzor Population.

One of the main branches of economic activity in the Upper Sangzor oasis was animal husbandry. The region's natural and geographical conditions—particularly the abundance of wide pastures—provided favorable opportunities for breeding and raising livestock. Consequently, pastoralism became a leading element in the local population's lifestyle. It was not merely an economic occupation but also a key factor in shaping various forms of craft production.

Products derived from livestock were widely used for weaving wool fabrics, making clothing, and producing leather goods and household items. At the same time, agriculture played an important role in the oasis economy, existing in close interrelation with pastoralism. In some areas, crops grown in the fields were used as fodder for livestock, while also meeting the population's basic food needs.

The blacksmithing craft also reached a high level of development and played a vital role in supporting both pastoral and agricultural practices. Iron tools and weapons were produced for herders, while ploughs, sickles, and other implements essential for farming were made for agricultural communities. Thus, metalworking became not just a branch of production but an integral component of the economic system.

Recent archaeological discoveries confirm these processes. Artifacts associated with animal husbandry, craft production, agriculture, and ironworking indicate

that economic life in the Upper Sangzor oasis developed in a multifunctional and interdependent manner.

Connections with the Ustrushona Culture.

The pastoral communities of the Upper Sangzor oasis mostly led nomadic or semi-nomadic lifestyles. They moved their herds seasonally to different pastures, either permanently or temporarily relocating according to climatic conditions. This way of life not only provided optimal conditions for livestock but also facilitated the development of economic and cultural interactions between local populations and neighboring regions.

Pastoralists traded their own products—wool, milk, hides, and other goods—in exchange for grain, fruit, household utensils, and craft products. This exchange indicates that the inhabitants of the Upper Sangzor maintained continuous economic contact with other parts of Ustrushona.

Archaeological evidence supports these interactions. For example, seeds discovered at the Toshbuloq site belong to plant species that do not occur naturally in mountainous areas, suggesting that agricultural products were imported from other regions. Furthermore, architectural styles and burial structures demonstrate close links with other cultural centers of Ustrushona, proving that the population of the Upper Sangzor oasis was integrated not only economically but also culturally and spiritually within the broader regional system.

Archaeological Surveys in the Upper Sangzor Region.

Based on the analysis of recent literature and earlier research, the northern part of the Upper Sangzor basin and the southern slopes of the Molguzar Range, which had not yet been thoroughly explored archaeologically, were selected for new field investigations. The region's complex topography, dense hydrographic network, and historically important communication routes made it a promising area for archaeological research.

In the initial stage, cartographic and remote-sensing materials from open sources were analyzed. In particular, Corona satellite mission imagery (1960–1972) with 1–2 m spatial resolution and Soviet military topographic maps (at scales 1:100,000 and 1:50,000) were examined. In the next stage, higher-resolution Hexagon (KH-9) panoramic images (1971–1986) were acquired and processed using orthophotogrammetric techniques.

Based on these materials, ArcGIS Pro software was used to integrate hydrological, elevation, and geomorphological layers, identifying zones with a high probability of ancient habitation. As a result, several locations with favorable ecological and strategic conditions for human activity were delineated and examined through archaeological surface surveys. This approach led to the discovery of new sites, significantly expanding the known scope of ancient occupation in the Upper Sangzor region.

Conclusion

Research conducted in the Upper Sangzor oasis demonstrates that this region has been an important center of human activity since antiquity. Surface observations identified a total of 28 archaeological sites, of which 10 were cemeteries. From each site, 1–2 ceramic

samples were collected, providing evidence of continuous habitation in the valley from the Iron Age to the Medieval period.

Among the traces of ancient economic activity, the remains of cultivated fields (0.5–1 ha), irrigation channels (100 m to 3 km long), and spring-fed water installations on mountain slopes were recorded. These findings indicate that the inhabitants of the Upper Sangzor developed mountain-adapted irrigation methods. Meanwhile, the extensive pastures confirm that pastoralism formed the backbone of the local economy.

The cemeteries located on mountain slopes, along with the diversity of burial types (stone cists, simple earth graves, etc.), suggest a variety of religious beliefs and funerary customs. Although their precise chronology will require future excavation and radiocarbon dating, existing data already reveal strong cultural links between the oasis and other regions of Ustrushona.

The scientific significance of this research lies in the fact that the archaeology of the Upper Sangzor provides crucial insights into the development of mountain regions in Central Asian history, the interaction between pastoralism and agriculture, and the economic and cultural relationships between local populations and neighboring territories.

Future research prospects include conducting systematic excavations, establishing precise chronologies through radiocarbon (^{14}C) analysis, studying anthropological and archaeobotanical materials, and reconstructing the spatial organization of sites using GIS technologies. These steps will not only enhance the understanding of the Upper Sangzor but will also contribute to forming new scientific perspectives on the archaeology of Ustrushona and Central Asia as a whole.

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JURISPRUDENCE

EFFECTIVE SUPPORT OF IP POLICIES FOR PROMOTING INNOVATIVE DEVELOPMENT

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<https://doi.org/10.5281/zenodo.17492579>

Abstract

The article examines the role of intellectual property rights in the process of innovative development of the economy in modern world. Based on the report of the World Intellectual Property Organization on global innovation index, main trends in the economic development of states are analysed, and the role of innovations in this process are put in the centre of attention. The importance of commercialization of innovations is emphasized. The role of protection of intellectual property rights at different stages of innovation activity is also considered, and the main areas in which innovative development is directly related to ensuring these rights are identified. The article examines the experience of Azerbaijan from the point of view of the abovementioned processes and identifies areas that are most important for the development of the country's innovative economy, according to the author.

Keywords: innovative development, intellectual property rights, commercialization, productivity.

1. GLOBAL INNOVATION INDEX 2022

Every year, the World Intellectual Property Organization publishes a report on the Global Innovation Index, which shows the level of innovation development in approximately 132 countries. The main theme of the report, the latest version of which, at the time of writing this article, was published at the end of 2022, is dedicated to innovation-led development. At the same time, the report seeks answers to pressing questions related to the process of innovative development and highlights existing problems.

One of the most important questions is whether the two main directions of modern innovative development, which means "Digital age wave" and "Deep science wave", can lead to a global economic revival and increased productivity around the world.¹³

Here, arises the question of how can innovative development and productivity growth give new impetus to global economic progress? It is worth noting that innovative development should be understood not only as the production of an innovative product, but also as the condition for development of a system of factors necessary to create innovative potential. Development of society based on economy of knowledge is conditioned with the creation of favorable innovative climate, due to innovation is a key form of transformation of knowledge to a tangible product. Innovative development should be understood not only as the production of an innovative product, but also as the development of a system of factors and conditions necessary to create innovative potential transforming all spheres of the economy and social system on the basis of scientific and technical achievements. In other words, such development involves the implementation of major na-

tional, regional, sectoral, and corporate innovation programs and projects, which together embody an innovative culture in society as a whole.

In its report, WIPO analyzes various important factors for innovation development. For example, what problems do different countries face along the way?

This article analyzes the role of effective protection and enforcement of intellectual property rights in the process of forming a knowledge-based economy. The question is how the state can develop intellectual property rights so that they become a catalyst for innovative development. The article, summarizing these processes, further develops these ideas on the specific example of Azerbaijan, deducing positive trends, shortcomings and development prospects in the country in this direction.

2. INNOVATIVE DEVELOPMENT AND IP

Intellectual property has a direct impact on the process of effective management of innovative production. Stronger IPR regimes and growing numbers of registered property rights for knowledge goods have catalytic functions by fostering creative and innovative activities of enterprises and individuals in the economy with economic incentives.¹⁴ We can say that a competent strategy, combined with a policy of reliable protection and enforcement of intellectual property, becomes one of the key success factors. For this reason, the management of this area goes beyond just economic and technological processes, which is reflected in the massive creation of departments at enterprises for working with intellectual property at enterprises. IP captures and secures the competitive advantage conferred by innovation. This translates into enormous value for which IP is the custodian.¹⁵

¹³ Soumitra Dutta, Bruno Lanvin, Lorena Rivera León, Sacha Wunsch-Vincent, *Global Innovation Index 2022 What is the future of innovation-driven growth?* (15th Edition, First published 2022, WIPO, 2022)

¹⁴ Andreas Bielig, *Intellectual property and economic development in Germany: empirical evidence for 1999–2009* (First edition Eur J Law Econ 2015) 609

¹⁵ Abbott Frederick M. *International intellectual property in an integrated world economy* (Fourth edition, 2019) 182

The most important factor in creating innovations are the conditions for attracting investments into the country and theseir investments' effective regulation. In this regard, the Chairman of the Intellectual Property Agency of the Republic of Azerbaijan, Kamran Imanov, believes that "...industrial property (patents and trademarks), being an integral part of intellectual property, is not an abstract, self-sustaining instrument. The main purpose of intellectual property is to attract investment and implement innovation."¹⁶ The function of intellectual property in this aspect is that rights to intellectual property play an important role in the process of bringing innovations to markets, i.e. in their commercialization.

Intellectual property law determines the framing of an innovative invention within a legal framework and ensures its transition to the market as a product without the threat to the author being subjected to unpunished violation of the rights to the results of his intellectual activity.

In general, to improve global innovative development, society and the business world should be more aware of the importance of intellectual property. It is especially important for states to pay increased attention to the development of the education sector and informing society about the importance of intellectual property rights as a factor necessary for achieving long-term income at the individual, micro and macro levels of the economy. An example confirming the above can be the experience of the European Union. Innovative development of the EU is carried out in the form of real assets of industrial property objects - trademarks and patents for inventions. Firstly, being one of the world centers in the number of applications received, the EU makes a significant contribution to the formation of the global trend of increasing demand for protection in the field of high- and medium-tech goods, being a significant subject of the global trademark market. Secondly, the largest number of trademarks registered by the EU Patent Office in the year under study were classified as 5th and 9th classes of the Nice Classification.¹⁷ The main objects of application of the trademark in these classes (apparatus and instruments for scientific or research purposes, information technology equipment, pharmaceuticals and other drugs for medical needs) directly reflect the success of the implementation of the EU innovation policy. The high potential for scientific and technical cooperation between the EU and third countries can be assessed as a strong point of innovative development. The high demand for patent protection among the member countries of the union is due to the large share of regional trade and close inter-dependence of economies. The high level of development of national IP institutions is positive impact on the scale of use of the EU patent system and acts as a central factor in deepening innovative interaction within the EU.

IP also provides a competitive advantage for innovations. A study published by the United States government estimated that in 2019, IP-intensive industries accounted for nearly 41% of U.S. GDP and directly accounted for 33% of all U.S. employment.¹⁸ The recognition of this value derived from IP also explains the growing demand for IP rights worldwide. However, the thesis that an effective legal regime for the protection of intellectual property is a key factor in the development of an innovative economy is also relative. The fact is that this postulate is not valid for all countries. For example, in the issue of technology transfer between countries, with higher incomes and technological capabilities, intellectual property rights become an important factor in this regard, although they are only one of the variables that affect ITT.

3. PROTECTION OF IP RIGHTS IN AZERBAIJAN

Speaking of the legal framework for the protection of IP rights in Azerbaijan, we can say that the nation has quite comprehensive laws in this field, which cover all categories of intellectual property. On February 2, 2021, the "Azerbaijan 2030: National Priorities for Socio-Economic Development" program was approved by the president. The program includes the following goals:

- Development of the business environment
- Promotion of investments
- Development of the non-oil sector
- Focus on innovations development
- A modern educational system and an environment that enables and encourages innovation.¹⁹

Many of these goals have, as a condition for development of economy, an effective system of IP enforcement. Thus, today Azerbaijan is led by a new model of development, which is oriented to the future and meets the challenges of the modern world. This economic model takes into account the development of the business environment, promotion of investments, focus on innovations, and a social orientation. Today, the Azerbaijani economy is entering the path of innovation development, is developing its non-oil sector, is successfully implementing diversification, and is promoting the brand "Made in Azerbaijan." The intellectual property system is one of the factors that has a real effect on the innovation process in Azerbaijan. It creates the legal foundations of the innovative ecosystem.

First, it is worth looking at the legal and institutional framework of IP protection in Azerbaijan. In Azerbaijan there is a comprehensive system of institutional (the Agency of Intellectual Property, established in 2018, plays the role of a single, specialized body in IP) and legislative protection of IP rights. Laws on the different aspects of intellectual property protection can be split in the Azerbaijani legal system into two groups: 1) laws that provide direct protection of IP and 2) laws

¹⁶ Imanov Kamran *Innovative development and intellectual property*. (First edition 2022, Intellectual Property Agency of the Republic of Azerbaijan, Baku) 56

¹⁷ WIPO IP Statistics Data Center < <https://www3.wipo.int/ipstats/key-search/indicator?tab=patent> > last access 23 September 2024

¹⁸ Andrew A. Toole, Richard D. Miller, Nicholas Rada, *Intellectual property and the U.S. economy: Third edition* < [uspto-ip-us-economy-third-edition](https://www.uspto.gov/ip/us-economy-third-edition) > last access 23 September 2024

¹⁹ "Azerbaijan 2030: National Priorities for Socio-Economic Development" Order of the President of the Republic of Azerbaijan 2021

that provide additional IP protection. Below is the list of IP laws in Azerbaijan:

3.1. Direct Protection of IP

3.1.1. Protection of Traditional IP

- Law on Copyrights and Related Rights
- Law on Protection of IP Rights and to Fighting Piracy

- Law on Patents
- Law on Trademarks and Geographical Indication

- Law on Selecting Achievements

3.1.2. Protection of Non-Traditional IP

- Data Protection Law
- Law on Protection of Folklore Samples
- Law on Protection of Integrated Circuit and Topologies

3.1.3. Additional Protection of IP

- Law on Unfair Competition
- Law on Commercial Secret

Regarding an institutional framework of IP protection, there is the Agency of Intellectual Property of Azerbaijan as mentioned, above. The Agency is the central executive authority in the area of IP rights. It implements state policy in the field of copyright, related rights, intellectual property rights to samples of Azerbaijani folklore, integrated scheme topologies, and databases. It also ensures normative regulation, development of the field of intellectual property, and coordinates activities in this area. The Agency also includes the Patent and Trademark Expertise Center.

4. GLOBAL INNOVATION INDEX 2023 - AZERBAIJAN

To understand the state of innovative development in Azerbaijan and to assess the impact of intellectual property rights on this process, let us turn to some indicators for Azerbaijan indicated in the WIPO report on the Global Innovation Index 2023. Azerbaijan performs worse in innovation outputs than innovation inputs in the 2023 GII Report. For 2023, Azerbaijan ranked 76th in innovation inputs, which is higher than a year before. Moreover, Azerbaijan ranks 104th in innovation outputs and this position is also higher in comparison with the previous year. (GII report 2023). According to GII 2023:

- "Relative to GDP, Azerbaijan's innovative performance is below expectations for its level of development."
- "Azerbaijan produces less innovation outputs relative to its level of innovation investments."
- "Azerbaijan ranks highest in Institutions (42nd), Business sophistication (64th), Market sophistication (85th) and Human capital and research (87th).
- Also noteworthy is the fact that "Azerbaijan ranks lowest in Knowledge and Technology outputs (114th), Creative outputs (100th) and Infrastructure (95th)."²⁰

Thus, it follows from the analysis of certain statistical data that there is a certain gap between innovative

results and innovative opportunities in Azerbaijan. Research, conducted with data gathered from around the world, shows that there is a positive relationship between a nation's level of creativity and use of intellectual property on the one hand and the country's economy on the other; for example, around the world there is a correlation (dependence) between the number of claims to register inventions and level of GDP. The problem in Azerbaijan is that such a correlation is still not noticeable. This is because the level of commercialization of innovations is extremely weak. Patents that provide protection of inventions are in a dormant state and mainly just increase the reputation of the inventor. In addition, we observe a decrease in the number of valid patents, which indicates a weak interest by inventors in patent validity and a weak market demand for existing patents. This harms the incentive factor of innovation development due to the lack of commercialization of industrial property objects.

5. THE ROLE OF THE PATENT ACTIVITY FACTOR IN COMMERCIALIZATION

Since the commercialization of intellectual property rights occurs mainly in the field of innovation and scientific and technological development, it is important to study the role of innovation development's patent activity factor in commercialization, in this case using Azerbaijan as an example.

First, we observe a decrease in the number of valid patents, which indicates a weak interest of inventors in patent validity and a weak market demand for existing patents; this harms the incentive factor of innovation development due to the lack of commercialization of industrial property objects. This can be the result of two conditions. The first one is that there is weak interest of inventors in patent validity, while the second one is weak market demand for existing patents. We have tried to find what could be the reason for these processes. Searching for the answer to this question brings us back to the issue of weak commercialization. The issue is that weak commercialization of industrial property objects also harms the incentive factor in turn. The adoption of a law protecting the rights of inventors along with the law on patents is one way out of this situation. Passing a law that protects the rights of inventors can have a number of positive effects. Firstly, it can encourage innovation. Protecting intellectual property rights can encourage inventors and companies to innovate because they can be confident that their intellectual property will be protected and will not be misused by others. Secondly, such law eventually can cause economic growth, because innovation can lead to the creation of new goods, services, and jobs. Relatedly, protecting inventors' rights can help companies become more competitive in the marketplace because they can protect their innovations from being copied by competitors. Thirdly, it can support the innovation ecosystem. Protecting the rights of inventors can develop the innovation ecosystem, which includes universities, research

²⁰ Azerbaijan ranking in the Global Innovation Index 2023 < chrome-extension://efaidnbmnnnibpcajpcglclefind-mkaj/https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023/az.pdf > accesed 23 September 2024

institutes, and start-ups because these entities can be confident that their research and development will be protected. Finally, it can attract investments to the country because investors can be confident that their intellectual property will be protected. However, it should be noted that the protection of inventors' rights must be balanced with public interests, such as access to knowledge and innovation, so as not to create obstacles to development.

6. ROLE OF IP IN INVESTMENT ATTRACTIVENESS

Intellectual property protection plays an important role in stimulating investment. When companies and individual inventors are confident that their intellectual property will be protected, they are more willing to invest in research, development, and innovation. Here are some ways IP protection can impact investment by increasing investors and companies' confidence that their investments in innovation will be protected from illegal use by competitors. Effective IP protection can foster innovation due to how when companies know that their intellectual property will be protected they tend to invest more in research and development of new products and technologies. Attracting capital is another positive result, as countries with well-developed IP protection systems may be more attractive to investors looking for places to invest in innovative projects. Moreover, competitiveness is increased due to how companies with protected intellectual property can be more competitive in the marketplace, which can lead to increased investment in those companies.

Overall, intellectual property protection helps create an enabling environment for investment in innovation, which promotes economic growth and development. In Azerbaijan support by legal acts regarding intellectual property to increase investment to areas of innovations is developed by legislation. However, enforcement mechanisms of these laws have certain gaps and flaws. Specifically, in the patent registration process there is established procedure that determines how a given company or inventor hires a patent attorney who will review his/her application and approve its patentability. The problem with this is that there are very limited number of patent attorneys in the country, and they are overloaded with incoming applications. At the moment, there are only 12 patent attorneys in the country who are appointed to this position by the Intellectual Property Agency. Given that these same attorneys review applications related to the registration of trademarks, too, the volume of their work is very large, and for this reason the consideration of applications can be delayed for a long time. This leads to the problem where foreign companies that want to register their patents in the country are faced with a very long procedure for reviewing their applications, registration, etc. This, in turn, sometimes causes companies simply to refuse to register their inventions in the country and selling its patented goods there. One way out of this situation is increasing the number of patent attorneys from

the state and enforcing examination-based admission to the position of patent attorney.

A second very important condition of IP protection in a given country are effective judicial mechanisms providing this protection. Effective judicial protection of IP rights in case of infringement is a condition for attracting investors to the field of innovation and creating an effective system for protecting their intellectual rights in the courts. Despite improvements in the judicial system for protecting intellectual property rights in Azerbaijan, there are some challenges and problems such as the length of the dispute resolution process and the need for further improvement of legislation and judicial practice. For this, it is necessary to conduct trainings and refresher courses in IP law for judges and to prospect for and establish specialized IP courts. "Specialized IPR courts often make quicker and more effective decisions. Because judges in specialized courts are generally encouraged to have specialized knowledge, they are able to understand the procedures and technicalities associated with IPR cases."²¹

7. UNIVERSITIES AND INDUSTRY – CORRELATION

The next important point in terms of commercializing the results of intellectual activity and their positive impact on economic growth is the connecting of universities, scientific institutes, and research centers with industry. Commercialization of technologies is a two-way street between universities and industry.

In Azerbaijan, despite the universities having good scientific results, there is a lack of patenting activity and a lack of technology commercialization.

Generally, universities play an important role in the development of innovation and intellectual property. Universities can facilitate this process by promoting research and development due to their being centers of scientific research and their conducting research in various fields including science, technology, engineering, and mathematics (STEM). This research may lead to the creation of new technologies, products, and services that may be protected by patents and other forms of intellectual property protection. Moreover, universities can facilitate technology transfer from academia to industry through commercialization and licensing processes. These processes allow innovations created in universities to be transformed into commercially successful products and services. Universities also can train students and researchers in entrepreneurship and commercialization skills, which would facilitate the creation of new start-ups and innovative companies, as well as facilitate collaboration with industrial partners to conduct joint research and development, which in turn would facilitate the exchange of knowledge and experience between universities and business. Finally, universities can play an important role in supporting regional development through innovation, helping to create new jobs, and improving quality of life. Thus, universities play a key role in the creation and

²¹ Rohazar Wati Zuallocobley, *Study on Specialized Intellectual Property Courts, International Intellectual Property In-*

stitute, 25 January 2012 <https://www.yumpu.com/en/document/read/29991735/assoc-prof-rohazar-wati-zuallocobley-international-intellectual> last accessed 23 September 2024

commercialization of innovations, which contributes to the development of the economy and society as a whole.

Azerbaijani universities have a high level of scientific activity and results. However, there is a lack of patent activity and a low level of commercialization of innovations. An important factor for the development of an innovative economy is the process of introducing innovations into markets. Unfortunately, the practice of applying intellectual property rights as tool for protecting the rights of inventors and the commercialization of technology are poorly developed in Azerbaijani universities. That said, the country has sufficiently rich scientific and educational potential.

8. WHAT IS DONE AND WHAT ARE THE SUGGESTIONS FOR FUTURE IN THIS REGARD?

First, we would like to draw attention to the achievements in this area that increase the development of innovative potential in universities.

- Universities and scientific research institutes have become public legal entities.

In doing so, universities can act as intellectual property owners.

- The Commercialization and Transfer of Technology Center under the supervision of Intellectual Property Agency of the Republic of Azerbaijan was established. (2022)

The Center's main aim is commercialization of research results in institutions and universities and the establishment of a connection between science and industry.

- Technology and Innovation support centers have been established under the supervision of Intellectual Property Agency of the Republic of Azerbaijan.

These centers' aim is to provide patent information to participants of the innovation process and, by this, increase innovation potential.

9. SUGGESTIONS FOR DEVELOPMENT OF IP COMMERCIALIZATION

In conclusion, we would like to emphasize, using Azerbaijan as an example, measures that could create significant prerequisites for the development of commercialization of the results of intellectual activity and innovative potential in a given country. Below are some important points, for Azerbaijan in particular, that may raise the scientific activity at the university level and stimulate the commercialization process for innovative results in universities and research institutes:

- Formation of universities and scientific-research institutes' official legal position on IP issues (IP policy)

- Establishment of rules for distribution of income gained by commercialization

- Giving preference to those intellectual property results which have commercial potential

- Increasing IP literacy, culture, education, and business skills

- Implementation of measures related to the availability, openness, and attractiveness of research to venture capital owners and potential investors of private capital

- Developing technology transfer between universities and industries by establishing clear IP policies

All these factors, if implemented correctly, can serve to ensure that knowledge eventually leaves the walls of universities and becomes an object of trade, thereby contributing to the development of the overall economic growth of the country.

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MEDICAL SCIENCES

DIGITAL TECHNOLOGIES IN PROSTHODONTICS

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Abstract

The development of new materials and additive technologies represents a cutting-edge scientific direction in dentistry. The demand for these technologies is driven by the high quality of dental prostheses and restorations, including: aesthetic appeal, precise control over thickness and spatial dimensions, and geometric accuracy of critical design and technological elements of the prosthetic structure.

Additive digital technologies reduce material consumption, decrease the need for personnel, and significantly shorten the time required to transfer information from the patient to the dental technician, as well as the overall fabrication time of prostheses.

Dentists need to be aware of the full range of possibilities offered by digital technologies to provide a personalized approach to each clinical situation. Timely training of specialists fully proficient in digital workflows is a key condition for ensuring high-quality prosthodontic care.

Keywords: additive digital systems and technologies; prosthodontics.

Rapid Development of Digital Technologies in Dentistry

The global dental industry is advancing at a pace far exceeding other areas of medicine. A major breakthrough in dentistry has been driven by digital technologies, which are now widely used at all stages of prosthodontic treatment. Among these, CAD/CAM systems (Computer Aided Design / Computer Aided Manufacturing) are the most prevalent [1–6].

Thanks to the rapid development of computer technologies, new opportunities for applying automated systems in dentistry emerge every year. Today, almost all leading global manufacturers of dental equipment offer their own CAD/CAM systems [7–10].

The use of dental CAD/CAM systems is not limited to the fabrication of prostheses. Several CAD/CAM systems have been developed for surgical applications. For example:

- **SURGI GUIDE (MATERIALISE, Belgium)** is used to produce individual surgical templates that facilitate accurate placement of dental implants during surgery.
- **NOBELGUIDESOFTWARE (NOBELBIOCARE, Sweden)** enables the fabrication of a restoration immediately after implant placement.

Both systems utilize data from computed tomography (CT), specialized CAD software to determine optimal restoration placement, and CAM technologies for manufacturing templates or working models [11–14].

Open vs. Closed CAD/CAM Systems

CAD/CAM systems are categorized as open or closed. An open system allows replacement of any of its modules with a compatible module from another manufacturer, and integration with other systems is relatively seamless. Openness can be considered at various levels of the software and hardware hierarchy of the system or its components. In some cases, system openness refers to compliance with modern industry standards, enabling integration with other open systems.

CAD/CAM systems can also be classified according to the method of optical scanning into clinical (intraoral) systems and dental laboratory systems. In clinical systems, intraoral scanning is performed directly in the patient's mouth, and the data is transmitted as a digital file. In dental laboratory systems, scanning is performed on gypsum models [15].

Subtractive vs. Additive Methods

CAD/CAM technologies are divided based on the manufacturing method into:

1. Subtractive methods – involve material removal processes such as milling and grinding to achieve the desired prosthetic shape. This method is called the subtractive method because the material is “taken away” (English: subtractive).

2. Additive methods – involve material addition processes, including stereolithography, 3D printing, selective laser sintering, and direct injection printing [16]. These methods are alternatives to subtractive techniques and are referred to as additive methods (English: additive).

Additive manufacturing, also known as 3D printing or fabber technologies, is sometimes called rapid prototyping (RP). It is based on converting CAD models into solid physical objects using specialized digital fabrication devices called fabbers.

Currently, 3D printing is especially effective for creating metallic components of removable prostheses [17]. It is also suitable for producing larger or more complex structures such as facial prostheses or skeletal models, which are difficult to fabricate using traditional CAD/CAM methods that are better suited for smaller components. Additive manufacturing allows the use of materials with varying properties and consistencies [18].

In Russia, there is no unified classification of additive technologies. Methods are typically categorized based on materials used, the presence or absence of a laser, layer formation techniques, energy delivery, etc.

Two main additive manufacturing technologies are used:

Laser-based technologies:

- Laser polymerization – a UV laser gradually hardens a liquid photopolymer, either directly or through a photomask, layer by layer, forming a durable plastic object.
- Laser sintering – a laser selectively fuses powder (e.g., from light-alloy plastics) layer by layer to form the contour of the desired part.

Inkjet-based (jetting) technologies will likely follow in the next section.

Additive Manufacturing: Jetting Technologies and Laser History in Dentistry

Laminating (Laser-Based Additive Method)

- The part is built from multiple layers of material, which are gradually stacked and fused together. A laser traces the contour of each cross-section of the future object. After processing, excess powder is removed from the finished part.

Jetting (Inkjet-Based) Technologies:

1. Material solidification upon cooling – a dispensing head deposits droplets of heated thermoplastic onto a cooled base platform. The droplets quickly solidify and bond together, forming layers of the object.
2. Powder bonding or sintering – similar to laser sintering, but here the powder is bonded with a liquid adhesive from a jetting head. This method can also reproduce colors by using binders of different shades [19].

History of Lasers in Dentistry:

- The first laser was invented in 1960 by Theodore Maiman, using a ruby crystal to produce an intense red light, with no medical application initially.
- In 1964, Goldman proposed using lasers in dentistry, specifically for caries treatment. For safety in the oral cavity, pulsed lasers were later introduced. With growing experience, the anesthetic effect of lasers was discovered.
- In 1968, CO₂ lasers were first used for soft tissue surgery.

Modern dental lasers are increasingly used in endodontics, periodontology, surgery, orthodontics, and implantology, gradually replacing scalpels, electrosurgical tools, and some medicinal approaches due to their

high clinical efficacy and ease of use. Lasers allow for minimally invasive, virtually painless procedures that meet high clinical standards.

Fused Deposition Modeling (FDM) and 3D Printing:

- FDM, invented by S. Scott Crump and patented in 1988, creates 3D forms by extruding heated thermoplastic layer by layer, without using a laser.

- In 2000, PolyJet photopolymer jetting technology was developed, where a printer head deposits photopolymer layers that are cured with UV light.

- The term “3D printing” was coined in 1995 by Jim Brecht and Tim Anderson, who modified a flatbed inkjet printer to produce three-dimensional objects instead of images on paper [20].

- One of the rapid prototyping methods used in dentistry is laser stereolithography (SLA). The term “stereolithography” was introduced in 1986 by Charles W. Hull, who patented the method and device for producing solid physical objects by sequentially layering a photopolymer material. The method is based on the photo-initiated polymerization of a light-sensitive photopolymer composition (PPC) using laser radiation.

- Using this technology, a computer-designed 3D object is synthesized from liquid PPC in consecutive thin layers (0.05–0.2 mm) formed by laser exposure on a movable platform [21, 22]. Typically, the processor for generating horizontal cross-sections first converts the 3D model description in STL format into a series of layer cross-sections with the required layer thickness. This array is saved in an SLI file, which contains 2D vector data to sequentially control the laser beam orientation via mirrors, laser activation commands, platform movement, and other operations [23–25].

- Next, the laser is activated to cure the polymer in areas corresponding to the object walls. After this, the platform is lowered by the thickness of one layer. At this stage, a special brush wets any areas that might remain dry due to surface tension. Upon completion of the object’s construction, it is immersed in a bath with special solutions to remove excess material and clean the part. Finally, it undergoes intense UV exposure for complete curing. Like many other 3D prototyping methods, SLA requires support structures, which must be manually removed after fabrication [26].

- The 3D printing process saves considerable costs and significantly improves the quality of surgical procedures, such as dental implantation. In addition to producing prostheses, crowns, and bridges, 3D printing allows for the fabrication of orthodontic aligners. Teeth are scanned, a 3D model is created based on the scan, and the aligners are subsequently printed [27, 28].

- Laser stereolithography enables rapid transition—from a design or engineering idea to a finished model—in just a few hours to a few days. Selective laser sintering (SLS) is another technology used to manufacture ceramic or metal dental restorations. Examples include the Medifactory system (BegoMedical AG, Germany) and DigiDent (Hint-ELs, Germany). In this method, the computer calculates the tool path, similar to other CAD/CAM systems, but instead of milling, the laser sintering fuses the material layer by layer.

риала, двигаясь по заданной траектории внутри ем-кости, заполняемой послойно керамическим или ме-таллическим порошком. Каждый последующий слой спаивается с предыдущим [31]. В стоматологии сте-реолитография нашла своё применение в ортопедии, ортодонтии, имплантологии и челюстно-лицевой хи-рургии [30–35]. Таким образом, цифровые технологии в настоящее время развиваются и совершенствуются, обеспечи-вая врачей-стоматологов новыми более эффективными возможностями для лечения пациентов. Востребован-ность технологий обусловлена высоким каче-ством из-готовления зубных протезов и реставра-ций: эстетич-ностью, полным контролем толщины и пространства, геометрической точностью разме-ров ответственных конструкторско-технологиче-ских элементов и формы изделия. Кроме того, ад-дитивные цифровые технологии снижают расход материалов, уменьшают количество не-обходимого персонала и существенно сокращают сроки пере-дачи информации от пациента зубному технику и сроки изготовления протезов. Сохранение данных в цифровом формате позволяет повторно воспроиз-вести протез в случае поломки. Разработка новых материалов и аддитивных технологий является но-вым научным на-правлением в стоматологии. Врачи-стоматологи долж-ны быть осведомлены о спектре возможностей, предо-ставляемых цифро-выми технологиями. Своевременная подготовка специалистов, в полной мере владеющих цифро-выми технологиями, программным обеспечени-ем, является важным условием обеспечения качества стоматологической помощи

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A COMPARATIVE ANALYSIS OF COVID-19 METHODOLOGICAL RECOMMENDATIONS IN KYRGYZSTAN AND INDIA

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Abstract

The COVID-19 pandemic presented a biological threat but was a diverse spectrum of national responses. This review analyzes and contrasts the methodological recommendations implemented by the Kyrgyzstan Republic and the Republic of India. These differences underscore a critical lesson for future pandemics clinical and public health guidelines are not monolithic. Their work is very linked to their adaptation to the unique epidemiological, socio-economic, and infrastructural context of a nation. As we know that this was a major global issue.

Keywords: COVID-19; Kyrgyzstan; India; public health response; pandemic management; diagnostic approaches; clinical management protocols; containment strategies; vaccination policy.

INTRODUCTION

The emergence of SARS-CoV-2 in late 2019 triggered a global health outflow unparalleled in modern history. As the pandemic wave crashed across the globe, it was refracted through the unique prism of each nation's healthcare system, socio-political landscape, and resource capacity. The Kyrgyzstan Republic, a landlocked, mountainous nation of under 7 million people, operates with a more centralized health system. Although, this very disparity makes the comparison more sensational. Both nations faced the same viral antagonist. how to diagnose the infected, treat the sick, and protect the healthy people of both the country. As we know both the countries do not share that much similar things.

METHODS

A proper research was conducted by both of the government and found the loopholes which lead to the massive and uncontrolled outbreak of the disease. Kyrgyzstan vaccination strategy were also implemented. The collected information was then organized and compared across three core thematic pillars:

1. **Diagnostic Approaches include the** Examining the evolution of testing policies, from the type of tests utilized (RT - PCR vs. Rapid Antigen Tests) to the criteria for testing individuals.

2. **Clinical Management Protocols include the** Analyzing the therapeutic guidelines for hospitalized patients, including the recommended use of antivirals, oxygen therapy, and supportive care.

3. **Public Health and Containment Strategies like** large-scale interventions, such as lockdowns, and national vaccination campaigns were conducted.

RESULT

The result of both the countries were not satisfactory at the starting of the outbreak but by the time of second outbreak both the countries got an idea of management.

India's diagnostic strategy was very big and massive. Kyrgyzstan's approach was, by necessity, more small and centralized. Kyrgyzstan did not have that

much production of RTPCR test kit which was the gold standard treatment for Covid-19.

ICMR released numerous ways of their clinical management protocol. The guidelines treated patients into mild, moderate, and severe categories, with clear treatment pathways for each of them. The protocols were highly efficient, they initially included drugs like Hydroxychloroquine on preliminary data but later explicitly advised against their use as stronger evidence emerged. The second wave, driven by the Delta variant, forced a critical focus on the proning protocol, rational use of oxygen, and the urgent inclusion of anticoagulants and high-dose corticosteroids.

DISCUSSION

Kyrgyzstan's response was a model of a country which fought against the pandemic. Their strategy reflected a clear-eyed assessment of limitations, leading to a focus on proven, high-impact interventions. By seeing closely with WHO guidelines, the Ministry of Health avoided costly and potentially ineffective therapeutic away. The union on international aid was a necessity, but it also highlights the critical role in enabling smaller nations to mount an effective defense against a shared threat.

CONCLUSION

The COVID-19 pandemic forced every nation to write its own emergency response playbook. A comparison of Kyrgyzstan and India is a study in this forced innovation. India deployed a strategy of overwhelming scale, leveraging its immense domestic capacity and digital infrastructure. Kyrgyzstan executed a focused, resource-conscious strategy, prioritizing internationally validated core interventions. Both of the countries fought like they should and bought a more radical solution to their people. It was only possible by the correct actions and decision at the right time.

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DRUG-RESISTANT TUBERCULOSIS: LOCAL AND GLOBAL PERSPECTIVES**Muskan Kumawat***Teacher, Department Of public health, Infectious diseases, International Medical Faculty, Osh State University, Osh, Kyrgyzstan.***Nimmakuri Varun***Medical Student, International Medical Faculty, Osh State University, Osh, Kyrgyzstan.***Deepak Yadav***Head of Department, Department Of public health, Infectious diseases, International Medical Faculty, Osh State University, Osh, Kyrgyzstan.***Mamatkulova Nazgul***Dean, International Medical Faculty, Osh State University, Osh, Kyrgyzstan*<https://doi.org/10.5281/zenodo.17492584>**Abstract**

This research explores about drug-resistant tuberculosis and the impact of TB worldwide. It is a well pronounced cause of death all over the globe, and the death is caused by untreated bacteria that destroys lung tissue. One of the main infectious causes of morbidity and mortality worldwide is s tuberculosis (TB), and the resistant strains of the disease pose a serious risk to public health across the world. Disease control initiatives have been made more difficult by the rise of largescale drug-resistant tuberculosis (XDR) and multidrug resistant tuberculosis (MDR), especially in low and middle-income nations.

The respiratory organs are the primarily affected by tuberculosis (TB), a chronic infectious illness caused by *Mycobacterium tuberculosis* that can also affect the lymph nodes, bones, and meninges. Even though tuberculosis is preventable and treatable, it is still one of the directing diseases in the world, especially in low and middle-income nations. The illness is contracted by inhaling airborne droplets from sick people. Fatigue, night sweats, pyria, weight reduction, and a chronic cough are some of the early signs. Clinical assessment, radiographic results, sputum smear microscopy, culture, and quick molecular testing are used to make the diagnosis. First-line anti-TB medications are given in combination during a six-month period as part of standard treatment. Treatment and control efforts are made more difficult by the advent of drug-resistant strains, such as extensively drug-resistant TB (XDR-TB) and multidrug-resistant TB (MDR-TB), which is a serious public health problem. Improved living circumstances, early diagnosis and treatment of active cases, and the *Bacillus Calmette–Guérin* (BCG) immunization are examples of prevention measures. Through improved monitoring, coordinated public health measures, and research into novel vaccines and treatments, global programs like the WHO's End TB Strategy seek to lower the incidence and death of TB.

Keywords: Airborne droplets, Endemic, Cell-mediated immunity, Lymphadenitis, Reactivation TB, Granuloma, Tubercle, Caseating necrosis, MDR-TB, XDR-TB, prevention, treatment, drug resistance, tuberculosis.

I. INTRODUCTION

Tuberculosis, one of the oldest disease which affect humans, and it is major cause of death worldwide[13]. It is caused by bacteria of *Mycobacterium tuberculosis* complex, and majorly it affect lungs and other area of body like spine, brain and kidneys[6]. If properly treated then it can be curable in virtually all cases and if untreated, the disease may be fatal within 5 years. Transmission take place by airborne. *Mycobacteria* belong to *Mycobacteriaceae* and other *Actinomycetales*. It is rod shaped, no spore forming, thin aerobic measuring by 0.5 micro meter by 3 micro meter. Basically they are neutral on gram's staining[10].

Mycobacterium tuberculosis is the bacterium that causes tuberculosis (TB), a chronic infectious illness[6]. Although pulmonary TB mostly affects the lungs, extrapulmonary TB can also move to the kidneys, spine, lymph nodes, and brain[12]. For ages, tuberculosis has plagued mankind and continues to rank among the world's major infectious agents in terms of fatality rates, even exceeding HIV/AIDS[8]. The World Health Organization (WHO) reports that millions of new cases of tuberculosis are recorded each year, with low- and middle-income nations bearing the brunt of this burden[13].

The illness is extremely infectious, particularly in crowded or poorly ventilated environments, since it is spread by airborne droplets that are emitted when an infected person coughs, sneezes, or talks[12]. After being inhaled, *M. tuberculosis* can lie dormant in the body for years, resulting in latent tuberculosis infection (LTBI)[6]. When the immune system is compromised, this infection can then develop into active illness. In clinical terms, TB manifests as exhaustion, night sweats, fever, chest discomfort, prolonged coughing, and inexplicable weight loss. Despite the availability of efficient diagnostic methods and curative treatments, poverty, malnutrition, limited access to healthcare, and the emergence of extensively drug-resistant (XDR) and multidrug-resistant (MDR) strains of the disease make tuberculosis (TB) a serious public health concern[8].

Bacillus Calmette–Guérin (BCG) vaccine, early identification, efficient treatment, and public health campaigns that break the chain of transmission are the main focuses of global TB control efforts. In order to achieve the WHO's "End TB Strategy," which aims to eradicate tuberculosis as a global health hazard by 2035, more research, public awareness, and international collaboration are necessary[7]. Acid fastness is mainly by high content of mycolic acids, long chains

cross-linked fatty acids and another molecule in cell wall, lipoarabinomannan.

Complete genome sequence has 4043 gens encoding 3993 proteins and 50 genes encoding RNAs.

WHO has reported more than 5 million new cases in 2005[7].

Our educational department are spreading awareness regarding tuberculosis and their consequences of damage in lungs, bones, joints, brain.

II. RESEARCH METHODOLOGY

Data collection methods :

Quantitative data : are from WHO, The European Centre for disease prevention and control (ECDC), The organisation for Economic Co-operation and development (OECD), Global fund.

Search Strategy:

WHO Records pertaining to TB Case Finding, Screening, and Search Recommendations for systematic screening for active TB. Module 2 of the WHO Operational Handbook: Screening: Systematic TBI Screening. Recommendations for augmented TB case-finding and isoniazid prophylactic treatment for individuals with HIV Enhancing active case-finding for TB (WHO, study of the South-East Asia area). WHO unified guidelines for screening for tuberculosis in high-risk groups, which include using instruments like chest examinations. **Geographical distribution :**

Globally, tuberculosis (TB) continues to rank among the most common infectious causes of illness and mortality. The World Health Organization's (WHO) 2024 Global Tuberculosis Report estimates that 10.6 million people contracted TB in 2023, that 1.3 million of those who were HIV-negative died from the disease, and that 167,000 of those who were HIV-positive died. The illness still poses a major hazard to public health, especially in poorer nations, despite tremendous advancements in its control during the last few decades.

Although TB is present everywhere in the world, its prevalence is not uniformly distributed. The six areas that make up the worldwide TB burden are Africa, Americas, the Eastern Mediterranean, Europe, South-East Asia, and the Western Pacific, according to the World Health Organization (WHO).

The WHO South-East Asia Region has the greatest number of TB cases (about 45% of the global total), with India alone responsible for around 28% of it. The Western Pacific Region contributes about

18%, with China and the Philippines being major contributors; the Americas, Eastern Mediterranean, and European regions together account for the remaining proportion; and the African Region bears about 23% of cases, primarily due to high rates of HIV co-infection and limited healthcare resources. The WHO's End TB Strategy objectives, which call for a 90% decrease in TB incidence and a 95% reduction in fatalities by 2035 compared to 2015 levels, cannot be met at the current rate of decline in the worldwide incidence rate of TB, which has been decreasing gently—by around 1.5–2% annually. A resurgence in incidence and death occurred between 2020 and 2022 as a result of the COVID-19 pandemic's severe disruption of TB control efforts,

which decreased case discovery and postponed treatment commencement in many countries.

An increasing problem is the rise of extensively drug-resistant TB (XDR-TB) and multidrug-resistant TB (MDR-TB). Globally, there were around 410,000 new MDR/RR-TB cases reported in 2023.

Countries like India, China, Russia, and Pakistan have the greatest rates of medication resistance. MDR-TB treatment success is still much lower (approximately 60%) than that of drug-susceptible TB (about 85%).

One of the key risk factors for TB is still HIV. Compared to people without HIV, persons living with HIV have a 16–18 times higher risk of developing active TB. The largest proportion of TB/HIV co-infection occurs in Sub-Saharan Africa, where integrated HIV-TB management initiatives are crucial to lowering mortality. All age groups are impacted by tuberculosis, although the most prevalent age group is adults between the ages of 15 and 54, who make up the economically active portion of the population. With around 56% of all TB cases occurring in men, men are more likely than women to be infected, while 11% of cases worldwide occur in children under the age of 15.

TB cases in KYRGYZSTAN

In Kyrgyzstan, one of the 30 nations the World Health Organization (WHO) has designated as having a high burden of multidrug-resistant tuberculosis (MDR-TB), tuberculosis (TB) continues to be a significant public health problem. Despite notable advancements in recent years, tuberculosis remains a major source of illness and mortality nationwide.

Kyrgyzstan reported an expected 6,000 new and relapse TB cases in 2023, which translates to an incidence rate of almost 87 cases per 100,000 people, according to the WHO Global Tuberculosis Report 2024. The estimated TB mortality rate among those living with HIV was around 0.7 per 100,000, whereas the estimated TB mortality rate (without included HIV) was approximately 8 deaths per 100,000 population.

Drug-resistant TB continues to be one of the nation's most significant problems. One of the nations with the highest rates of MDR-TB and rifampicin-resistant TB (RR-TB) is Kyrgyzstan. MDR/RR-TB was expected to account for 56% of previously treated patients and 30% of new TB infections in 2023. Because of this high percentage of resistance, managing tuberculosis has become more difficult, and the necessity for second-line treatment regimens—which are more expensive and linked to more adverse effects—has grown.

Although the frequency of HIV among TB patients in Kyrgyzstan is still low, at about 1% to 2%, co-infection with HIV also adds to the burden of TB. In order to guarantee early detection and combination medication, the nation has made strides in integrating TB and HIV care.

Kyrgyzstan's National Tuberculosis Program (NTP), which is funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria, emphasizes patient-centered treatment, universal drug susceptibility testing, early case identification, and the growth of quick

diagnostic techniques like GeneXpert MTB/RIF. In order to lower TB incidence and death through better treatment results, infection control, and preventative efforts, the government has also embraced the WHO End TB Strategy.

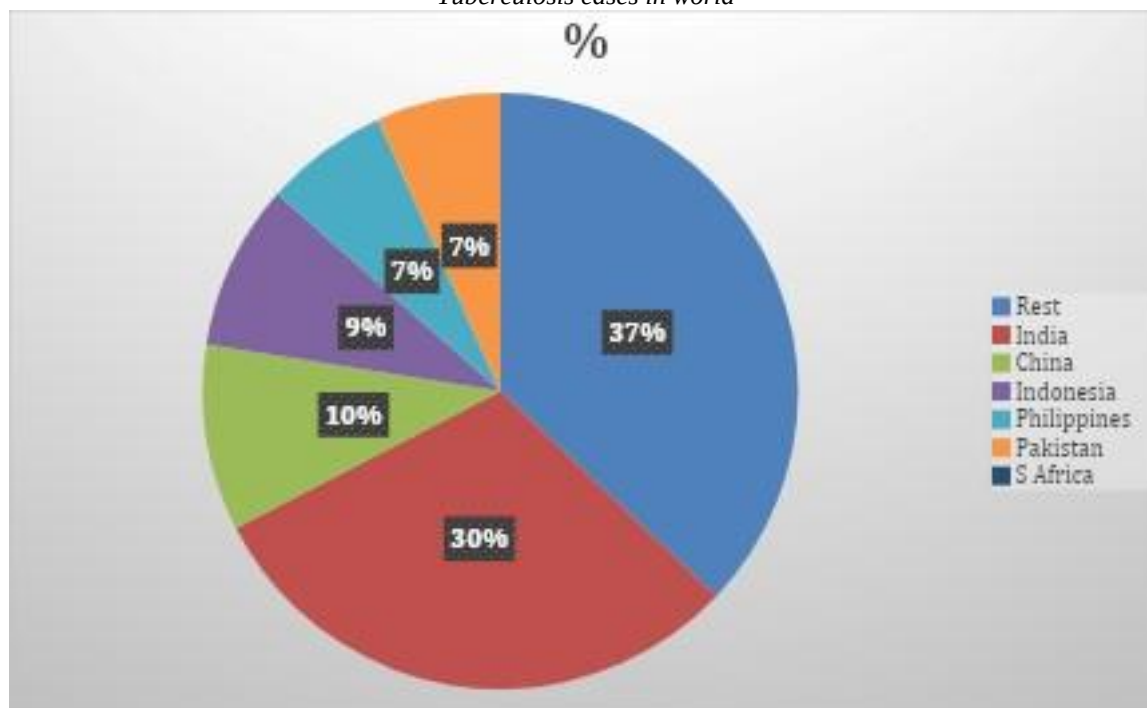
In the survey we conducted personally among the people of Kyrgyzstan of different ages and we found

that highest rate of Tuberculosis in men is at the age 18-35 years

In this pie chart we can see that India suffered more compare to other country.

III. RESULTS AND DISCUSSION

Tuberculosis cases in world



Result of survey

Total number of people in world are affected by Tuberculosis: 1 crore, in India total people are suffering from Tuberculosis : 26.9 lakh. In Kyrgyzstan total people are suffering from Tuberculosis: 4018 in 2022 compared to 2021 it decreased by 3891 and in 2020 it

decreased by 3518. And death are fell from 1.6 million in 2017 to 1.5 million in 2018.

So, according to WHO India has largest number of TB patient in the world and countries which suffer least from TB are New Zealand, Canada, Australia, United States.

Country	Estimated TB cases	%
India	2.8 million	26%
Indonesia	1.1 million	10%
China	734,000	6.8%
Philippines	734,000	6.8%
Pakistan	681,000	6.3%
Nigeria	507,000	4.6%
Bangladesh	379,000	3.5%
Democratic republic of the congo	335,000	3.1%
Myanmar	331,000	3.1%
Vietnam	314,000	2.9%

By this table we conclude that, we found that, WHO Global Tuberculosis Report 2024, India accounted for 26% of all TB cases worldwide in 2023, with an estimated 2.8 million cases.

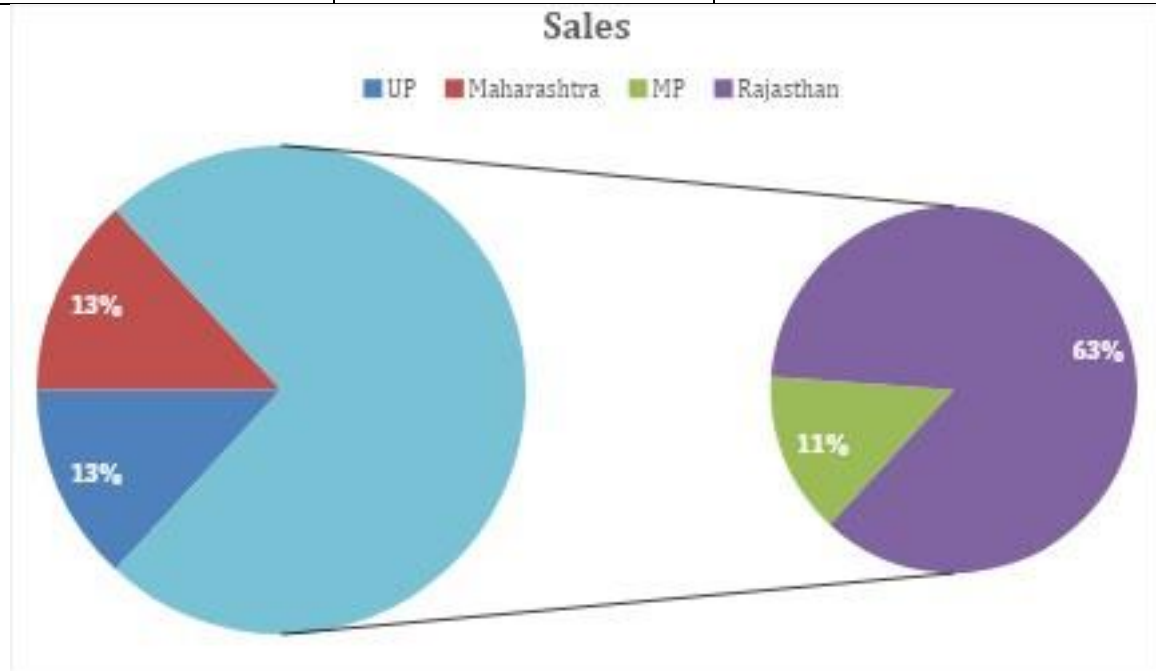
Pakistan (681,000 cases, 6.3%), China (734,000 cases, 6.8%), the Philippines (734,000 cases, 6.8%), and Indonesia (1.1 million cases, 10%) are among the

other high-burden nations. Significant contributions to the global TB burden are also made by African nations including the Democratic Republic of the Congo (335,000 cases) and Nigeria (507,000 cases). Over 70% of all TB cases globally occur in the top 10 nations combined, underscoring the epidemic's regional focus.

Characteristics

Age(years)	Number	Percentage
<14 /14	1,401	17.5
15-29	2,569	32.1
30-44	2,287	28.6
>45/451	1,744	21.8

Sex	Number	Percentage
Male	4,362	54.5
Female	3,639	45.5



State	Number of cases
Uttar Pradesh	6.8 lakh (680,000)
Maharashtra	6.8 lakh (680,000)
Madhya Pradesh	5.5 lakh (550,000)
Rajasthan	5 lakh (500,000)
Bihar	5.1 lakh (510,000)

Uttar Pradesh: the state most impacted in India

Santosh Medical College/Hospital in Ghaziabad (UP) which has maximum number of patient which suffer from TB. According to State level data we found there is 2181 cases per 100,000 population in 2022 .And the treatment rate is increased by 69% in 2017 to 86% in 2022. And in UP there are some district which has more patient compare to others like Agra (which affected more last year there are 30,965 cases) and Lucknow (there are 28,283 cases seen in 2023).

Uttar Pradesh is India's most populous state, home to over 240 million people, or nearly 18% of the country's total population; • Urban centers such as Lucknow, Kanpur, Varanasi, and Allahabad are densely populated, with many people living in cramped housing conditions. Person-to-person transmission is increased by high population density.

Malnutrition and Poverty A sizable portion of the population of Uttar Pradesh is socioeconomically disadvantaged, and poverty breeds malnutrition, which

impairs immunity. In addition to slowing treatment recovery and increasing vulnerability to co-infections like HIV or respiratory infections, malnutrition increases the risk that a person may develop active TB illness from a latent TB infection. Malnutrition slows treatment recovery and increases vulnerability to co-infections such as HIV or respiratory infections. Malnourished people are also more prone to develop from latent TB infection to active TB illness.

Restricted Medical Access approximately 75% of UP's population lives in rural regions with poor access to primary healthcare. There are sometimes no well-equipped TB testing facilities, labs, or qualified medical personnel in many communities. In addition to a lack of knowledge about early TB symptoms, which leads to late presentation, delayed diagnosis lets infected people go longer without treatment, raising the risk of transmission.

Drug-resistant TB prolongs the infectious period and necessitates more extensive, expensive, and time-consuming therapy with poorer success rates.

Occurrence of cases and mortality

The state recorded a 19.0% decline in TB fatalities between 2019 and 2020, with 3,496 fewer deaths. Out of all Indian states, Uttar Pradesh reported the most TB cases in 2023—624,490. Improvements in TB detection and treatment results are seen in the death rate, which has been decreasing despite the large number of notifications.

Uttar Pradesh (UP) had the greatest number of TB cases recorded in 2023, with almost 624,490 cases reported, more than any other Indian state. However, the sources cited do not readily give particular statistics on TB-related death and survival rates in UP.

An estimated 2.8 million new and relapse cases of tuberculosis were recorded in India in 2023, accounting for around 26% of the worldwide TB burden. | In 2022, India's case fatality ratio (CFR) for tuberculosis was at 12.3%. When UP's reported cases are compared to this national CFR, an estimated 77,000 TB-related fatalities are predicted for the state in 2023. According to a research on treatment results, out of 134 TB patients in the rural Jalaun area of Uttar Pradesh, 86.6% were cured or finished their treatment, while 5.2% passed away while receiving it. If comparable treatment success rates are assumed, extrapolating these numbers to UP's 2023 caseload indicates that around 540,000 people may have survived TB.

About 2.51 million (25.1 lakh) of the anticipated 2.7 million (27 lakh) TB cases in India in 2023 were detected and treated.

- The incidence of tuberculosis has decreased from 237 cases per 100,000 people in 2015 to around 195 cases per 100,000 in 2023. This indicates a decrease of around 17.7% throughout that time frame. TB mortality has also decreased. Deaths were around 28 per 100,000 in 2015; by 2023, that number had dropped to about 22 per 100,000.

- Treatment coverage has significantly improved: in 2015, around 72% of projected TB patients were being identified and placed on treatment; by 2023, this had grown to 89%. This represents a decrease of approximately 21.4% over the same time. A significant portion of the worldwide TB burden is caused by India.

It was responsible for around 26% of all TB cases and fatalities worldwide in 2023. Drug-resistant TB is also prevalent in India. According to recent statistics, India has a significant impact on the number of MDR/RR-TB infections worldwide. In 2023, India accounted for over 27% of all MDR/RR-TB cases worldwide.

Some plans are currently running in India;

- 1-Pradhan Mantri TB Mukta Bharat Abhiyaan (PMTBMBA): Is was launch in September 2022
- 2-National TB Elimination programme (NTEP)
- 3-Nikshay Poshan Yojana launched in 2018
- 4-Universal Drug Susceptibility testing – every TB patient is tested for drug resistance
- 5-Nikshay Sampark-it is online platform for tracking and management.

DOTS –

- A worldwide approved tuberculosis control strategy is DOTS (Directly Observed Treatment, Short-course). It is recommended by World Health Organization (WHO) to ensure that patients adhere to a complete course of anti-tb treatment under qualified doctors.

- Key parts of DOTS includes:

1. Political commitment and financial support
2. Identification of cases using quality-assured bacteriology
3. Standard treatment plan
4. Directly observed therapy
5. Routine observation and reporting

IV. Conclusion

As per the survey we are concluding that TB is a complex condition that is influenced by many risk factors. And we are also see that the TB is maximum occur in younger (under 5 age) and older (65age) because of weak immune system.

For management of TB various approach includes; general principles are (early diagnosis, assess drug susceptibility , monitor), supportive care , drug management and public health measures Globally, tuberculosis (TB) is one of the most important infectious diseases, presenting major obstacles to healthcare systems, socio-economic development, and public health. Millions of people are afflicted with tuberculosis (TB), which is mostly caused by *Mycobacterium tuberculosis*. Although it usually affects the lungs, it can also cause extrapulmonary illness that affects the lymph nodes, bones, meninges, and other organs. Even though tuberculosis is treatable and curable, it is still one of the infectious illnesses that kills the most people; in 2023, there were an anticipated 10.8 million new cases and 1.25 million deaths globally. Since poverty, malnutrition, overcrowding, inadequate sanitation, and limited access to high-quality treatment are socioeconomic factors, the illness disproportionately affects low- and middle-income nations. With almost 26% of all cases, India has the biggest TB burden in the world. States like Uttar Pradesh, Maharashtra, Madhya Pradesh, Rajasthan, and Bihar are the main contributors. Inadequate healthcare infrastructure, high migration rates, poverty, hunger, and high population density all contribute to the spread of tuberculosis and make treatment compliance more difficult. More than 624,000 cases and a projected 77,000 fatalities were recorded in Uttar Pradesh alone in 2023, underscoring the critical need for focused interventions in high-burden areas.

Multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) are serious challenges in TB control that arise from inadequate therapy, non-adherence, and inappropriate treatment. Treatment for drug-resistant TB is more involved, expensive, and time-consuming; it is also frequently linked to increased morbidity and decreased cure rates. TB susceptibility is further increased and therapy is made more difficult when co-infection with HIV, diabetes, and other immunocompromising diseases occurs. In communities, transmission persists because social stigma and ignorance continue to postpone diagnosis and treatment. TB treatment necessitates a comprehensive, patient-centered strategy. Timely intervention requires

early detection by routine sputum smear and culture testing, systematic screening of high-risk individuals, and sophisticated molecular diagnostics like GeneXpert MTB/RIF. To improve results, it is essential to provide second-line medications for drug-resistant TB, manage co-morbidities, provide nutritional support, and ensure effective treatment adherence through directly observed therapy (DOTS) programs. Long-term TB reduction is based on prevention, which includes public health education, infection control techniques, better living circumstances, and Bacillus Calmette–Guérin (BCG) immunization.

The goal of national and international initiatives like India's National Tuberculosis Elimination Programme (NTEP) and the WHO End TB Strategy is to drastically lower TB incidence and death by 2035. The goal of national and international initiatives like India's National Tuberculosis Elimination Programme (NTEP) and the WHO End TB Strategy is to drastically lower TB incidence and death by 2035. Collaboration across sectors, including social welfare, housing, nutrition, and health, as well as strong political commitment and enough resources, are necessary to meet these goals. Particularly in high-burden environments, research into new TB vaccines, shorter and more efficient treatment regimens, and quick diagnostics is still essential to accelerating progress.

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THE COVID-19 PANDEMIC: A COMPREHENSIVE REVIEW OF THE GLOBAL AND MAHARASHTRA CRISIS

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Abstract

The COVID-19 pandemic, caused by the virus SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2), represents the most significant global public health crisis since the 1918 influenza pandemic. Studies suggest that the virus was initially transmitted from bats to humans, resulting in a rapid and unpredictable world-wide spread. First identified in Wuhan, China, in December 2019, the virus affected approximately 500 to 700 million people globally to date, with ongoing cases. The pandemic has caused considerable physiological and psychological challenges. This review, drawing on contemporary scientific and epidemiological data, provides a scholarly perspective on the lessons learned from the COVID-19 pandemic. It highlights the constant mutation of the virus and discusses vaccine developments, emphasizing the necessity for effective pandemic prevention and management strategies in the future.

Introduction

The COVID-19 pandemic began with a series of atypical acute respiratory events occurring in late December 2019 in Wuhan, China[1,14]. It was rapidly established that a novel coronavirus was responsible for these events[1]. The virus was named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which led to acute respiratory distress syndrome (ARDS)[12]. The infection quickly spread globally, developing into a full-blown pandemic within months and affecting over 150 countries and territories[8]. In January 2020, the World Health Organization (WHO) declared COVID-19 a public health emergency of international concern and officially designated it a global pandemic on January 30, 2020[1]. The first case in India was reported on January 27, 2020, in the state of Kerala[2]. Case identification worldwide was primarily conducted using Reverse Transcription Polymerase Chain Reaction (RT-qPCR) and Rapid Antigen Tests (RAT)[1,13]. The pandemic has irreversibly reshaped global healthcare systems, economies, and societies[1]. According to WHO reports, despite variations in surveillance and testing policies, the virus continues to circulate worldwide[1].

Methods and Methodological Approaches

Study Design

This study follows a descriptive and analytical review approach to examine the progression and impact of the COVID-19 pandemic in Maharashtra, India. It combines quantitative data—such as confirmed cases, deaths, and recoveries—with qualitative insights on government actions, community behavior, and healthcare challenges to provide a clear and balanced

Information was gathered from reliable national and international agencies, official reports, and scholarly literature. Key sources included:

- World Health Organization (WHO) reports and dashboards
- Ministry of Health and Family Welfare (MoHFW), Government of India
- Public Health Department, Government of Maharashtra
- Indian Council of Medical Research (ICMR) publications
- Worldometer and MyGov.in for statistical updates
- Newspaper archives (The Times of India, Hindustan Times, Indian Express, Lokmat, Sakal) for regional data
- Academic books and articles on pandemic

Study Period

The study covers the period from January 2020 to October 2025, encompassing the outbreak, peak waves, and recovery phase of the pandemic globally and Maharashtra.

Data Collection Methods

Quantitative data: were drawn from WHO, MoHFW, and ICMR databases, along with state bulletins detailing district-wise case counts and demographic patterns.

Qualitative data: came from government circulars, media reports, and academic reviews describing state responses, social effects, and healthcare measures during the pandemic.

Geographical Distribution

In late December 2019, several patients with severe cold and pneumonia of unknown etiology were admitted to hospitals in Wuhan, China. On January 2,

2020, WHO reported 44 patients diagnosed with an unknown virus, with 10 patients severely ill. On March 11, 2020, WHO declared SARS-CoV-2 a pandemic as cases were confirmed in over 115 countries. By the end of March 2020, COVID-19 had spread to more than 160 countries.

By August 2020, the Americas held the highest global burden of COVID-19, accounting for nearly half of all new cases reported in the final week of August. During this period, America reported over 100,000 cases daily, which later declined to approximately 40,000 cases per day by July 2020. The Americas remained the most affected WHO region, with the United States, Argentina, and Colombia reporting the highest numbers of new cases by late September 2020.

In India, the spread of COVID-19 showed a notable geographic clustering. The southern states, including Kerala, Maharashtra, Tamil Nadu and Telangana, reported higher case numbers compared to northern re-

gions. This clustering correlated with population density, travel patterns, and economic activity. Kerala and Maharashtra consistently recorded high case numbers for several months. As of January 17, 2021, COVID-19 had affected over 93 million people globally, with 60 countries reporting either imported cases or community transmission of the VOC 202012/01 variant. Currently, according to Worldometer, more than 704 million cases have been reported worldwide, with over 7 million deaths.

COVID-19 Cases Trend (2020 - 2025)

This chart shows the COVID-19 trend from 2020 to 2025 for selected countries. The peaks represent major waves of infections, with the United States and France showing the highest spikes, particularly around late 2021 to early 2022. After 2023, case numbers in all countries declined significantly, indicating better control measures and widespread vaccination

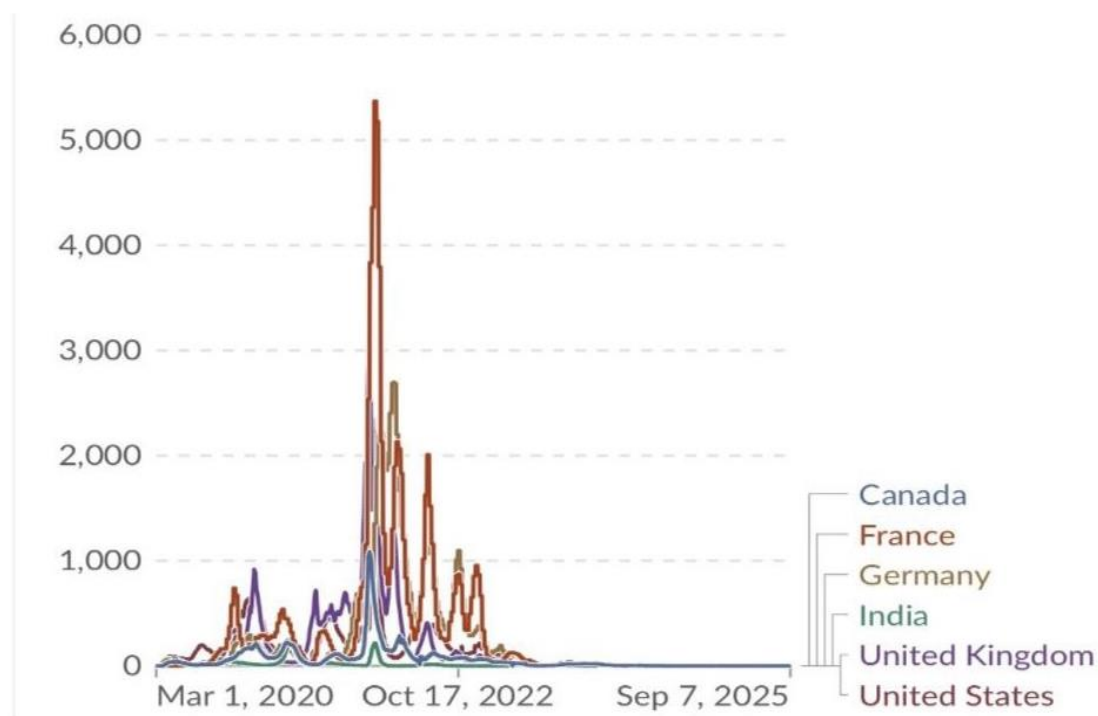


Figure 1. COVID-19 Cases Trend (2020 - 2025)

Summary by Country:

United States: Highest infection peaks, around 2021- 2022

France: Noticeable surges similar to the US but slightly lower.

Germany: Multiple smaller waves observed.

India: Significant spike during mid-2021 (Delta variant).

United Kingdom: Sharp but short-lived waves.

Canada: Lowest infection rates among listed countries.

After mid-2023, all countries experienced a sharp decline in reported cases.

Top 10 Most Affected Countries Globally

Country	Total Cases	Total Deaths	Total Recovered
World	704,753,890	7,010,681	675,619,811
USA	111,820,082	1,219,487	109,814,428
India	45,035,393	533,570	N/A
France	40,138,560	167,642	39,970,918
Germany	38,828,995	183,027	38,240,600
Brazil	38,743,918	711,380	36,249,161
S. Korea	34,571,873	35,934	34,535,939
Japan	33,803,572	74,694	N/A
Italy	26,723,249	196,487	26,361,218
UK	24,910,387	232,112	24,678,275
Russia	24,124,215	402,756	23,545,818

Figure 2. Most Affected Countries Globally

Maharashtra: India's Worst-Affected State

Maharashtra was the most affected state in India, recording the highest number of positive cases. The first confirmed case in Maharashtra was reported on March 9, 2020, in Pune—a couple returning from Dubai tested positive and were admitted to Naidu Hospital, Pune. Within six days of this first case, the total number of cases reached 32, reported in various cities including Nagpur, Ahmednagar, Pune, and Sambhajnagar. By the end of March, the case count in Maharashtra rose to 153.

In response to the escalating cases, the Government of India declared COVID-19 a pandemic on March 13, 2020, and imposed lockdowns in several cities, closing all commercial and educational establishments and banning public gatherings. By 20 March, workplaces were closed, and “work from home” became a new norm. On March 22, Section 144 was imposed, and a nationwide lockdown was declared. Despite these measures, cases continued to rise exponentially, with 5,000 confirmed cases and a fatality rate of 1.5% by April 2020. India experienced one of its largest single-day spikes of 68,631 cases on April 18, 2021. By June 2020, India had overtaken China in the number of confirmed cases.

Within Maharashtra, Mumbai and Pune emerged as major hotspots. The state's government undertook continuous efforts to control the spread of COVID-19, but the pandemic remained a significant challenge. A particular concern was the Dharavi slum in Mumbai, Asia's largest slum, with a population of about one million within an area of approximately 2.39 square kilometers. Controlling the spread in such a densely populated area was challenging. In May 2020, there was a surge in cases in Dharavi. The state government implemented the “Dharavi Model,” which encouraged voluntary testing by the residents, free of cost, to identify and isolate asymptomatic carriers. By mid-June, Dharavi reported a zero-case day for the first time, marking a significant success, and this model was subsequently applied to other parts of the state.

Maharashtra accounted for approximately 22.35% of India's total COVID-19 cases and about 30.55% of all deaths. Pune and Mumbai were the most affected districts.

From January 2020 to October 2025, Maharashtra reported approximately 8,173,792 cases, with around 148,571 deaths and about 8,024,339 recoveries.

COVID-19 District-wise Summary: Maharashtra

District	Confirmed Cases	Deaths	Recovered
Pune	10,99,851	18,679	10,66,447
Mumbai	7,38,239	15,968	7,15,650
Thane	5,92,025	11,092	5,74,998
Nagpur	4,93,063	9,137	4,83,591
Nashik	4,03,658	8,561	3,94,257
Ahmednagar	2,94,758	6,304	2,83,222
Satara	2,26,151	5,471	2,14,414
Kolhapur	1,99,490	5,647	1,89,411
Solapur	1,94,066	4,986	1,83,777
Sangli	1,92,215	5,217	1,80,025

Figure 3.District-wise Summary

Summary:

Pune recorded the highest number of confirmed cases (10.9 lakh) and deaths (18,679), but also achieved a high recovery count of over 10.6 lakh.

Mumbai followed with 7.38 lakh cases and 15,968 deaths.

Thane and Nagpur reported around 5-6 lakh total cases with strong recovery rates.

Districts like Sangli, Solapur, and Kolhapur had lower case counts but consistent recovery outcomes.

Overall, the recovery rate across Maharashtra remained above 95%, indicating effective management of the pandemic at the district level.

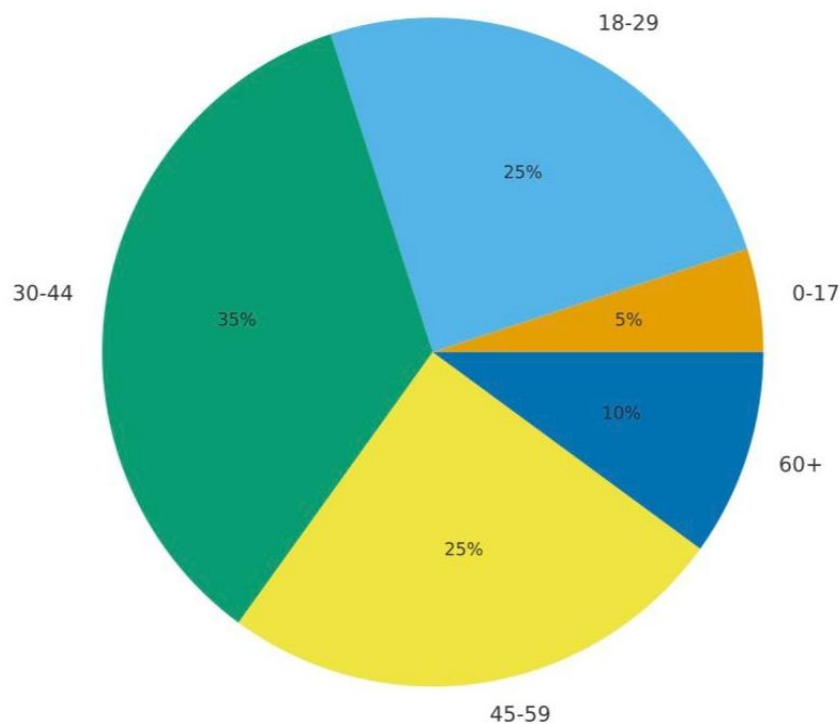
Age distribution of Covid 19 cases -Maharashtra

Figure 4.Age distribution of Covid 19 cases -Maharashtra

Summary

The data reveals that the 30–44 age group was the most affected, accounting for 35% of all cases — representing more than a third of the total. Combined, the working-age adult population (18–59 years) made up the vast majority of infections at 85%. In contrast, younger individuals (0–17 years) and older adults (60+ years) represented smaller proportions, at 5% and 10% respectively. This distribution highlights that the pandemic disproportionately impacted the middle-aged and adult population

Steps Taken by the Maharashtra Government to Fight against COVID-19

Before the lockdown was announced, the Maharashtra state government took several important steps to prepare for and limit the spread of COVID-19 as cases started to rise.

Health Actions

On March 14, the government introduced specific COVID-19 regulations. These required hospitals to screen patients for the virus and advised people who had traveled to affected areas to stay in home quarantine. They also set rules for areas where the virus was spreading rapidly to control the situation.

Restrictions on Movement

By March 15, when the number of cases jumped to 31, the government ordered places like cinemas, gyms, swimming pools, theatres, and museums to close until the end of March. The next day, all schools, colleges, and hostels were shut down, with teachers instructed to work from home. All exams were postponed until March 31.

Administrative approach

On March 13, a special committee was formed to monitor the situation daily and to make sure the state followed advice from health experts like the World Health Organization. After the first COVID-19 death in the state on March 17, the government limited meetings in offices and instructed safety measures for those meetings.

Due to rising cases in cities like Mumbai, Pune, and Nagpur, government offices reduced employee attendance to just 25% on March 20, and by March 23, this was cut further to 5%.

Lockdown and Further Restrictions

To stop the virus from spreading even more, the state government imposed a full lockdown starting March 23 until March 31. This included closing state borders, stopping public transport, and banning gatherings of more than five people. Essential services like food supply were allowed to continue.

Soon after, the central government enforced a nationwide lockdown from March 25, which was initially until April 14 but later extended to May 3. Before this extension, Maharashtra extended its state lockdown until April 30. In mid-April, guidelines were released to gradually allow some activities in areas less affected by the virus, like farming, construction, and certain industries, with safety rules in place.

Support for People

The government also focused on helping people during the lockdown. On March 30, schools were told

not to collect fees while closed. Assistance was arranged to provide food to vulnerable groups like tribal women and children. Employers were instructed to pay full salaries to their staff despite the shutdowns.

On April 7, the government decided to supply subsidized wheat and rice to those above the poverty line and offer meals at very low prices through Shiv Bhojan centers for three months. Later, on April 17, landlords were asked to postpone collecting rent for three months, and evictions for non-payment during this period were banned.

These early actions by Maharashtra aimed to slow down the spread of COVID-19 while trying to ease the challenges faced by residents during the lockdown.

IMPACT OF COVID 19 ON MAHARASHTRA

The human toll of COVID-19 in Maharashtra was profound, leaving a scar on the state's collective well-being. It wasn't just a news headline it was a period where the very measure of a human life our life expectancy took a step back, dropping by nearly a year. Behind this statistic are countless families who lost loved ones, with the virus claiming a significant portion of all lives lost in the state during that first year.

The tragedy extended beyond the final number of deaths. The pandemic stole years of potential, cutting lives short and resulting in over a million collective years of life lost. The overall burden of disease and premature death weighed heavily on the population, a silent measure of the pandemic's true cost.

Maharashtra found itself at the epicenter of the storm, witnessing infection and death rates that outpaced most of the country. Our hospitals became the front line in a battle that often felt overwhelming. The images of overwhelmed ICUs, the desperate scramble for oxygen, and the stretched limits of testing are etched into our memory, a stark reminder of a healthcare system pushed to its breaking point.

The economic shockwaves were just as devastating. The state's economy, the engine of much of India's growth, contracted sharply. The vibrant industrial and service sectors, usually bustling with activity, fell silent and shrank dramatically. While the agricultural heartland showed remarkable resilience, thanks to generous rains, the urban economic landscape was battered.

The lockdowns emptied our streets, shuttering the small shops, hotels, and trade that form the backbone of our local economies. Thousands of these small enterprises vanished. But the deepest suffering was felt by the invisible workforce the daily wage laborers, the street vendors, the helpers who saw their livelihoods evaporate overnight, leaving many to struggle for basic necessities without a safety net.

The government poured billions into fighting the virus, procuring essential equipment and supplies. Yet, the cost of pressing pause on public life was astronomical, with a single lockdown phase estimated to have wiped out tens of thousands of crores from the economy.

Perhaps the most haunting images of the pandemic were social. The sight of thousands of migrant workers, stranded and desperate, walking hundreds of miles to reach their home villages, exposed a deep vulnerability.

The state eventually facilitated the return of over a million people, but the exodus revealed the fragile existence of a vast population living on the margins.

The crisis didn't create inequality; it magnified it. Access to testing and healthcare became a tale of two realities, divided between urban and rural, between the haves and the have-nots. As the health system focused entirely on COVID, other essential care routine immunizations, maternal health checks, and management of chronic diseases was disrupted.

The classroom moved online, but this shift only widened the chasm between students with resources and those without, deepening the digital divide. And beneath it all, in the silence of isolation and the anxiety of uncertainty, a silent mental health crisis took root, leaving an invisible scar that would long outlast the virus itself.

Conclusion

It's difficult to overstate just how much COVID-19 changed our world. The pandemic was more than a health crisis; it was a profound human tragedy that upended lives on a global scale. It didn't just strain our hospitals; it shook the very foundations of how we work, eat, and connect with each other, pushing millions into poverty and hunger and reminding us of the delicate balance that holds our societies together.

The economic shockwaves were immediate and brutal. From farms to airlines, construction sites to tourist hotspots, the gears of the global economy ground to a halt. Powerhouse nations like the US, Germany, and China saw their economies shrink—a rare and sobering event. The recovery has been a slow, uphill climb.

The crisis also revealed the hidden frailties in our systems. A single disruption showed how easily our food supply chains and job markets could fracture, with the hardest blow falling on those with the least security—the daily wage laborers, the informal workers, and the poor who were left without a safety net. The clear lesson for the future is that we can't afford to be caught off-guard again; the world must invest in being prepared to prevent such devastating human and economic costs down the line.

Here in India, Maharashtra found itself on the front lines of this global war. The state was hit harder than almost any other, with the first case detected in early March 2020. As the virus spread, the numbers became staggering—at its peak, Maharashtra was bearing over a fifth of the nation's cases and nearly a third of its

heart-wrenching losses. Cities like Mumbai and Pune became household names for all the wrong reasons, synonymous with the fight against the virus.

We lived through those terrifying days of record-breaking case counts, watching the news with a knot in our stomachs. While the intense crisis eventually subsided, the threat never fully disappeared, with new waves and variants causing periodic concern. The state's response was a massive undertaking, a race to ramp up testing, set up containment zones, and bolster a healthcare system pushed to its absolute limit. It was a battle fought street by street, hospital by hospital, and one that has left a lasting mark everyone who called maharashtra home during those difficult years.

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PHILOLOGICAL SCIENCES

DIALECT IS NOT DIFFERENCE, BUT RICHNESS

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<https://doi.org/10.5281/zenodo.17492588>

Abstract

The article systematizes the main phonetic-lexical features of local speech in a simple and practical language, showing that dialect is not a “difference”, but a strategic asset that nourishes the literary language. In the study, audio samples collected on the basis of field observations are processed with multilayer annotation, the open-closed and front-back distribution of vowels, assimilation and fricativeization in consonants, as well as variations in stress-intonation contours are explained in minimal pairs. At the lexical level, the functional value of local variants stabilized in everyday communication (proximity, style signal) is indicated and a small table for the transition “dialect → literary language” is presented. Urban-rural and intergenerational differences, media influence and the importance of code-switching skills in the social context are discussed. Recommendations for schools and the media are supplemented with the creation of an open audio corpus, annotation based on ELAN, simple IPA guides and editorial ethics. As a result, the scientific description of dialect increases clarity in communication, preserves cultural diversity, and creates a stable basis for the rapid renewal of the literary language.

Keywords: dialect, literary language, phonetics, intonation, lexical differences.

Introduction: Dialects are living cultural units that carry the memory of a community, the style of everyday communication, and local identity; therefore, they are not an “extra” element of the language, but a natural source that nourishes the norm [10; p. 3]. The phonetic variation observed in the historical and geographical spread of Azerbaijani Turkic — the opening and closing of vowels, the softening and hardening of consonants, stress and intonation patterns — is of a systematic nature and has a separate scientific value in the general Turkic context [7; p. 248–252]. In this respect, dialects not only retain traces of antiquity, but also expand the expressive reserve of the modern literary language: each new pronunciation nuance, each local word-intonation combination included in the norm increases the flexibility of the future standard [7; p. 248–252]. This understanding also has practical consequences in the public sphere: instead of stigmatizing a dialect as a “mistake”, recognizing it as a cultural asset creates inclusiveness in language policy and strengthens the commitment of local communities to the language [10; p. 3].

Preservation of dialects is both a moral duty and a scientific necessity; since urbanization and mass media accelerate the leveling of the speech of the younger generation and reduce the lively circulation of sound differences [10; p. 3]. The basis of the preservation strategy is accurate description and transparent sharing: first, the uniform recording of phonetic features in the International Writing System (IPA) enables comparison between studies [5; pp. 200–206]; second, digital archive networks (OLAC) provide long-term accessibility by linking language resources to searchable metadata [4; pp. 210–218]; third, the multimodal annotation environment (ELAN) stratifies audio recordings with time precision and makes them usable for teaching

and scientific analysis [12; pp. 1556–1559]. Thus, a dialect example—a story written in the field, a proverb, a toponym—makes both the subtlety of pronunciation and the cultural landscape visible at the same time; This visibility not only “reinforces” the past, but also enriches the selective capacity of tomorrow’s literary language [5; pp. 200–206], [4; pp. 210–218].

The main purpose of this article is to show the main phonetic-lexical features of local speech, without renouncing scientific rigor, but in as simple and practical a language as possible. The task is twofold: on the one hand, to give a concise answer to the question “what is it and where does it work?” of such features as the open-closed and front-back distribution of vowels, the softening-hardening tendencies of consonants, stress and intonation patterns; on the other hand, to trace how the same features behave in contact with the literary norm — enriching, neutralizing or creating misunderstandings — based on examples of everyday communication. The relevance of the topic is strengthened by three reasons: urbanization and mass media accelerate leveling in the younger generation; as the education system focuses on communication, the need for students to explain the sounds they hear at home in a scientific language in the classroom increases; in the cultural self-awareness of local communities, dialect is not only a relic of the past, but also a living indicator of today’s identity. Ultimately, the article aims to provide the reader with two practical tools: a small guide to recognizing the minimal pairs that are often encountered in the transition “dialect → literary language” and a brief explanatory model for the classroom, editorial office, and media environment. Such an approach presents dialect as a source that nourishes the norm, not “against the norm,” and makes inclusive, delicate balance in language policy possible.

The material base consists of two layers: field observations and descriptions validated on the basis of existing literature. In the field phase, purposive sampling is applied so that at least the main axes of differentiation are represented by region, age (18–30; 31–55; 56+), type of residence (rural/urban), and gender; a 30–45-minute semi-structured interview is conducted with each informant, along with spontaneous speech (memories, everyday life stories), purposeful elicitations are collected through a 100-unit word list, 10 minimal pairs, and a short reading passage. A quiet location is selected for high sound quality, an external microphone is used, 48 kHz/24-bit parameters are maintained, the microphone-speaker distance is stabilized, and the sound files are pre-processed with normalization and basic silence removal. Informed consent is obtained in accordance with ethical requirements, personal data is replaced with encrypted codes, and minimal metadata such as region, age group, and communication context is included in the file names.

At the annotation stage, each sample is stratified on the time axis with orthographic level, phonetic transcription, stress, word root and context markers; sentence end contours are separately marked for intonation, length and pause points are marked. In phonetic analysis, the square positions of vowels are estimated based on the F1/F2 support points, the duration of sounding in consonants and VOT for plosives are observed, the shift of stress from a prosodic perspective and the main trends in the melodic contour are noted. In the lexical part, samples are selected according to the principle of frequency and semantic proximity in the most frequently used areas — household, economic, ceremonial lexicon. The principle of demonstration is simple: only the most common and stable features in speech are presented; if “a similar form is not confirmed in at least three informants and two age groups”, that sample is excluded from the final presentation. To increase reliability, annotation rules are standardized with a short “decision table”, a second annotator check is performed on randomly selected fragments, and inconsistencies are resolved with a discussion protocol. The article prioritizes explanatory examples to present the results without tiring the reader, tables are used only when necessary, for the purpose of “seeing at a glance,” and each table is closely linked to the explanation in the text. This method ensures readability while maintaining scientific accuracy: the reader first hears the sound, then sees it in writing, and then understands the role of that sign in communication in a concise, understandable framework.

Vowel/consonant changes. The most visible trend in the vowel system is the stabilization of small shifts in the open–closed and front–back dimensions: in some regions, a narrowing towards /e/ → [i] (“I say” → “I say”), the transformation of the /ey/ sequence into a hiatus (“eating” “eating”), and at the same time, the weakening of the “-ra-” sequence as a result of syntagm in mid-syllables (“where/there/here” “where/there/here”) is observed [10; pp. 52–61], [11; pp. 130–145]. In vowel harmony, the preservation or loss of roundness, especially in the final syllable, varies

from dialect to dialect; this also affects the sound harmony of word-final suffixes and makes some of the correspondences neutralized in the literary norm visible again in speech [11; pp. 146–156]. The main changes in consonants are associated with regressive assimilation and local solutions of the hard-soft contrast: the “brother” “brother” type of pronunciation shows voicing assimilation, the tendency to fricativeization in positions where the density of “k” and “q” decreases; in some dialects, [h] weakens or becomes zero at the beginning of the syllable, which creates conditions for the transfer of the sound load to the vowel in a position close to the stress [10; pp. 62–70], [11; pp. 157–170]. All of these phenomena correspond to general phonetic regularities: an increase in the F1 indicator of open vowels creates an “opener” sound, while a decrease in F1 in closed vowels creates an audible “narrowing” impression; in consonants, as the VOT and continuity parameters change, the listener perceives the hardness-softness contrast differently [9; pp. 281–299], [5; pp. 200–206].

Stress and intonation. The place of stress in speech is not only the “loudness of the voice”, but also a sign indicating the boundaries of the rhythmic unit and the information structure: in some Western dialects, the shift of word stress from the penultimate syllable to the penultimate syllable strengthens the phrase stress and increases the amplitude of the falling contour at the end of the sentence; as a result, the same word order creates the impression of a more “flexible” intonation compared to the model in the literary language [11; pp. 171–182]. The “spreading” of the rising contour in the middle of Y/n interrogative sentences, and the sharp fall of the final tone in news sentences, give the listener additional pragmatic signals; therefore, the stress-intonation change is not only a matter of “melody”, but also an element affecting the transfer of meaning [10; pp. 71–79]. To describe prosodic differences, it is sufficient to work on minimal pairs and short template sentences: noting the location of the pitch peak and the angle of the fall at the end of the phrase, marking syllable lengths and pauses allows the reader to see the “soundscape” in the text [5; pp. 200–206], [9; pp. 290–299].

Lexical vernacular words (3–5 examples). At the lexical level, differences are concentrated mainly in everyday communication areas and often appear in conjunction with phonetic simplifications. Below are five examples that are both widespread in use and phonetically explainable:

“where/there/here” “where/there/here” — syn-gopesis in the middle syllable; as the rhythm of speech accelerates, the vowel in the weak position is shortened [10; pp. 52–61], [11; pp. 130–145].

“I say” “I say” — contraction of /e/ [i] and transformation of the “ey” sequence into a hiatus; strengthening of vocal harmony in rapid speech [10; pp. 58–60].

“yiyir” “yiyir” — weakening of diphthongization or a sequence of two separate vowels; articulatory flexibility prevails at the syllable boundary [11; pp. 138–142].

“brother” “brother” — regressive voicing assimilation; the transition [q] [g] is more often heard in contexts where intonation is rising [11; pp. 160–165].

“nətər” “nəcə” — lexical variant; although the meaning remains the same, the local form signals intimacy and informal style in communication [10; pp. 66–68].

These examples show that phonetic processes (syngope, contraction, assimilation, weakening of diphthongization) and lexical variation often work together: a small shift in sound is read as a stylistic signal, and

stylistic choice makes the transition between the literary norm and local speech “painless” [10; pp. 71–79], [11; pp. 171–182]. The practical conclusion for the reader is clear: in which cases the transition to the literary form preserves the meaning, and in which cases the preservation of the local form makes communication natural and convincing; in the next part of the article we will summarize this transition with a small table “dialect → literary language” [10; pp. 79–82], [11; pp. 182–186].

Table 1.

"Dialect literary language"		
Local form	Literary response	Short explanation
where / there / here	where / there / here	Synopsis in the middle syllable: the syllable -ra- in the weak position is shortened; it is retained in the literary style [10; pp. 52–61], [11; pp. 130–145].
I say	I say	The contraction of /e/→[i] and the transformation of the “ey” sequence into a hiatus increase articulatory flexibility in rapid speech [10; pp. 58–60].
brother	brother	As a result of regressive voicing assimilation, the transition q→g is heard; q is retained in the literary language [11; pp. 160–165].
what is it	how	Lexical variation: same in meaning, informal in style, signals closeness; “how” is acceptable in formal communication [10; pp. 66–68].
eats	eats	Weakening of diphthongization or the succession of two vowels; in some dialects the hiatus is fixed, in the literary language “ey” is preserved [11; pp. 138–142].

Social context

The difference between urban and rural speech is primarily formed by the density and diversity of everyday communication networks: in the countryside, pronunciation models that have been stabilized within the circle of relatives and neighbors are preserved for a long time, while in the city, speech types from different regions collide in the same space and professional environment, accelerating leveling [10; pp. 83–90]. As the literary norm gains dominance in urban speech, processes such as the reduction of weak vowels (“harada” → “harda”) and regressive assonance (“qardash” → “qardash”) are either neutralized or become stylistic signs; in the countryside, these forms live as signs of social identity and are stabilized in assembly, ceremonial, and economic discourses [11; pp. 190–198]. Observations of dialect atlases also show this on the map: as the flow to large urban centers increases, isoglosses soften, transition zones expand, and “sharp boundaries” are preserved only in pockets where communicative isolation remains [1; pp. 9–15], [3; pp. 5–8].

The generational difference is more subtle: in older speakers, the fixed rhythm and stress distribution act as a powerful prosodic sign expressing the emotional charge of speech, while in young people, literary examples learned through school and the media “regulate” the rhythm and simplify the contour [11; pp. 171–182]. This is not just a change in sounds at the phonetic level, but a redistribution of the information structure: the younger generation conveys the same idea in a more neutral melodic contour, and this contour gains additional strength with the spread of written-speech synthesis in social networks [10; pp. 91–95]. In the communication of young people, code-switching (dialect form → literary form) is often connected with a situa-

tional function: with a teacher, official, in a job interview, the literary form prevails, and at home and in a close circle, the local form; as a result, the ability to flexibly switch between the two modes becomes social capital [10; pp. 95–98].

The influence of the media is twofold: on the one hand, the acoustic “template” of the literary language is widely disseminated on television, radio and especially on global platforms and triggers mass imitation mechanisms; on the other hand, local content (regional blogs, folklore channels, micro-podcasts) makes the dialect sound visible, giving it a positive symbolic value [11; pp. 200–208]. What is decisive in this balance is the “public reputation” of the pronunciation: dialect is either stigmatized as a “mistake” and hidden, or presented as a “cultural asset” and put on display; the first case strengthens the leveling, the second case strengthens the conscious protection mechanisms [10; pp. 83–90]. That is why education and media cooperation should become a goal: simple explanatory audio-examples, dialect-literary pairs and short explanatory stories form both auditory discrimination and awareness of stylistic choice in the younger generation [11; pp. 204–208].

Migration and the labor market also play an important role in the restructuring of speech regimes: seasonal and permanent migrations create new speech coalitions, and although professional jargon prevails over literary language, the local style remains a sign of “social proximity” outside of work hours [7; pp. 248–252]. This shows that dialect is not only a “geographical” but also a “functional” entity: as the space changes, the form changes, but the functions — expressing identity, creating proximity, strengthening emotional emphasis — live on and adapt to new conditions [10; pp. 96–98]. Thus, the social context is not a passive background

that determines the fate of a dialect; on the contrary, it is an active mechanism that reshapes its sound, rhythm, and social value every day in conversations, on screens, and in classrooms [11; pp. 200–208], [1; pp. 12–15].

Recommendations. Use of dialect resources in school and media

The integration of dialect resources into the educational and media environment should be based on two main principles: a stigmatization-free approach and a “dual-code literacy” model. The first principle requires explaining the functional value and historical-cultural burden of dialect forms without labeling them as “wrong”; the second principle aims to provide the student and listener with the ability to flexibly switch between the literary language and the dialect in accordance with the situation [10; pp. 83–90], [11; pp. 190–198]. This framework both increases the credibility of communication and supports the adaptive development of the norm, preserving the living diversity of the language [10; pp. 95–98], [7; pp. 248–252].

The use of dialect resources in the school environment should be implemented primarily through small modules that create a bridge between listening-discriminating, transcription and meaning-making. In the 6–8 textbook micro-module entitled “Dialect and Literary Language: Listening-Writing”, the student first hears the sound difference of minimal pairs, then briefly notes this difference with IPA symbols, and then checks the meaning in context by converting the text fragment into literary language; the goal is to establish a conscious connection between the sound level and the meaning level [5; pp. 200–206], [9; pp. 281–299]. Assessment should be formative in nature, that is, the student should not be punished for using a dialect form, but on the contrary, it should be supported by rubrics on the explanation and argumentation of code-switching appropriate to the situation (why the literary form is more appropriate in this context) [10; pp. 91–98], [11; pp. 171–182]. It is recommended that the teacher's brief guide file include a schematic explanation of the five most common phonetic features, a map of the “main isoglosses” by zone, and a 10-sentence test piece for quick classroom diagnostics; this material should be localized by region, aligned with maps from local dialect atlases [1; pp. 9–15], [3; pp. 5–8], [11; pp. 200–208].

For the sustainability of the resource base, a small open audio corpus should be created based on school-community collaboration. An informed consent form is stored with each entry, audio files are collected at 48 kHz/24-bit settings, minimal metadata such as region, age group, and communication context are included in the file names; the orthographic layer, IPA transcription, stress, and intonation contours are marked on separate layers during the annotation phase [12; pp. 1556–1559]. During the archiving and sharing phase, minimal description fields are filled in accordance with OLAC principles so that the resources remain permanently “findable”; this facilitates both inter-school exchange and secondary analysis for researchers [4; pp. 210–218]. For the terminological consistency of the annotation rules, the elementary marking of the morpho-

syntactic layer within the MAF (ISO 24611) framework is adopted; thus, the sound-text-grammar relationship can be reused in the development of future learning materials [6; pp. 12–18]. This technical design provides practical implications for the classroom while maintaining scientific accuracy: the teacher immediately explains the “auditory difference” with symbols appearing on the board, and the student relates that difference to its role in the text [5; pp. 200–206], [12; pp. 1556–1559].

The use of dialect resources in the media environment should be regulated by a separate section of the editorial stylebook. Neutrality is maintained for the news language, but the heroes of the plot can speak in their own dialect in quotes; here, the transition “dialect → literary language” in the subtitles is given with small parenthetical notes or a parallel line of writing at the bottom of the screen in order to both maintain authenticity and ensure comprehensibility for the general audience [11; pp. 200–208]. In cultural-educational programs, it is advisable to allocate a 5–7-minute section called “dialect window”: in each issue, one local phonetic sign and 3–4 lexical units are presented in context, a short explanation and a sample sentence are given for the listener, and audio clips are uploaded to the program's website [10; pp. 83–90], [1; pp. 12–15]. The metadata of material shared on digital platforms (podcasts, short videos, radio archives) should be done with the same standards, and the files should be released under open licenses; this serves both reuse and a positive attitude of the public towards the dialect [4; pp. 210–218], [12; pp. 1556–1559]. In editorial language, it is an ethical norm to avoid “caricature” and the exaggeration of phonetic features into the object of ridicule; the dialect sound gains a public reputation through informative and respectful presentation, which in turn slows down leveling and increases the prestige of local speech [11; pp. 200–208], [10; pp. 95–98].

A short in-service training module for trainers and media professionals is of particular value. The four-block, 12-hour program sequentially covers the practical foundations of IPA, isogloss mapping based on local atlases, multi-layer annotation with ELAN, and editorial ethics; each block is completed with a micro-task on real material, and participants prepare a 10-minute sample package from their region to add to their portfolio [5; pp. 200–206], [1; pp. 9–15], [12; pp. 1556–1559]. Such programs create a common frame of reference for teachers and journalists, ensure synchronous movement in the training-media-community triangle, and make the value of dialect as “social capital” collectively visible [7; pp. 248–252], [11; pp. 204–208].

Consequently, the intelligent use of dialect resources in the school and media environment serves not only to preserve cultural heritage, but also to revitalize the literary language: the difference that is heard is reflected in writing, and the difference that is reflected in writing becomes a functional value in communication; the more stable this chain is, the more flexible and rich the future of the language seems [10; pp. 95–98], [11; pp. 200–208].

Conclusion

This article has shown that the phonetic and lexical layers of dialects are not a collection of randomly distributed differences, but a systematic structure that carries the rhythm of communication, the division of meaning, and the subtle signs of social relations. The expansion and contraction of vowels, the assimilation tendencies of consonants, the shifting contours of stress and intonation, as well as local variants of everyday vocabulary enrich the general language system and create a creative reserve for the literary norm. Against the background of urbanization and mass media, leveling may seem inevitable, but a smartly organized “dual-code literacy” in schools and the media — a flexible transition between literary and local forms depending on the situation — is the healthiest way to preserve both clarity and cultural diversity. The creation of small open audio corpora, the explanatory presentation of examples with multilayer annotation, and the respectful presentation of dialect sound based on editorial ethics strengthen the public reputation of the language, strengthen auditory discrimination and awareness of stylistic choices in the younger generation. Ultimately, dialect is not just a “trace of the past” but a “reserve of the future”: we must see it as such and protect it, valuing it as a strategic asset for the longevity and expressive power of the language.

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MYTHOLOGICAL SOURCES OF MOUNTAIN, RIVER AND LAKE CULTS IN AZERBAIJANI LEGENDS**Zeynalova Z.***Doctoral Student, Faculty of Translation and Philology, Azerbaijan University**ORCID: 0009-0007-3275-4447*<https://doi.org/10.5281/zenodo.17492590>**Abstract**

The article is devoted to the study of the mythological origins of mountain, river and lake cults in Azerbaijani legends. The study shows that these natural elements were perceived in the mythological worldview of the people not only as geographical objects, but also as sacred spaces and symbols of divine power. Mountains are presented in poetic language in legends as symbols of closeness and resistance to God, rivers as symbols of life and abundance, and lakes as symbols of mystery and purity. The article analyzes the connection of these motifs with cosmogonic ideas, their common elements with the mythological tradition of the Turkic peoples, and the forms of preservation in collective memory. In particular, the legends related to Murovdag, Kura, Araz and Lake Goycha are examined as examples and their mythologized semantics are shown. The results prove that nature cults in Azerbaijani folklore are both a continuation of ancient mythological thought and an important mechanism for preserving national and cultural identity.

Keywords: legend, folklore, lake, mountain, river.

Introduction: The Azerbaijani mythological worldview has been built on the sacred appreciation of natural elements - mountains, rivers and lakes - since ancient times. These natural objects were perceived in the imagination of the people not only as geographical entities, but also as carriers of holiness, divine power and spiritual values. In legends, the height of the mountains is presented as a symbol of closeness to God, the permanence of rivers as a symbol of life and abundance, and the depth of lakes as a symbol of the mysterious world and holiness. In this regard, nature cults constitute the oldest layers of Azerbaijani folklore and play an important role in preserving collective memory.

The relevance of the topic is that legends related to nature cults reflect not only the traces of mythological thinking, but also the formation of the historical and cultural identity of the people. In them, the remains of archaic cosmogonic ideas, mythological motifs common to the Turkic peoples, and the historical experience of the Azerbaijani people find their poetic expression. The problem is that in these legends, historical facts and mythological images are intertwined, causing events to be experienced in both real and symbolic layers.

The aim of the article is to investigate the mythological origins of mountain, river and lake cults in Azerbaijani legends, to reveal their poetic-semantic functions and to show their role in the formation of national identity. To achieve this goal, the theoretical and methodological foundations, mythological layers, genre features and connection with collective memory of legends will be analyzed.

In Azerbaijani mythological thought, the elements of nature – mountains, rivers and lakes – constitute the deepest layer of archaic ideas. These elements were perceived not only as real objects of nature, but also as sacred centers that ensure the connection of man with the cosmos. Mountains were presented as a symbol of closeness to God, power and exaltation, rivers were associated with life and abundance, and lakes with mystery and the hidden world. Tokarev writes that the mythification of natural elements in various peoples of

the world led to their survival in the collective memory and acquisition of sacred status [12, p. 144]. It is also possible to observe this most ancient layer of mountain, river and lake cults in Azerbaijani legends.

In cosmogonic myths, the elements of nature perform the main functions related to the creation and preservation of the order of the world. The mountain is perceived as the support of the mythical cosmos, that is, the “axis of the world” (axis mundi). Eliade notes that the mountain serves as a bridge between God and man in all archaic mythological systems [5, p. 97]. Rivers and water sources symbolize the beginning of life, and their constant flow expresses the continuity of both time and life. Gasimov shows that in Azerbaijani legends the creation of rivers is often explained by the “divine beginning”, which highlights the sacredness of water [11, p. 153]. Lakes are perceived as a place of cosmic harmony and at the same time trials; their depth is described as a door opening to a mysterious world. Thus, in cosmogonic ideas, mountains, rivers and lakes act not only as elements of nature, but also as protectors of the cosmic order.

Azerbaijani mythological experience is an integral part of the mythological system of the Turkic peoples. In this regard, the common motifs of mountain, river and lake cults are striking. In Turkic epics, mountains are often presented as a sacred starting point, a place of origin of tribes. In the “Ergenekon” epic, the mountain is not only a geographical object, but also a place of rebirth and freedom of the Turks. The sacred function of rivers and lakes is associated with the perception of water as a “life-giving force” in general Turkic mythology. Abdullayev notes that myths related to water in Azerbaijani legends are local variations of the “Mother Water” and “Primordial Sea” archetypes, which are widespread among the Turkic peoples [2, p. 203]. This confirms both the universality of mythological thought and the specific role of Azerbaijani material in the Turkic mythological tradition.

In the Azerbaijani mythological worldview, the mountain has always been perceived as a sacred place.

For a person, the mountain is not only a physical-geographical object, but also a place to approach God, feel divine power and be protected. Eliade shows that the mountain is perceived as the “axis mundi” in all mythological systems; it has a mediating function between heaven and earth and is considered the center of the cosmic order [5, p. 97]. In Azerbaijani legends, the mountain peak is also described as a sacred center, where it is believed that people's prayers are heard and God communicates with people. This approach shows that both religious and cultural codes are combined in the people's attitude towards mountains.

In legends, the formation of mountains is often explained by mythological motifs. Sometimes the mountain is presented as a being suddenly raised to the surface of the earth by the power of God, and sometimes there is a plot of a village or city turning into a mountain as a result of the sins of the people. Such a mythopoetic explanation actually expresses not the physical formation of the mountain, but its spiritual-semantic origin. Tokarev notes that the mythification of the mountain is the result of a person understanding it not just as an object of nature, but as the embodiment of cosmic force [12, p. 144]. In Azerbaijani legends, the sudden formation of the mountain is sometimes interpreted as a divine warning given for the deeds of the people, and sometimes as a symbol of heroism and resistance.

Azerbaijani legends demonstrate the vitality of this cult with examples related to specific mountains. In the legends about Murovdag, the height of the mountain is associated not only with a geographical description, but also with the concept of a “high spirit”; here it symbolizes human endurance, strength and invincibility [8, p. 103]. In the legends about the Khizi Mountains, the sharp silhouette of the mountain is perceived in the collective memory of the people as a sign of divine power. At the same time, in the legends about Kirs Mountain and the Caucasus Mountains in the Karabakh region, these places are presented as sacred places of protection, points of communication between God and man. Huseynli writes that in such legends the mountain acts not only as a place, but also as a carrier of national and cultural identity [7, p. 115].

Thus, in Azerbaijani legends, the mountain cult is one of the main layers of the mythological thinking of the people. Its sacralization and mythification are closely connected with both cosmogonic ideas and historical events. Mountains have been preserved in the memory of the people as a symbol of protective force, resistance and closeness to God, becoming symbolic pillars of national identity.

The cult of the river is of particular importance in the Azerbaijani mythological worldview. Rivers are perceived not only as the life-giving force of nature, but also as an integral part of the spiritual world of man. It is no coincidence that they are presented in legends as symbols of life, abundance and purity. The constant and uninterrupted flow of the river expresses the continuity of life, while the abundance of water is identified with fertility and prosperity. Eliade notes that in archaic mythological systems, water symbolizes the initial beginning, the chaos before the formation of the cosmos,

and carries the function of purification [5, p. 104]. In Azerbaijani legends, rivers are presented as an artistic image of a person's cleansing from sin and entering a new life.

Legends about the Kura and Araz rivers are among the most striking examples of this cult. In folk tales, their non-meeting is explained by the plot of “forbidden love”. This motif has both an emotional impact and a moral teaching function: a natural event is framed in an artistic framework with the theme of love and longing, and the source of the rivers acquires a sacred meaning in the collective memory of the people. Gasimov writes that legends about rivers are not only a mythification of a geographical fact, but also a poetic coding of the socio-spiritual experience of the people [11, p. 162]. In this regard, plots about the Kura and Araz carry an important semantic load for both historical memory and national self-awareness.

The ancient religious-mythological roots of the water cult are part of a broader system. In the Turkic peoples and in world mythology in general, water was perceived as the beginning of life, a source of vitality and abundance. Abdullayev shows that in Azerbaijani mythological thought, water is a local variation of the “primordial beginning” archetype, and in legends about water these archaic ideas were embodied in artistic form [2, p. 203]. The sanctification of springs in various regions, their acquisition of the status of healing and sacred places also confirms the vitality of this ancient cult. The description of water in legends as a “gift of God” or “divine blessing” shows that in the people's memory, rivers and springs are not just objects of nature, but also carriers of spiritual and cultural identity.

Thus, the cult of tea lives on in Azerbaijani legends as a symbol of life, abundance, and purity, while the plots about the Kura and Araz demonstrate the preservation of both mythological and historical-spiritual layers in the collective memory of the people. The ancient religious roots of the cult of water retain their relevance in the modern folklore environment through these legends.

In the Azerbaijani mythological worldview, the cult of the lake occupies a special place along with the cults of mountains and rivers. In the popular imagination, lakes are interpreted as a symbol of the “mysterious world” and “divine power”. Their depth and silence are perceived as a place of unknown, hidden forces, and the majesty of water is perceived as a sign of the power of God. Eliade notes that in archaic mythological systems, water bodies are not only a natural phenomenon, but also serve the function of “a gateway to other worlds”, therefore lakes acquire the status of a sacred space [5, p. 115]. In Azerbaijani legends, the image of a lake, in addition to being a real geographical object, is also a poetic expression of divine purity, silence and holiness.

Legends about Lake Goycha are one of the most famous examples of this cult. In legends, the creation of the lake is often associated with the sins of the people, a tragic event, or divine punishment. The motif of a village turned into water or people turned into stone is widespread here. This is, on the one hand, a symbolic preservation of historical memory, and on the other

hand, a manifestation of a moral teaching mechanism. In the legends about Aghgol, the lake is described as a source of purity and healing. Huseynli shows that lake motifs in Azerbaijani legends are often associated with people's desire for spiritual purification, and lake water is presented as a gift from God [7, p. 121]. The same feature is noticeable in legends about other lakes: the sanctity of water, belief in the sanctities formed around the lake, and rituals associated with this place indicate the vitality of the lake cult.

The connection of lake motifs with mythological archetypes is also noteworthy. In legends, the lake is sometimes depicted as a tear of God, which is the embodiment of divine sorrow and mercy. In some cases, the lake acquires the image of a refuge, playing the role of a place of salvation from difficulties or a place for a new life. Tokarev notes that in myths related to water, the motifs of "holiness" and "safety" always coexist [12, p. 288]. In Azerbaijani legends, the lake also carries both holiness and protective power: the belief systems built around it are passed down from generation to generation as part of collective memory.

Thus, the cult of lakes lives on in Azerbaijani legends as a rich poetic expression of cosmogonic ideas. Lakes act as a gateway to the "mysterious world", a symbol of divine power, and a symbol of spiritual purity and refuge. This feature ensures that they are preserved in collective memory and become important memory spaces of national identity.

The poetic semantics of mountain, river and lake motifs in Azerbaijani legends is one of the most powerful mechanisms for their preservation in collective memory. These natural elements existed in the life of the people not only as geographical objects, but also as memory spaces. The name of each mountain was perceived as a symbol of heroism and resistance, the flow of each river as life and purification, and the depth of each lake as a symbol of mystery and holiness. From the point of view of Nora's concept of "memory spaces", nature cults act as codes symbolizing the historical experience of the people and preserving national memory [10, p. 64]. Therefore, their poetic semantics has not only artistic-aesthetic, but also historical-cultural value.

The role of legends in the formation of national and cultural identity is particularly noteworthy. It has been repeatedly emphasized in Azerbaijani folklore that legends are an important tool in strengthening the identity consciousness of the people [1, p. 112]. The loftiness of the mountains, the abundance of rivers, the mysterious and sacred nature of lakes are included in the process of self-awareness of the people in the texts of legends. These motifs serve both to protect spiritual values and to transmit national identity to the younger generations. Huseynli notes that legends related to nature cults instill in the younger generation not only folklore knowledge, but also a sense of national and cultural identity [7, p. 130]. Thus, nature motifs become symbolic cornerstones of national and cultural identity through legends.

The transformation of nature cults in the modern folklore environment shows their dynamic and living structure. In today's folklore examples, mountain, river

and lake motifs continue to live, adapting to new socio-cultural conditions. If in ancient legends these elements were more related to mythological imagination and religious concepts, in modern legends their connection with tourism, ecological values and regional identity comes to the fore. According to Assmann's theory of cultural memory, memory is constantly being reconstructed and adapted to the modern context [4, p. 73]. Such a transformation of nature cults is also observed in Azerbaijani legends: mountains and lakes are now also valued as ecological symbols, national wealth and cultural heritage. This change ensures that they do not lose their relevance in the folklore environment, but, on the contrary, strengthen it even more.

Consequently, the motifs of mountains, rivers and lakes in Azerbaijani legends are memory codes that ensure the survival of not only the ancient mythological layer, but also the national identity in the modern era. Their preservation in the collective memory, the role they play in the formation of national-cultural identity and their transformation in the modern folklore environment show that nature cults are an indispensable part of both the historical and spiritual life of the people.

Conclusion

The study of mountain, river and lake cults in Azerbaijani legends shows that these motifs not only bear traces of ancient mythological ideas, but are also important carriers of the collective memory and national identity of the people. Mountains live in memory as a symbol of loftiness, resistance and closeness to God, rivers as a symbol of life, abundance and purification, and lakes as the embodiment of the mysterious world and divine power. Their mythologizing serves to preserve the historical experience of the people not just as a memory, but with a deep spiritual and poetic meaning.

The preservation of these cults through legends shows that folklore is not just a creative art form, but also the main mechanism for the formation of historical consciousness. Legends, in addition to transmitting national identity and historical values to generations, also create a sense of sacredness related to nature. Their transformation in the modern folklore environment in new social and cultural contexts proves that these cults have not lost their relevance, but, on the contrary, are constantly renewed and live in the memory of the people.

Thus, the cults of mountains, rivers, and lakes are an integral part of the Azerbaijani mythological worldview, constitute the poetic code of national-cultural identity, and remain one of the strong pillars in the spiritual life of the people.

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SOCIAL SCIENCES

ASSESSMENT OF GLOBAL GREAT ENTREPRENEURS' LIFE: LESSON FOR NEW ENTREPRENEURS FOR SUCCESS IN 21ST CENTURY

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<https://doi.org/10.5281/zenodo.17492594>

Abstract

World resource is limited and always there is a constraint. Any founders of venture/business can control only their own human, social, and financial capital at a new venture's outset or startup. Entrepreneurship is a long, challenging journey, not an overnight success story. Great entrepreneurs emphasize qualities like motivation, innovation, passion, patience, balance, self-confidence, and embracing failure as a learning opportunity, rather than a setback. They focus on a long-term vision over quick riches, prioritizing customers and their product or service over investors and they always take some amount of risk. New founders of a venture/business can learn to adopt an entrepreneurial mindset, demonstrate unwavering commitment, be flexible and adaptable, maintain brilliant communication, and stay focused on providing value to the world to build a long-lasting, purposeful and successful business. Execution risk relates to the entrepreneur's ability to attract employees and partners who can implement the venture's plans. The potential of entrepreneurship to drive economic growth is significant, applicable to individual nations and the global landscape, provided that favorable conditions are in place and individuals pursue entrepreneurship with the appropriate motivations. Entrepreneurs, whether operating independently or collaboratively, identify opportunities within both their personal and professional spheres. They develop hypotheses regarding methods to provide value to customers and conduct systematic experiments to verify their concepts in 21st century, where technological advancement is crucial. Innovation and tech modernization frequently correlate with successful entrepreneurship. Many entrepreneurs bootstrap and they keep expenditures to a bare minimum while investing only their own time and their personal funds. In some cases, this is adequate to bring a new venture to the point where it becomes self-sustaining from internally generated cash flow. With most high-potential ventures, however, founders must mobilize more resources than they control personally and the venture eventually will require production facilities, distribution channels, working capital, and many more. This investigative paper will assess the life of great entrepreneurs around the globe and analyses their grooming, struggling and developing narrative along with their successful story and ideas for success of new entrepreneurs.

Keywords: Venture, Entrepreneur, entrepreneurship, innovation, technology, risk, success

1. Introduction

The English word entrepreneur originates from the French word "entreprendre," meaning "to undertake," which leaves considerable scope for creativity and significance in its application.²² Stevenson, widely known as an expert and a professor and pioneer in entrepreneurship studies at Harvard Business School (HBS), has defined entrepreneurship as the "pursuit of opportunity beyond resources controlled."²³ Entrepreneurship encompasses a diverse array of fields, including economics and incentives, markets, management and opportunity, processes, sociology and influence, norms, psychology and motivation, anthropology and history, values and culture, regionalism, regulation and firm structure, research and development, as well as technology and engineering, among others. **They develop hypotheses regarding methods to provide value to customers and conduct systematic experiments to verify their concepts.**²⁴ Tom Eisenmann, another HBS professor, explains that "beyond resources

controlled" means resource limitations. The founders of a new business are solely responsible for their own financial, social, and human resources at the outset. Many entrepreneurs employ a strategy known as "bootstrapping," in which they invest their own time and, if necessary, their personal funds, while keeping expenses to a minimum.²⁵ Stanford University's Stanford Center provides a little more straightforward definition for Professional Development: "At its core, entrepreneurship pertains to an individual or a small consortium of partners who embark on an innovative venture to establish a new business. An individual with entrepreneurial aspirations diligently pursues a specific business opportunity, taking on the highest level of risk linked to the endeavor. This individual is likely to benefit the most if the project is successful."²⁶ Joseph Schumpeter, a former professor at Harvard University and Austrian political

²² <https://link.springer.com/article/10.1007/s11301-020-00193-7>, accessed on 12 Sep 2025

²³ <https://www.amazon.com/Howards-Gift-Uncommon-Wisdom-Inspire/dp/1250004241/>, accessed on 12 Sep 2025

²⁴ <https://www.amazon.com/Howards-Gift-Uncommon-Wisdom-Inspire/dp/1250004241/>, accessed on 25 Sep 2025

²⁵ <https://hbr.org/2013/01/what-is-entrepreneurship>, accessed on 12 Jul 2025

²⁶ <https://online.stanford.edu/what-is-entrepreneurship>, accessed on 12 Jul 2025

economist and Finance Minister,²⁷ stated, "The fundamental impulse that keeps the capital engine in motion comes from the new consumers' goods, the new methods of production and transportation, and the new markets (which are known as the process) continually revolutionize from within, incessantly destroying the old one and incessantly creating a new one." The fundamental reality of capitalism is this process of Creative Destruction.²⁸ Entrepreneurship is widely recognized as a key driver of economic progress.²⁹ Entrepreneurship is a broad term that encompasses the initiation of a new venture. However, scholars and policymakers have been in controversy for an extended period regarding its precise definition. An entrepreneur is a person who starts a new venture, taking on the majority of the risks and receiving the majority of the rewards. Social entrepreneurship may endeavor to generate both financial gain and societal benefit; however, the outcomes are frequently inconsistent.³⁰ The history of the word entrepreneurship is fascinating and scholars have indeed parsed its meaning.³¹ Many profit improvement opportunities are not novel—and thus are not entrepreneurial—for example, raising a product's price or, once a firm has a scalable sales strategy, hiring more reps.³²

New entrepreneurs should create a business that makes a positive impact on the world, and the financial rewards will often follow. Financing risk relates to whether external capital will be available on reasonable terms. New entrepreneur's task is to manage this uncertainty, while recognizing that certain risks cannot be influenced by their actions.³³ Adam Smith's theory of economic growth is based on the notion that a country's prosperity is determined by its whole output, rather than just gold or agriculture. He thought that economic progress is driven by higher productivity, principally through labor division or work specialization and capital accumulation.³⁴ Smith's theory emphasizes free markets, competition, and self-interest as drivers of economic growth. Within this framework, entrepreneurial activity is a fundamental force for global development. Consequently, the study of entrepreneurship

has expanded beyond business and economics into numerous disciplines. This intellectual diffusion has resulted in a fractured, yet rapidly growing, field of study. Its academic origins are often traced to Joseph Schumpeter's arrival at Harvard University in 1932. In 1946, he established the Research Center for Entrepreneurial History in collaboration with Arthur Cole.³⁵ The next year, Myles Mace gave 188 Harvard Business School students what might have been the first entrepreneurship course in the United States.³⁶ Entrepreneurship education (EE) refers to specialized training designed to equip students with the knowledge, skills, and motivation to pursue entrepreneurial success across various disciplines. Since its inception, the integration of such programs within higher education has seen remarkable growth. Nevertheless, EE is accessible at all levels of education, from primary or secondary institutions to graduate university programs.³⁷

Entrepreneurs are passionate and fully engaged in everything they do. They believe in themselves, remain dedicated, and have strong confidence in their projects. At times, this focus and conviction may come across as stubbornness, but it is balanced by their dedication and consistent discipline.³⁸ When he has a deep passion for his work and the confidence to succeed, it is essential to pair it with disciplined execution. Successful entrepreneurs are known for their exceptional discipline, which in their chosen endeavors can often be compared to military-grade precision.³⁹ Being objective in his business is never easy, especially when he is deeply passionate about its success. However, it is essential to remain dispassionate and impartial when making decisions, as bias, sentiment, and emotion can ultimately lead to poor choices.⁴⁰ One of the most important qualities of entrepreneurs is self-discipline. Being self-disciplined means putting in the necessary work even when he doesn't feel like it. For those balancing a day job alongside a startup, this often involves working long hours to ensure the business receives the attention it needs to thrive. There will be times when he needs to motivate himself to wake up early or stay up late to

²⁷ Shionoya, Yuichi (2007). *Schumpeter and the Idea of Social Science: A Metatheoretical Study*. Cambridge University Press. p. 14. ISBN 978-0521037969, accessed on 12 Jul 2025

²⁸ Reisman, David A. (2004). *Schumpeter's Market: Enterprise and Evolution*. Cheltenham: Edward Elgar Publishing. p. 4. ISBN 978-1845420857, accessed on 12 Jul 2025

²⁹ <https://ageconsearch.umn.edu/record/49270/?ln=en#:~:text=Economic%20growth%20may%20have%20a,a%20larger%20number%20of%20people>, accessed on 12 Jul 2025

³⁰ "Entrepreneurship: A Survey of the Literature," David Audretsch, European Commission, 2003, accessed on 12 Jul 2025

³¹ Albulescu CT, Draghici A (2016) Entrepreneurial activity and national innovative capacity in selected European countries. *Int J Entrep Innov* 17:155–172, available at: <https://doi.org/10.1177/1465750316655902>, accessed on 25 Sep 2025

³² Acs ZJ, Audretsch DB, Lehmann EE (2013) The knowledge spillover theory of entrepreneurship. *Small Bus Econ* 41:757–774, available at: <https://doi.org/10.1007/s11187-013-9505-9>, accessed on 25 Sep 2025

³³ <https://hbr.org/2013/01/what-is-entrepreneurship>, accessed on 25 Sep 2025

³⁴ Spengler, J. J. (1959), 'Adam Smith's theory of economic growth Part II'. *Southern Economic Journal* 26, 1–12.

³⁵ Hughes, J. (1986), *The Vital Few: The Entrepreneur and American Economic Progress*. Oxford: Oxford University Press

³⁶ Katz, J. A. (2003), 'A chronology and intellectual trajectory of American entrepreneurship education: 1876–1999'. *Journal of Business Venturing* 18, 283–300, accessed on 12 Jul 2025

³⁷ <https://www.igi-global.com/dictionary/gender-and-entrepreneurship-in-developing-economies/72294>, accessed on 12 Jul 2025

³⁸ <https://ceoentrepreneur.com/are-successful-entrepreneurs-born-or-made/>, accessed on 14 Jul 2025

³⁹ Ruangkrit, S. and Thechatakerng, P. (2015). Characteristics of Community Entrepreneurs in Chiangmai. Thailand. *World Journal of Management*. 6(1): 58 – 74, accessed on 23 Aug 2025

⁴⁰ <https://quasa.io/media/34-characteristics-of-successful-entrepreneurs>, accessed on 23 Aug 2025

move his venture forward.⁴¹ While self-discipline is essential, it is equally important to maintain balance and avoid overworking to the point of burnout. Entrepreneurs also possess a growth mindset—the belief that skills and intelligence can be developed over time. While some qualities may come naturally to certain individuals, continuous personal development is what ultimately drives success. He can cultivate a growth mindset by reframing failure as a learning opportunity, recognizing his limitations, and setting clear goals for self-improvement.⁴²

Entrepreneurship can fuel economic growth under the right conditions and when people become entrepreneurs for the right reasons. It's not a magic bullet for economic growth, however, particularly in less-developed economies.⁴³ Technical, social and small product/industrial entrepreneurship can attempt to deliver both profits and societal good although often with mixed results.⁴⁴ The level of economic development of a country can affect whether entrepreneurship will lead to greater economic growth there. Entrepreneurship is related to starting a business. Its precise definition has long been a matter of debate among scholars and policymakers.⁴⁵ We live in an era in which innovation and entrepreneurship seem omnipresent and global in nature, particularly in the area like Silicon Valley or Research. But many metrics of economic growth, such as productivity growth and business dynamism, have been at best modest in recent years.⁴⁶ The resolution of this apparent paradox is dramatic heterogeneity across sectors, with some industries seeing robust innovation and entrepreneurship and others seeing stagnation.⁴⁷ By construction, the impact of innovation and entrepreneurship on overall economic performance is the cumulative impact of their effects on individual sectors. Understanding the potential for growth in the aggregate economy depends, therefore, on understanding the sector-by-sector potential for growth.⁴⁸ For successful en-

trepreneurs, competition often serves as a key motivator.⁴⁹ Competitiveness drives them to continually ask why customers would choose their business over others, and the answer lies in their ability to succeed. Good communication is crucial for exchanging information accurately, especially in today's fast-moving world, using various methods including both electronic and interpersonal channels.⁵⁰

New entrepreneurs need to cultivate confidence in their ideas and their ability to overcome challenges. Successful entrepreneurs are optimistic and consistently focus on the positive aspects of any situation. They strive to improve in everything they do, taking calculated risks and seeing opportunities in every challenge. Instead of dwelling on the negatives, an entrepreneur concentrates on the potential benefits and solutions.⁵¹ Entrepreneurship is never a one-person endeavor, even for solo entrepreneurs. No matter how skilled he is, the support of a talented and reliable team is essential. Without a capable team, entrepreneurs may fall behind on achieving their milestones.⁵² Having the right team can be a decisive factor in the success of a venture. Successful entrepreneurs typically begin any project with a strong team that helps them make a significant impact.⁵³ Trust and honesty is essential in business. Entrepreneurs with high integrity not only follow ethical practices but are also transparent and honest in all their interactions. This fosters trust and builds long-term relationships, which are crucial for business growth and sustainability. The business environment is constantly evolving, with new challenges arising regularly. New entrepreneur needs to remains flexible and adaptable, adjusting strategies based on feedback and changing circumstances while keeping their ultimate goals in focus.⁵⁴ This investigative paper will assess the life of great entrepreneurs around the globe and analyses their grooming, growth, struggling and developing narrative along with their successful story as entrepre-

⁴¹ Zhao, H., Seibert, S. E., & Hills, G. E. (2005). The mediating role of self-efficacy in the development of entrepreneurial intentions. *Journal of Applied Psychology*, 90(6), 1265–1272, accessed on 23 Aug 2025

⁴² <https://www.businesspartners.co.za/the-four-most-common-traits-of-successful-entrepreneurs-with-examples/>, accessed on 23 Aug 2025

⁴³ Atems B, Shand G (2018) An empirical analysis of the relationship between entrepreneurship and income inequality. *Small Bus Econ* 51:905–922. <https://doi.org/10.1007/s11187-017-9984-1>, accessed on 25 Sep 2025

⁴⁴ <https://www.nber.org/books-and-chapters/role-innovation-and-entrepreneurship-economic-growth>, accessed on 12 Sep 2025

⁴⁵ Alvarez SA, Barney JB (2014) Entrepreneurial opportunities and poverty alleviation. *Entrep Theory Pract* 38:159–184, available at: <https://doi.org/10.1111/etap.12078>, accessed on 25 Sep 2025

⁴⁶ Andersson M, Noseleit F (2011) Start-ups and employment dynamics within and across sectors. *Small Bus Econ* 36:461–483. <https://doi.org/10.1007/s11187-009-9252-0>, accessed on 25 Sep 2025

⁴⁷ Acs ZJ, Varga A (2005) Entrepreneurship, agglomeration and technological change. *Small Bus Econ* 24:323–334, available at: <https://doi.org/10.1007/s11187-005-1998-4>, accessed on 25 Sep 2025

⁴⁸ Acs ZJ, Armington C (2004) Employment growth and entrepreneurial activity in cities. *Reg Stud* 38:911–927, available at: <https://doi.org/10.1080/0034340042000280938>, accessed on 25 Sep 2025

⁴⁹ Thomke, S. H. (2020). *Experimentation works: The surprising power of business experiments*. Harvard Business Press

⁵⁰ <https://www.nu.edu/blog/skills-needed-to-be-an-entrepreneur/>, accessed on 23 Aug 2025

⁵¹ Zuzul, T., & Edmondson, A. C. (2017). The advocacy trap: When legitimacy building inhibits organizational learning. *Academy of Management Discoveries*, 3(3), 302–321, accessed on 23 Aug 2025

⁵² Zott, C., & Huy, Q. N. (2007). How entrepreneurs use symbolic management to acquire resources. *Administrative Science Quarterly*, 52(1), 70–105, accessed on 23 Aug 2025

⁵³ Carrie, M., Van Stel, A., Thurik, R., & Wennekers, S. (2002). Economic development and business ownership: an analysis using data of 23 OECD countries in the period 1976–1996. *Small Business Economics*. 19(3): 271–290, accessed on 23 Aug 2025

⁵⁴ <https://www.quora.com/What-are-some-qualities-of-a-great-business-owner-manager-What-makes-them-successful-and-what-can-we-learn-from-them-to-be-more-successful-ourselves>, accessed on 23 Aug 2025

neurs. This analytical article will evaluate entrepreneurship in global perspective on basis of the story of great entrepreneurs along with analysis of literature, history, lesson learn of successful entrepreneurs, their thought, story, life, along with discussion/connection of owner, CEOs, managers, of firm/organization (around the globe), professional, advisers, teachers, researchers, consultant, public and private government official, and many more. There will be discussion on the ideas and lessons from great entrepreneurs' life and which will be useful for new entrepreneurs success in 21st century.

2.1 Research Gap

In 21st century, an entrepreneur is a person who identifies a need or a want and starts a business to fill that void. And he/she provides little insight into the specific quality and attributes that makes his/her thrive as an entrepreneur and that is appropriate for anyone who is doing business in this era. Entrepreneurship is a critically important driver of economic development and has undergone significant changes over time. Traditional entrepreneurship relies on proven methods and heavily depends on established business models and personal savings. According to a Small Business Administration (SBA) study, 75% of traditional small businesses are funded through individual savings, loans, and grants. This approach typically involves physical locations and direct interactions with customers. Whereas modern entrepreneurship is different from traditional entrepreneurship. It is shaped by innovation and agility and uses technology and digital platforms. According to a report by Statista, 62% of startups use digital marketing as their primary way to get new customers. Today crowdfunding and venture capital are also crucial for successful entrepreneurs.⁵⁵ At a fundamental level, all entrepreneurs try to overcome adversity to pursue opportunity with limited resources. According to the U.S. Bureau of Labor Statistics (BLS) states that about 20% of new businesses fail in their first year, 30% within two years, 45% within five years, and 65% within ten years.⁵⁶ The road to success as entrepreneurs is often long and lonely, with brutal hours, massive amounts of stress, and lots of personal/family sacrifice and debt. The benefit to become entrepreneurs is very distinguished and prestigious as it gives us the freedom to become our own boss and the creator of our own future. Again, there exists a clear deficiency in comprehending understanding of **modern thinking of entrepreneurship along with** relation between technology and economic development with **entrepreneurship in modern era. We must know how to develop** contemporary entrepreneurs for success in

modern age. This discrepancy between theoretical frameworks and practical application reveals a significant gap. So, useful research may conduct to address the relation between technology and economic development with **entrepreneurship** as a global perspective. This investigative paper will evaluate the life of great entrepreneurs around the globe and analyses their life struggling and grooming narrative along with their successful story as entrepreneurs.

2.2 Research Questions

- What is the concept of entrepreneurship in historical and global perspective?
- What are the benefits and challenges of technology in 21st Century
- What are the story and narrative of (selective) great global entrepreneurs?
- What are the lessons of (selective) great global entrepreneurs for new entrepreneurs?
- How to develop of new entrepreneurs for success in 21st century?

3. Literature Review and Methodology

There is a comprehensive understanding of the activities that entrepreneurs undertake and the genuine factors that drive a venture to succeed is not currently available. This evaluation and summary of current scholarship is based on a methodical review of literature encompassing several hundred empirical studies and an examination of the biographies of several hundred prosperous entrepreneurs, connecting their actions and cognition to business outcomes. Theories of behaviorism, for instance, those put forward by Watson (1924)⁵⁷ and Skinner (1953)⁵⁸, contend that an individual's traits are molded by their surroundings and processes of learning. The capacity for people to develop entrepreneurial abilities by building confidence and learning from their actions is emphasized in Bandura's (1977)⁵⁹ concept of self-efficacy. The viewpoint that entrepreneurial competencies are acquired through formal education, mentorship, and experiential learning is supported by contemporary research⁶⁰. Furthermore, current analyses emphasize the way expertise within an industry and professional connections boost entrepreneurial achievement, particularly for more mature entrepreneurs, which strengthens the idea that entrepreneurship is developed progressively.⁶¹ Although some innate personality characteristics might provide a benefit, the field of entrepreneurship is mainly formed by acquired knowledge, hands-on experience, and external influences. The conclusion that entrepreneurs are more often made than born is supported by many academic literatures.⁶²

⁵⁵ <https://eimrglobal.org/traditional-entrepreneurship-vs-modern-entrepreneurship/>, accessed on 25 Sep 2025

⁵⁶ https://www.bls.gov/bdm/us_age_naics_00_table7.txt, accessed on 25 Sep 2025

⁵⁷ Watson, John B. (1913). "Psychology as the Behaviorist Views It". *Psychological Review*. 20 (2): 158–177. doi:10.1037/h0074428. hdl:21.11116/0000-0001-9182-7. S2CID 145372026, accessed on 08 Aug 2025

⁵⁸ Skinner, B. F. (1972). *Beyond Freedom and Dignity*. Vintage Books. ISBN 978-0-553-14372-0. OCLC 34263003, accessed on 13 Sep 2025

⁵⁹ Bandura, A. (2006). "Toward a Psychology of Human Agency". *Perspectives on Psychological Science*. 1 (2): 164–

80. doi:10.1111/j.1745-6916.2006.

00011.x. PMID 26151469, accessed on 08 Aug 2025

⁶⁰ Nicholls-Nixon, C., & L., Cooper, A. C., & Woo, C. Y. (2000). Strategic experimentation: Understanding change and performance in new ventures. *Journal of Business Venturing*, 15(5), 493–521. [https://doi.org/10.1016/S0883-9026\(98\)00018-4](https://doi.org/10.1016/S0883-9026(98)00018-4), accessed on 08 Aug 2025

⁶¹ <https://ideas.repec.org/top/top.country.downloads.html>, accessed on 08 Aug 2025

⁶² Shane, S., & Venkataraman, S. (2010). The promise of entrepreneurship as a field of research. *The Academy of Management Review*, 25(1), 217–226, accessed on 08 Aug 2025

The utilization of literature reviews as a formal research methodology holds increased relevance and critical importance within modern fields of study such as entrepreneurship. Conventional approaches to reviewing literature frequently suffer from a lack of rigor and systematic process, being performed in an ad hoc manner without adherence to a defined procedure.⁶³ These reviews fulfill a vital function as a foundational element for all research endeavors. They are capable of acting as a platform for the advancement of knowledge, establishing frameworks to guide policy and practice, and furnishing proof of an effect; when executed proficiently, they also possess the potential to generate novel concepts and trajectories for a specific discipline.⁶⁴ Furthermore, they provide the foundational justification for subsequent research and theoretical development. When confidence exists that an investigation is constructed upon a base of high accuracy, it becomes significantly more feasible to pinpoint genuine gaps in the research rather than perpetually replicating previous studies, to formulate superior and more exact hypotheses and questions, and, as a result, to elevate the collective standard of research quality.⁶⁵ Consequently, it is essential to maintain a clear research question from the outset and to guarantee the selection of an appropriate methodological approach to address the specific research problem.

This paper of the process involves a careful examination of different studies including literature. The focus is on the methods they used, like research on twins and the study of personality traits. Along with the literature review, a content analysis is also done. This analysis uses a collection of important publications about entrepreneurship. These include works by famous experts like Drucker (1985)⁶⁶, Gladwell (2008)⁶⁷, and Sarasvathy (2001)^{68, 69}. Interviews and case studies of successful entrepreneurs are also used. These provide real-life examples of how experience and networks are important for success.⁷⁰ A wide range of literature on entrepreneurship has been thoroughly reviewed, including both the history of entrepreneurship and contemporary views from academic and practical perspectives. This paper presents the key literature used to support the conclusions. Again, Harvard Business School has made a significant impact on the field of entrepreneurship through historical research and the development of

various schools of thought. The institution's emphasis on business history, notably via the Harvard Research Center in Entrepreneurial History, has influenced perceptions of entrepreneurial functioning within extensive economic and social frameworks. In addition, Harvard professors have developed ideas such as the "Harvard School" hypothesis, which examines how internal and external factors interact to facilitate entrepreneurial success.⁷¹ This Harvard Business School center played a pivotal role in promoting research on the historical role of entrepreneurs. Entrepreneurship as a historical phenomenon has been dramatically influenced by historians affiliated with the center, such as Arthur Cole and Joseph A. Schumpeter.⁷² The center's research examined how entrepreneurship has evolved over time and how entrepreneurs have impacted economic growth and social transformation in various periods. This historical approach offered significant insights into the enduring patterns and dynamics of entrepreneurship, influencing both scholarly study and pragmatic commercial practices.⁷³ Harvard has made numerous contributions to entrepreneurship, including the development of theoretical frameworks, historical research, and hands-on educational initiatives. This comprehensive strategy has solidified Harvard's standing as a preeminent university in the field.

In 21st century, a new wave of entrepreneurship research was sparked by Schumpeter's theory of economic development and the notion of entrepreneurship that was part of it. However, reactions from twentieth-century writers have been fairly divergent. At Harvard University, Schumpeter's academic foundation in the United States gave rise to a tradition of studying entrepreneurship through the lens of economic history. Other scholars have focused on the analytics of Schumpeter's theory, namely, whether the entrepreneur is an equilibrating or disequilibrating force. Other writers distinguish themselves along neoclassical and Austrian lines. In this section, we will explore and discuss the various methods, as well as the writers who developed them. Following Schumpeter's examination of economic history, a tradition of historical studies of entrepreneurship emerged at Harvard University's Research Center in Entrepreneurial History, founded by Arthur

⁶³ Boyd and Solarino, 2016 B.K. Boyd, A.M. Solarino Ownership of corporations: A review, synthesis, and research agenda *Journal of Management*, 42 (2016), pp. 1282-1314, 10.1177/0149206316633746, accessed on 27 Sep 2025

⁶⁴ Carlborg et al., 2014 P. Carlborg, D. Kindström, C. Kowalkowski The evolution of service innovation research: A critical review and synthesis *The Service Industries Journal*, 34 (5) (2014), pp. 373-398, 10.1080/02642069.2013.780044, accessed on 27 Sep 2025

⁶⁵ Covington, 2000 M.V. Covington Goal theory, motivation, and school achievement: An integrative review *Annual Review of Psychology*, 51 (2000), pp. 171-200, 10.1146/annurev.psych.51.1.171, accessed on 27 Sep 2025

⁶⁶ Drucker, P. F. (1985). *Innovation and Entrepreneurship*. Harper & Row, accessed on 27 Sep 2025

⁶⁷ Gladwell, M. (2008). *Outliers: The Story of Success*. Little, Brown and Company, accessed on 27 Sep 2025

⁶⁸ Sarasvathy, S. D. (2001). Effectuation: Toward a theory of entrepreneurial expertise. *The Academy of Management Review*, 26(2), 243-263, accessed on 27 Sep 2025

⁶⁹ Wilkinson, A. (2015). *The Creator's Code: The Six Essential Skills of Extraordinary Entrepreneurs*. Simon & Schuster, accessed on 27 Sep 2025

⁷⁰ Kotler, S. (2021). *The Art of Impossible: A Peak Performance Primer*. Harper Wave, accessed on 27 Sep 2025

⁷¹ <https://www.rethinkingentrepreneurship.com/entrepreneurship-annotated-bibliogr/three-waves-of-research-on-historical-entrepreneurship>, accessed on 10 June 2025

⁷² https://www.researchgate.net/publication/39731185_A_Conceptual_History_of_Entrepreneurial_Thought#,

⁷³ <https://www.sbs.strath.ac.uk/newsletter/2022-11/09.asp#>, accessed on 12 Sep 2025

H. Cole (1889–1974).⁷⁴ Edwin influenced Cole's interest in entrepreneurship and his views on the subject. F. Gay (1867–1946), founder of the Economic History Association and a follower of Schumpeter. The entrepreneur, as a destabilizing force of change, holds a significant position in Gay's philosophy of history, which posits that the degree of allowable free competition in society fluctuates according to social necessity. In this system of free competition, the entrepreneur is a self-centered actor and a disruptive force, as noted by Gay (1923–1924),⁷⁵ "there are periods in the rhythm of history when ... that disruptive, innovating energy is socially advantageous and must be given freer opportunity." Entrepreneurs create history, according to G. L. S. Shackle (1903–1992), who lived across the Atlantic. Shackle concentrated on the psychological process of making decisions in the business environment.⁷⁶ Shackle (1955) defined two tasks that must be performed early on in his inquiry into the character and substance of economic businesses. One deals with uncertainty, and the other makes choices. These two jobs are connected because making decisions requires improvisation or innovation, which can only occur in a world full of unknowns and uncertainties. Shackle was at his finest when he explained what business decisions are and how people might act within them. He was a smart Marshallian who criticized orthodox economic theory for not recognizing Marshall's most important finding: the importance of time in the realm of affairs. Shackle claimed that time weaves a historical tapestry, and the strands of that tapestry are the results of people's choices. Consequently, "we assume that we bear responsibility for our actions; that these actions are fundamentally creative, initiatory, and the origin of historical innovation; that each action represents, in a sense, the independent commencement of a new thread in the tapestry woven by time" (Shackle, 1966, p. 73).⁷⁷

Shackle perceives his study as an extension of a Keynesian issue, specifically the factors influencing corporate investment. He discovered a fundamental discrepancy within the Keynesian framework. He referred to Keynes's General Theory as "a paradox, for its central concern is with uncertainty, decisions based on conjecture, and situations altogether lacking in objective stability, yet it uses an equilibrium method" (Shackle, 1955, p. 222).⁷⁸ In reaction to this anomaly, Shackle jettisons the equilibrium method – a radical stroke which probably accounts for the failure of mainstream economics to take him more seriously. Shackle's faithful followers are relatively few. The most prominent is Ludwig Lachmann, who also exhibits strong Austrian tendencies. Nobel laureate T. W.

Schultz (1902–1998)⁷⁹ has advanced a theory of entrepreneurship that is fully within the neoclassical paradigm. In contemporary economic literature, Schultz observes a persistent failure to recognize the benefits that accrue to those who facilitate economic equilibration, particularly in nonmarket activities. Schultz, a pioneer in the human capital theory, approached entrepreneurship from this perspective. He criticized the conventional concept and treatment of entrepreneurship on four primary grounds: (1) the concept is typically limited to businessmen, (2) it fails to account for the differences in allocative abilities among entrepreneurs, (3) the supply of entrepreneurship is not treated as a scarce resource, and (4) entrepreneurship is disregarded when general equilibrium considerations dominate economic inquiry (Schultz, 1975, p. 832).⁸⁰ Schultz made two significant moves. He began by redefining entrepreneurship as "the ability to deal with disequilibria," and he expanded the idea to include both market and nonmarket activities (such as time allocation and family decisions). Second, he presented data showing how education affects people's perceptions and responses to disequilibrium. He maintained that Schumpeter's formulation fell short. "If economic growth is considered 'progress,'" stated Schultz (1975, p. 832),⁸¹ "it is a process beset with various classes of disequilibria." Schumpeter's entrepreneur "creates developmental disequilibria," but he did not effectively apply this concept to "all manner of other disequilibria," such as laborers reallocating their labor, or students, housewives, and consumers reallocating their resources, primarily time. In the 1930s, several second-generation Austrian economists left Europe before the ominous shadow of Hitler's Third Reich spread across the continent. Friedrich Hayek (1889–1992)⁸² went to London. Ludwig von Mises (1881–1972)⁸³ and Joseph Schumpeter, both students of B. Böhm-Bawerk, came to America. Schumpeter soon found a place to work in the United States, while Mises had a hard time. He eventually became a professor at New York University as part of a unique agreement. There, he became the leader of Austrian economics, reaching out to a small but smart group of students and supporters.

The concept of a standard supply curve for entrepreneurial talent emerged as a significant point of debate between Kirzner (1979)⁸⁴ and Schultz. Schultz

⁷⁴ Cole, A. H. (1946), 'An approach to the study of entrepreneurship: A tribute to Edwin F. Gay'. *Journal of Economic History* 6, 1–15, accessed on 10 June 2025

⁷⁵ Gay, E. F. (1923–1924), 'The rhythm of history'. *Harvard Graduates' Magazine* 32, 1–16, accessed on 10 June 2025

⁷⁶ Shackle, G. L. S. (1966), *The Nature of Economic Thought*. Cambridge: Cambridge University Press

⁷⁷ Ibid

⁷⁸ Ibid

⁷⁹ Schultz, T. W. (1980), 'Investment in entrepreneurial ability'. *Scandinavian Journal of Economics* 82, 437–448, accessed on 10 June 2025

⁸⁰ Schultz, T. W. (1975), 'The value of the ability to deal with disequilibria'. *Journal of Economic Literature* 13, 827–846, accessed on 10 June 2025

⁸¹ Ibid

⁸² Hughes, J. (1986), *The Vital Few: The Entrepreneur and American Economic Progress*. Oxford: Oxford University Press

⁸³ von Mises, L. (1949), *Human Action: A Treatise on Economics*. New Haven, CT: Yale University Press

⁸⁴ Kirzner, I. M. (1979b), *Perception, Opportunity, and Profit: Studies in the Theory of Entrepreneurship*. Chicago: University of Chicago Press

(1980, p. 439)⁸⁵ criticized Kirzner for neglecting entrepreneurship as a scarce resource (i.e., failure to treat it in terms of a supply curve). According to Kirzner, entrepreneurship, or attentiveness, is a human quality that can exist or not.⁸⁶ Kirzner believes that awareness, like beauty, cannot be substantially enhanced once nature has conferred its particular allotments. Despite their basic disagreement, Kirzner and Schultz's theories address several crucial concerns.⁸⁷ Both authors regard the entrepreneur as an individual who identifies the potential for profit in a state of disequilibrium and responds accordingly. Both of them think that the idea is quite important and covers a lot more ground than it has been shown to do in economic writing up to this point. The distinctions between the two theories are predominantly established on methodological rather than analytical criteria. Kirzner and other neo-Austrian economists offer a theoretical alternative to neoclassical economics' general equilibrium paradigm. Their perspective emphasizes change, inaccuracy, and defects in markets and human decision-making, rejecting the comparative-statics, perfect-markets view of economic activity. Their challenge to the prevailing paradigm is not the only one, however, as we have demonstrated that Clark, Schumpeter, and Shackle have all made successful attempts to critique and offer alternative perspectives on the neoclassical framework. The concept of X-efficiency, developed by Harvey Leibenstein (1922-1994)⁸⁸, is another contemporary challenge that has emerged from outside the German group. Leibenstein's paradigm appears to converge with Austrian theory at several crucial points; yet, neo-Austrian theorists have expressed reservations over its analytical efficacy. Neo-Austrians often regard Leibenstein's concept of entrepreneurship as only an intriguing aspect of the economic landscape, rather than a fundamental component of the economic process. Kirzner (1979a, p. 142)⁸⁹ has written that Leibenstein's entrepreneurship "is a feature that indeed seems to come into focus when observed through the X-efficiency lens, but the X-efficiency paradigm can be presented without any special reference to entrepreneurs." Neo-Austrians, on the other hand, see the entrepreneur as the key to comprehending all economic events. The entrepreneur's thoughts and actions elucidate the occurrences within the disequilibrium situation. Schumpeter's theory of economic growth, which emphasized the role of the entrepreneur, led to several studies at Harvard University and beyond that sought to contextualize the entrepreneur within a historical framework. However, over the majority of the 20th century, ideas regarding the nature

and function of entrepreneurship predominantly concentrated on one of two issues: the dichotomy between risk and uncertainty, or the contrast between equilibrium and disequilibrium.

Now we are in 21st century, these problems remain largely unsolved. Still, writers in the 20th century tended to broaden the definition of entrepreneurship to the point where practically any economic action that involves uncertainty or changing disequilibria has some entrepreneurial aspect. There are two fundamental explanations offered by economic theory and tradition for why things are produced and distributed in the ways that they are. According to one theory, the pricing mechanism serves as the integrative force and resource allocator in a market economy. According to another, this role is carried out by the entrepreneur. Ronald Coase (1910–1975) was the first economist to question why the entrepreneur, an integrating force, should replace the price system and economic development of nation and globe. In a pioneering article, *The Nature of the Firm*, Coase (1937)⁹⁰ questioned why firms are commonly used as resource allocation mechanisms, when economic theory dictates that the price mechanism is an efficient allocator in competitive markets. If the competitive price system is an efficient allocator of resources, why do we have firms? And given that firms exist, does their presence imply market failure or the absence of competition? On the other hand, Arrow (1974)⁹¹ and Williamson (1975),⁹² Some people have said that the existence of economic organizations shows that the market isn't working. Coase utilized the Marshallian theory of substitution at the margin to examine the internal dynamics of organizations in addressing these inquiries. He said that businesses exist because the price system makes things more expensive, but administrative procedures can make them less costly or even eliminate them. There are many other types of costs, but to Coase, the most important one was the cost of determining the right prices in a market system.⁹³ The majority of the other expenditures he discovered are contract and transaction costs for various exchanges. According to Coase, production can be arranged via the pricing mechanism, an impersonal method of resource allocation, or a company's administrative channels under the direction of one or more people we'll refer to as entrepreneurs. Malmgren's (1961) careful exposition of the costs associated with allocating resources through the price system improved Coase's analysis. Uncertain input pricing and market flaws are the main causes of these expenses. Malmgren (1961, p. 399)⁹⁴ concluded that "the market operates

⁸⁵ Schultz, T. W. (1980), 'Investment in entrepreneurial ability'. *Scandinavian Journal of Economics* 82, 437–448, accessed on 10 June 2025

⁸⁶ Kirzner, I. M. (1973), *Competition & Entrepreneurship*. Chicago: University of Chicago Press

⁸⁷ Kirzner, I. M. (1985), *Discovery and the Capitalist Process*. Chicago: University of Chicago Press

⁸⁸ Leibenstein, H. (1979b), 'The general X-efficiency paradigm and the role of the entrepreneur'. In *Time, Uncertainty and Disequilibrium*, Rizzo, M. (ed.). Lexington, MA: D. C. Heath, accessed on 10 June 2025

⁸⁹ Kirzner, I. M. (1979a), 'Comment: X-inefficiency, error, and the scope for entrepreneurship'. In *Time, Uncertainty and*

Disequilibrium, Rizzo, M. (ed.). Lexington, MA: D. C. Heath, accessed on 10 June 2025

⁹⁰ Coase, R. H. (1937), 'The nature of the firm'. *Economica* N.S. 4, 386–405, accessed on 10 June 2025

⁹¹ Arrow, K. J. (1974), *The Limits of Organization*. New York: W. W. Norton

⁹² Williamson, O. E. (1975), *Markets and Hierarchies*. New York: The Free Press

⁹³ Williamson, O. E. (1985), *The Economic Institutions of Capitalism*. New York: The Free Press

⁹⁴ Malmgren, H. B. (1961), 'Information, expectations and the theory of the firm'. *Quarterly Journal of Economics* 75, 399–421, accessed on 10 June 2025

between firms, but the entrepreneur is the planning and coordinating agent within the bounds of any one firm.” Unlike Coase, he emphasized uncertainty, but confined it to input prices and quantities. Both Coase and Malgrem considered the final end of the production process as fixed, so the entrepreneur’s judgment in either case does not extend to the choice of which product to produce.

According to Knight, the rise of the entrepreneur class brings about major changes in the basic form of business organization of a nation. When things are unpredictable, a firm cannot simply leave the organization to chance or rely on a simple formula. Business owners must make their own choices. Companies must recognize that individuals differ in terms of intelligence, judgment, and willingness to take risks. To make informed decisions, a successful firm needs to establish an effective organizational structure. Knight (1921, pp. 269–270) states that it achieves this by encouraging the brave and confident to confront the danger that the unsure and scared wish to avoid. In short, entrepreneurs “insure” the latter group by promising them a certain amount of money in exchange for a percentage of the business’s profits. The Knightian firm exists because the real world doesn’t meet all of the conditions for competitive equilibrium that economic theory says it should. Knight believed that the price system is good at dividing up resources between different uses, but it doesn’t set the pattern of those uses. Entrepreneurs do that. So, the heart of entrepreneurship is making decisions based on not knowing what will happen. “Any degree of effective exercise of judgment, or making decisions,” Knight (1921, p. 271)⁹⁵ wrote, “is in a free society coupled with a corresponding degree of uncertainty-bearing, of taking the responsibility for those decisions.” The entrepreneur’s collateral promises of set compensation to resource suppliers are an expression of this obligation. Knight shared Schumpeter’s interest in elucidating the nature of economic advancement in a market system, which is primarily composed of businesses and entrepreneurs. He used the term “firm” to refer to a fundamental type of business structure where the entrepreneur assumes responsibility, control, and direction. According to Knight (1921, p. 353), contracting alone does not fully represent the role of the entrepreneur⁹⁶ because “In the world as it is the interests affected by contracts are never all represented in the agreements.” Knight thinks that entrepreneurs are more than just contractors. They are experts at dealing with uncertainty, and while the contract is one way to lessen it, some ambiguity can never be fully removed. Knight (1921, p. 283) posits that the number of enterprises is contingent, among other factors, on the availability of entrepreneurial abilities. Knight’s thesis provided a fair analysis of the roles that risk-taking and risk-management play. Because it did not restrict the firm’s ability to offer interim guarantees to its owners,

it established a broad class of entrepreneurs. In fact, finding the role of ultimate control in a Knightian company may require a significant climb up the management structure.

Knight stated that selecting the individuals who will make the necessary decisions to run the company is the key responsibility of management. A hierarchy of functionaries serves as the fundamental framework for the decision-making organization, with individuals at each higher level appointing the functionaries below them. Therefore, each functionary transfers economic responsibility to a higher level until it ultimately falls on the controlling functionaries (i.e., the guarantors of the contractual remuneration of resource suppliers) by leaving the repercussions of their actions to their selectors. For Knight (1921),⁹⁷ only this last decision is crucial; all subordinate decisions are routine, and consequently, non-entrepreneurial. Some researchers viewed that companies that operate well tend to develop, and bigger companies tend to have strict standards on how people should act. The notion of the corporation as the entrepreneur is likely to face opposition based on methodological individualism. Stauss (1944, p. 126)⁹⁸ rejected the notion that the firm is a mere aggregation of decision makers having a collective will be expressed through a system of working rules. Instead, he suggested treating the company as an accounting entity for the sake of general economic research and as a specific, tangible organization when addressing particular difficulties. However, he did not clarify how to make this dual concept of the company operative in economic theory, and it is nearly impossible to detect any indication of Stauss’s influence on other authors after more than 40 years. Therefore, in the first half of the 20th century, there was a significant debate over the distinction between the entrepreneur and the firm, as well as whether they could be interchangeable. These issues remain a topic of debate among modern economists. Since the idea of personality different from humans is resisted in most places, the sentiment appears to be maintaining a distinction—albeit an imprecise one—rather than combining the two into one. The relationship—whether symbiotic or not—between the entrepreneur and the type of business organization in which he operates has been brought to light by the controversy surrounding this topic.

Drucker’s earliest and favorite mentor was his father’s acquaintance, the Austrian economist Joseph Schumpeter, who instilled in Drucker the value of creativity and entrepreneurship.⁹⁹ Peter Drucker fought for the rights and well-being of all people throughout his long and successful career. Drucker believed that everyone should be treated with respect, have a sense of dignity, a significant role in society, and some freedom. Drucker also advised managers that while caring for employees is vital, productivity and success are what ultimately drive businesses forward (Murphy 2023).¹⁰⁰

⁹⁵ Knight, F. H. (1921), *Risk, Uncertainty and Profit*. New York: Houghton Mifflin, accessed on 10 June 2025

⁹⁶ Ibid

⁹⁷ Ibid

⁹⁸ Stauss, J. H. (1944), ‘The entrepreneur: The firm’. *Journal of Political Economy* 52, 112–127, accessed on 10 June 2025

⁹⁹ Beatty, Jack (1998). *The World According to Peter Drucker*. The Free Press. ISBN 978-0-684-83801-4, accessed on 14 Jul 2025

¹⁰⁰ Murphy, Glenn (2023). *Delivering on Drucker’s Call to Action*. *Strategic Finance*, Volume 104, Issue 7, Jan. 2023, accessed on 10 June 2025

Drucker states that successful entrepreneurs are committed to making innovation work and that innovation is the very foundation of entrepreneurship. He thought that innovation isn't so much about being smart as it is about finding and taking advantage of opportunities to be innovative (Drucker 2013).¹⁰¹ To highlight Drucker's view that successful organizations are creative and productive and contribute immensely to economic development. Drucker narrates entrepreneurship as "any business that engages in innovation," not simply small or new enterprises. Innovation is the attempt to make meaningful, targeted changes to a business's economic or social potential. In other terms, innovation is change that leads to greater results. One may argue that Drucker sees innovation and entrepreneurship as synonymous. In his essay titled *The Discipline of Innovation* (Drucker 2013),¹⁰² Drucker states that most successful innovations result from a conscious, purposeful search for innovation opportunities. Within a business or industry, Drucker identifies seven areas of potential. These include: unexpected events, inconsistencies, procedure requirements, Market and industry shifts, demographic shifts, perception shifts, and new information. The development of the first modern accounting computer by IBM in the early 1930s is an example of an unexpected event. Although banks were not purchasing new equipment at the time, it was developed with them in mind. Luckily, one of the devices was purchased by the New York Public Library. As a result, additional libraries purchased over 100 machines. Rather than losing money, IBM's success increased. Drucker provides further examples of unforeseen events that led to profitable inventions. Because mistakes or problems can lead to valuable inventions, Drucker advises firms to concentrate as much on arising problems as on possible opportunities in their monthly and quarterly reports.

Many renowned researchers found that the skill to create new things, take chances, and lead well is built through focused effort and constant learning. This supports the idea that entrepreneurs are made, not born.¹⁰³ Some people say today's great entrepreneurs, like Elon Musk, had an easy start. Others say genes are not important. Musk himself said, 'I believe the simple answer to the age-old question is that entrepreneurs are made, not born.' To be successful, entrepreneurs need education (which does not have to be formal) and experience. These are not qualities a person is born with. We all know stories about big companies that failed when the children of the founder took over. Other people did not get a business from their family and were not born rich. They started with nothing and learned how to build a successful business.¹⁰⁴ Skills for entrepreneurship are viewed as very important for a business to grow and

succeed. In fact, government groups and others use the idea of entrepreneurial skills in their work to help the economy and business. However, the main idea of these skills, how to measure them, and how they connect to business performance needs more careful research and use in the real world.¹⁰⁵ This paper presents a complete learning material for all entrepreneurs. It is for young or old; small or big; new or experienced; public or private; just starting or finishing. It is for any entrepreneurship or venture to help them succeed and handle challenges, struggles, risk, and failure. To answer the research questions well, this study uses a mixed-method design. It combines both qualitative and quantitative methods. It also uses serious and wide reading of previous literature and studies. This gives a full understanding of entrepreneurship and entrepreneur quality around the world.¹⁰⁶ This paper also talks about important insights with through reviewing literature and focused group discussions. It also includes a critical study and their views of all-time great entrepreneurs from around the globe. The study looks at their life, struggle, education, thoughts, views, ideas, and advice. This can show the path for modern entrepreneurial activities to ensure lasting economic growth and development. To effectively address the research questions, this study adopts a mixed-method research design, integrating both qualitative and quantitative approaches along with serious and extensive literature and previous studies to provide a multi-dimensional understanding of entrepreneurship and its relation with technology and economic development in a global context. It is an analytical article and it will evaluate the relation of entrepreneurship with economic growth and technology as a global viewpoint. This paper will also discuss about the development of entrepreneurs in technological enhancement in the modern era.

3.1 Secondary Data Collection and Analysis of Historical Concept

Comprehensive desk research was conducted to collect secondary data from authoritative sources such as literature, books, journals, recent studies, successful entrepreneurs' experiences of local and global entrepreneurs along with own experience and perspective as

¹⁰¹ Drucker, Peter (2013). *The Discipline of Innovation* Chapter in *On Innovation*, Harvard Business Review, 2013,

¹⁰² Ibid

¹⁰³ <https://ideas.repec.org/a/ajn/abrjou/v10y2025i3p45-49id315.html>, accessed on 12 Aug 2025

¹⁰⁴ Aparicio, S., Urbano, D. and Audretsch, D., 2016. 'Institutional factors, opportunity entrepreneurship and economic growth: panel data evidence', *Technological Forecasting and Social Change*, 102: 45–61 <https://doi.org/10.1016/j.techfore.2015.04.006>, accessed on 29 Sep 2025

¹⁰⁵

<https://www.emerald.com/ijebr/article-abstract/16/2/92/119106/Entrepreneurial-competencies-a-literature-review?redirectedFrom=fulltext>, accessed on 12 Aug 2025

¹⁰⁶ Atems, B. and Shand, G., 2018. 'An empirical analysis of the relationship between entrepreneurship and income inequality', *Small Business Economics*, 51: 905–922 <https://doi.org/10.1007/s11187-017-9984-1>, accessed on 29 Sep 2025

both an academicians and an industry operators as chairman/MD.^{107,108,109,110,111,112,113,114,115} The data and information were critically analyzed to benchmark local and global performance against global successful entrepreneurs and identify the important and driving traits and gaps. This step is essential in answering Research Question b, c, d and e regarding structural and strategic differences. The evolutions of global entrepreneurship concept and practice as well as relation with technological advancement and economic development along with available literatures have been studied to identify key qualities to become successful entrepreneurs. This involved analyzing huge literatures, academic studies, policy papers, journal, articles, reports, news, and information from social and online media.^{116,117,118,119,120,121,122,123,124} Those are analyzed and evaluated to find out the answer of related Research Questions and lesson for new entrepreneurs for their success in 21st century.

3.2 Focus Group Discussions (FGDs)

Three semi-structured focus group discussions, interviews, suggestions, advices, were conducted with more than 150 participants, including senior, mid and lower-level manager/executive like chairman, managing directors, directors, managers, both public and private firms and industries. Participants were selected through purposive sampling to ensure diversity of perspectives. Each session followed a thematic guide exploring perceptions of global competitiveness, infrastructure gaps, labor force readiness, and policy expectations. Content from the sessions was transcribed, coded using NVivo software, and analyzed through thematic pattern recognition to identify dominant issues

relevant to the research questions along with individual both face to face and online discussion in different occasion and meeting. Owner of firm/organization/entrepreneurship professional, advisers, teachers, researchers, consultant, public and private government official, and many more are consulted vigorously. Local and international business and industry owners and operators are also given their views and participate in the discussion. Economic, marketing, technical, financial and managerial aspects are also discussed. Those finding are evaluated to find out the answer of Research Question a, c, d and e along with evaluated knowledge and result.

4. Definition and Concept of Entrepreneurship

Entrepreneurship involves the generation or extraction of economic value, typically requiring a level of risk that exceeds that associated with conventional business practices, and may also encompass values beyond mere economic considerations. Conversely, the term entrepreneur originates from the French language and refers to an individual who establishes and/or invests in one or more businesses, assuming the majority of the risks while reaping the majority of the rewards.¹²⁵ The entrepreneur is often seen as an inventor who generates new ideas, products, services, and business or methods. The process of starting a business is known as entrepreneurship.¹²⁶ Entrepreneurship may be defined as "a process through which individuals and/or government either on their own or jointly exploit available economic opportunities without being scared by associated risks or inadequate resources under their

¹⁰⁷ Collins, J. and Moore, D. (1970) *The Organization Makers*, Appleton-Century-Crofts, New York, 1970

¹⁰⁸ Opcit Peter Drucker, (1970)

¹⁰⁹ Gold, Steven K (2005) "Entrepreneur's Notebook" Learning Ventures Press, 2005

¹¹⁰ Hebert, R.F. and Link, A.N. (1988) *The Entrepreneur: Mainstream Views and Radical Critiques*. New York: Praeger, 2nd edition

¹¹¹ Israel Kirzner, (1997) 'Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach', *Journal of Economic Literature* 35: 60-85, accessed on 29 Sep 2025

¹¹² Shane, S and Venkataraman, S (2000), 'The Promise of Entrepreneurship as a Field of Research', *Academy of Management Review* 25(1): 217-226, accessed on 29 Sep 2025

¹¹³ Deakins, D.; Freel, M. S. (2009). "Entrepreneurial activity, the economy and the importance of small firms". *Entrepreneurship and small firms*. McGraw-Hill Education. ISBN 978-0-07-712162-4, accessed on 29 Sep 2025

¹¹⁴ Almeida, Felipe; De Paula, Nilson; Pessali, Huascar (2014). "Institutional entrepreneurship in building the Brazilian market of functional yogurts". *British Food Journal*. 116: 2–15. doi:10.1108/BFJ-02-2012-0028, accessed on 29 Sep 2025

¹¹⁵ Landstrom, H. (2007). *Pioneers in Entrepreneurship and Small Business Research*. Springer. ISBN 978-0-387-23633-9, accessed on 29 Sep 2025

¹¹⁶ Lumpkin, GT and Dess, GG (1996) 'Clarifying the Entrepreneurial Orientation Construct and Linking it to Performance', *Academy of Management Review* 21(1): 135-172, accessed on 29 Sep 2025

¹¹⁷ Pinchot, G. (1985) *Intrapreneuring*, Harper and Row, New York, 1985

¹¹⁸ Joseph Schumpeter, (1950) *Capitalism, Socialism, and Democracy*, 3rd edition, Harper and Row, New York, 1950

¹¹⁹ Shane S., (2003) *A general theory of entrepreneurship: the individual-opportunity nexus in New Horizons in Entrepreneurship series*, Edward Elgar Publishing, accessed on 29 Sep 2025

¹²⁰ Stevenson, HH and Jarillo, JC (1990) 'A Paradigm of Entrepreneurship: Entrepreneurial Management', *Strategic Management Journal* 11: 17-27, accessed on 29 Sep 2025

¹²¹ Scott A. Shane (2008). "7". *The Illusions of Entrepreneurship: The Costly Myths That Entrepreneurs, Investors, and Policy Makers Live By*. Yale University Press. ISBN 978-0-300-15006-3, accessed on 29 Sep 2025

¹²² Perry-Rivers, P. (October 2014). "Stratification, Economic Adversity, and Entrepreneurial Launch: The Converse Effect of Resource Position on Entrepreneurial Strategy". *Entrepreneurship Theory & Practice*. 40 (3): 685–712. doi:10.1111/etap.12137, accessed on 29 Sep 2025

¹²³ Rauch, Jonathan (November 2018). "Generation next, Millennials will outnumber baby-boomers in 2019". *The Economist*. Archived from the original on 13 March 2019, accessed on 29 Sep 2025

¹²⁴ Henderson, James; Ferguson, Alastair (2014). *International Partnership in Russia: Conclusions from the Oil and Gas Industry* (reprint ed.). Springer Palgrave Macmillan. p. 86. ISBN 978-1137352279, accessed on 29 Sep 2025

¹²⁵ <https://www.investopedia.com/terms/e/entrepreneur.asp>, accessed on 20 Jul 2025

¹²⁶ Carlen, Joe (2016). *A Brief History of Entrepreneurship: The Pioneers, Profiteers, and Racketeers Who Shaped Our World*. New York: Columbia University Press. p. 1, ISBN 978-0231542814, accessed on 20 Jul 2025

control.”¹²⁷ Another meaning of entrepreneurship is the ability of a person to transform ideas into action. It includes being creative, coming up with new ideas, and taking calculated risks. It also includes being able to organize and manage projects to reach goals. This helps everyone in their daily lives at home and in society. It also helps employees understand the context of their work and take advantage of opportunities, and it gives entrepreneurs a place to start a business or social activity.¹²⁸ The OECD viewed entrepreneurship as “a motivating force for initiating business ideas, mobilizing human, financial and physical resources for establishing and expanding”.¹²⁹

Entrepreneurship can be broadly defined as the process of creating something new that holds value, which involves dedicating the necessary time and effort, while also taking on the associated financial, psychological, and social risks. The individual who engages in this endeavor is referred to as the entrepreneur, and they ultimately reap the rewards of both monetary gain and personal fulfillment, as well as independence.¹³⁰ According to Kuratko and Hodgetts (2017), entrepreneurship involves the passionate application of energy to create an enterprise. Their definition emphasizes key components: the willingness to take calculated risks, teamwork, the creative marshaling of resources, the development of a solid business plan, and a unique vision to discern opportunity where others see only confusion.¹³¹ The European Commission Communication summarizes it this way: “Entrepreneurship refers to an individual’s ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports everyone in day-to-day life at home and in society, makes employees more aware of the context of their work and better able to seize opportunities, and provides a foundation for entrepreneurs establishing a social or commercial activity”.¹³²

Entrepreneurship has been defined as both the act of being an entrepreneur and the services that entrepreneurs provide. It is also perceived as a dynamic process that is aimed at increasing capital. This process involves utilizing time, managing risks, and leveraging

creativity and innovation to generate new components. Entrepreneurship is a fundamental and limitless asset in all societies. It is a straightforward process that involves integrating resources to generate value.¹³³ Peter Drucker defined entrepreneurship as a discipline centered on creativity and deliberate change, rather than just launching new enterprises. He believed that entrepreneurs recognize and capitalize on opportunities arising from change, whether within existing businesses or through new ventures. Drucker emphasized the importance of adopting a methodical approach to entrepreneurship, which involves identifying potential sources of innovation and mitigating the risks associated with change.¹³⁴ Since the great majority of startups fail, entrepreneurship is frequently a challenging endeavor. Depending on the kind of organization being founded, entrepreneurial activities vary greatly.¹³⁵ Entrepreneurship can range from a single project that the entrepreneur works on part-time to a business that creates numerous jobs.¹³⁶ According to Peter Drucker, “If you are seeking a new business opportunity, keeping an eye on these seven sources may reveal an innovation opportunity.”

The modern concept of entrepreneurship in 21st century emphasizes adaptability, sustainable practices, and digital transformation in a rapidly evolving world. In addition to being company owners, modern entrepreneurs are innovators, change agents, and problem solvers who utilize data and technology to deliver value and address societal needs. Emerging technologies, such as AI, blockchain, and digital platforms, are reshaping business models and creating new opportunities. Entrepreneurs are leveraging these technologies to develop innovative solutions, enhance efficiency, and expand into new markets. It may include e-commerce platforms, online marketplaces, and businesses that utilize AI-powered tools.¹³⁷ Technology is no longer just a tool for entrepreneurs, but a core part of their business models. Entrepreneurs are leveraging technology to automate tasks, enhance communication, and expand their reach to wider audiences. It involves utilizing social media, cloud computing, and data analytics to gain

¹²⁷ Etuk, E. J. and Mbat, D. O., (2010). Entrepreneurship development for students and practitioners. Abuja: Century Frontiers Investment Limited, accessed on 20 Jul 2025

¹²⁸ European Commission, (2008). Final Report of the Expert Group Entrepreneurship in Higher Education, especially within non-business studies. Brussels: European Commission, March 2008, accessed on 20 Jul 2025

¹²⁹ Fems, K. M., Abara, O. & Poazi, F. W. D., (2016). Entrepreneurship: Cure for Economic Under-Development. A Theoretical Perspective. International Journal of Social, Behavioural, Educational, Economic, Business and Industrial Engineering, 10(9), pp. 3075-3080, accessed on 20 Jul 2025

¹³⁰ Ogundele, O. J. K., Idris, A. A. and Ahmed-Ogundipe, K. A. (2009). Entrepreneurial Succession Problems in Nigeria’s Family Businesses: A Threat to Sustainability. European Scientific Journal, 8(7), pp. 208-227, accessed on 20 Jul 2025

¹³¹ Izedonmi, P. F. & Okafor, C., (2010). The effect of entrepreneurship education on students’ entrepreneurial intentions. Global Journal of Management and Business Research, 10(6), pp. 49-60, accessed on 20 Jul 2025

¹³² Watkins-Mathys, L. (2009). Developing Student-led Entrepreneurship Learning: the South-East England Collaborative Model. Buckinghamshire: Buckinghamshire New University, accessed on 20 Jul 2025

¹³³ Kuratko, D. F., (2005). The Emergence of Entrepreneurship Education: Development, Trends, and Challenges. Journal of Entrepreneurship Theory and Practice, accessed on 20 Jul 2025

¹³⁴ <https://mlari.ciam.edu/peter-drucker-on-innovation-and-results>, accessed on 20 Jul 2025

¹³⁵ J. R. Lowerson, 'Slazenger, Ralph (1845–1910)', Oxford Dictionary of National Biography, Oxford University Press, 2004, accessed on 20 Jul 2025

¹³⁶ Casson, M. (2003) The Entrepreneur: An Economic Theory, second edition", Edward Elgar Publishing 2003, accessed on 20 Jul 2025

¹³⁷ Hossain K A, (2023c), Evaluation of Prospect and Challenges of Artificial Intelligence (AI) and Preparation for Future, American Journal of Computer Science and Technology 6 (4), 148-169, accessed on 10 Aug 2025

a competitive edge.¹³⁸ The modern business environment is characterized by rapid change and uncertainty. Entrepreneurs need to be agile, adaptable, and resilient to thrive in this environment. This includes the ability to quickly pivot strategies, embrace new technologies, and overcome challenges. Addressing systemic barriers

faced by marginalized groups and promoting diversity and inclusion are growing areas of focus. Entrepreneurs are developing strategies to overcome these barriers and create opportunities for all. Examples include businesses that target underserved communities, promote fair trade practices, and support social enterprises.



Figure 1: In 21st century world needs more capable and visionary entrepreneurs for sustainable economic growth.¹³⁹

The entrepreneur serves as the central actor in the process of entrepreneurship. Their effectiveness stems from a composite of essential traits, embodying the roles of an innovator, a calculated risk-taker, a motivator, and a proactive problem-solver who drives results. The prevailing consensus is that these individuals are developed, not born, with their capabilities shaped by a combination of familial influence, environmental factors, and education. However, the path of any new venture remains fraught with challenges. Due to pervasive constraints like limited resources, high uncertainty, and inexperience, startups face a notoriously high rate of failure. In response to these challenges and broader societal shifts, a modern entrepreneurial focus has emerged on balancing profit with environmental and social responsibility. This evolution is evident in the growing development of eco-friendly products, the implementation of sustainable business practices, and a heightened commitment to contributing to social good.¹⁴⁰ The modern entrepreneurial landscape is defined by a shift in purpose, moving beyond pure profit maximization towards a model that prioritizes creating broad societal value. Contemporary entrepreneurs are increasingly recognized as vital agents of change, driving positive impact by addressing pressing environmental and social challenges. This evolved ethos is exemplified by the rise of enterprises in sectors like renewable energy, sustainable agriculture, and ethical sourcing, whose missions integrate job creation and

economic growth with environmental stewardship and social equity.

There are many types of entrepreneurs in today's world. The entrepreneurs may be classified on certain parameters like based on economic development (innovative, adoptive, fabian, drone), according to growth (growth, super-growth), based on type of business (business, trading, industrial, corporate, agricultural), according to entrepreneurial activity (novice, serial, portfolio), according to the use of technology (technical, non-technical, professional), and according to motivation (pure, induced, motivated).¹⁴¹ First-generation Entrepreneurs are those who consist of entrepreneurs whose parents or family had not be in business. The booming Indian economy as led to a multitude of business opportunities, and with deregulation, it has become easier to establish businesses.¹⁴² Also, with a change in the mindset of the middle class, it is now more acceptable to become an entrepreneur. Typically, first-generation entrepreneur is one who starts an industrial initializing innovative skill. He is essentially an innovator, combining different technologies to produce a marketable product or service. As a modern entrepreneur undertakes those assets that aligning with current market scenario. On the other hand, a nascent entrepreneur is an individual who is in the process of starting a new business. However, a habitual entrepreneur is an individual who has prior experience in business. The

¹³⁸ Stevenson H, Roberts M and Bhidé A. 1999. *The entrepreneurial venture*, Sahlman W (Ed.). Harvard Business School, US, accessed on 10 Aug 2025

¹³⁹ <https://www.linkedin.com/pulse/why-world-needs-more-entrepreneurs-now-than-ever-megan-pauli-ovzif>, accessed on 12 Jul 2025

¹⁴⁰ Bernier L and Hafsi T. 2003, changing nature of public entrepreneurship. USA, Midwest Political Science Association Conference, accessed on 10 Aug 2025

¹⁴¹ https://www.researchgate.net/publication/380262803_Entrepreneurship_-_Concepts_Characters_and_Theories,

¹⁴² Mishra A H, El-Osta H and Shaik S. 2010. Succession decisions in U. S. Family farm business. *Journal of Agricultural and Resource Economics*. 35:133-2, accessed on 10 Aug 2025

nascent entrepreneur can either a novice or a seasoned entrepreneur.



Figure 2: In 21st century world needs huge woman entrepreneurs as they are contributing heavily.¹⁴³

A woman entrepreneur is another kind of business owner. Women starting their own businesses is a new thing in emerging countries like Bangladesh, India, and Pakistan. In India, social conventions made it hard for women to work. This is no longer the case. Progressive regulations and other incentives have also made it easier for women to start businesses in a wide range of sectors. Once more, lifestyle entrepreneurs have built a business that fits their own needs and way of life. Their main goal is to make money for themselves and their families.¹⁴⁴ Married couples who collaborate on a business venture are known as copreneurs. "Copreneurs" are married couples who share ownership, dedication, and accountability for a firm. Couples that are copreneurs battle to create equity in their partnerships. These couples are an example of how the systems of labor and love interact dynamically. Smart technology or IT entrepreneurs are now developing a new business platform that propels them to the top of the industry.¹⁴⁵ They are confident, ambitious, innovative, and have acquired creativity in the competitive global environment, creating a niche for themselves.¹⁴⁶ They are the brave new generation of entrepreneurs who are eager to tackle the world of information and advanced technology, including AI, ML, DL, big data, robotics, and more. New entrepreneurs should understand that seeing results requires doing something; don't let fear or doubt prevent them from starting.

5. Benefits and Challenges of Technology in 21st Century

5.1 History of Technological and Industrial Revolution

The main difference between human beings and animals is our capacity for abstract thinking paired with the ability to communicate and accumulate information. In essence, our superior intelligence propelled us to the top. Technology is improving at the snail's

pace of a few hundred thousand years ago, human technology would have needed one million years to become economically productive enough to sustain the lives of an additional million people. This number dropped to two centuries during the Agricultural Revolution in 5,000 BC. And in our post-Industrial Revolution era it shrunk to a mere 90 minutes. A technological advancement like the advent of superintelligent (SI) machines would mean radical change for the world as we know it. *Superintelligence* in 2014 investigates how creating a machine more intelligent than a human would change humanity. These blinks are full of facts, figures and studies from a variety of disciplines, resulting in a complex picture of the superintelligent future and how we might arrive there. However, now the question is, where does technology stand at present?

We have already been able to create machines that have the capacity to learn and reason using information that's been plugged in by humans. Consider, for example, the automated spam filters that keep our inboxes free from annoying mass emails and save important messages. Again, this is far from the kind of "general intelligence" humans possess, and which has been the goal of AI research for decades. And when it comes to building a superintelligent machine that can learn and act without the guiding hand of a human, it may still be decades away. But advancements in the field are happening quickly, so it could be upon us faster than we think. Such a machine would have a lot of power over our lives. Its intelligence could even be dangerous, since it would be too smart for us to disable in the event of an emergency.¹⁴⁷ Industrial revolution is a global phenomenon and continuous process. AI is going to lead to a redefinition and a disruption of service models and products. Although the technical development leads primarily to an efficiency enhancement in the production sectors, new creative and disruptive service models will revolutionize the service sector. These are

¹⁴³ <https://www.entrepreneur.com/en-in/women-entrepreneur/tracing-the-rise-of-women-entrepreneurs/329874>, accessed on 10 Sep 2025

¹⁴⁴ Uplaonkar S S and Biradar. 2015. Development of agriculture in India through arbitrageurs, *International Journal of Applied Research*. 1(9):1063-66, accessed on 10 Sep 2025

¹⁴⁵ Shailesh K, Gyanendra S and Yadav V K. 2013. Factors influencing entrepreneurial behaviour of vegetable growers.

Indian Research Journal of Extension Education. 13(1):16-19, 22, accessed on 10 Aug 2025

¹⁴⁶ https://www.researchgate.net/publication/5967914_Entrepreneurship_Research_and_Practice, accessed on 10 Sep 2025

¹⁴⁷ <https://www.blinkist.com/en/books/superintelligence-en>, accessed on 04 Oct 2023

adapted with the support of big data analyses at the individual requirements of the client and not at the needs of a company. Chronological development of industrialization has been discussed below.

INDUSTRY 1.0: INDUSTRIALIZATION or Industry 1.0 is known as the beginning of the industrial age, in 18th century. For the first time, goods and services were produced by machines. Besides the first railways, coal mining and heavy industry, the steam engine was the essential invention of the first industrial revolution; steam engines replaced many employees, which led to social unrest. At the end of the 18th century, steam engine was invented and introduced for the first time in factories in the Great Britain and it was a great driving force for industrialization, since they provided energy at any location for any purpose.¹⁴⁸

INDUSTRY 2.0: ELECTRIFICATION The second industrial revolution began at the beginning of electrification at the end of the 19th century. The equivalent of the steam engine in the first industrial revolution was the assembly line, which was first used in the automotive industry. It helped accelerate and automate production processes. The term Industry 2.0 is characterized by separate steps being executed by workers specialized in respective areas. Serial production was born. At the same time, automatically manufactured goods were transported to different continents for the first time. This was aided by the beginning of aviation.¹⁴⁹

INDUSTRY 3.0: DIGITALISATION The third industrial revolution began in the 1970s and was distinguished by IT and further automation through electronics. When personal computers and the internet took hold in working life. So, from this age, global access to information and automation of working has taken place. Moreover, human labour was replaced by machines in serial production. A process that was intensified in the context of Industry 4.0 was already in the offing at that time.¹⁵⁰

INDUSTRY 4.0: AUTOMATIZATION The term Industry 4.0 means in essence the technical integration of cyber physical systems (CPS) into production and logistics and the use of the 'internet of things (IoT)' or connection between everyday objects¹⁵¹ and services in (industrial) processes including the consequences for a new creation of value, business models as well as downstream services and work organization.¹⁵² CPS refers to the network connections between humans, machines, products, objects and ICT (information and

communication technology) systems.¹⁵³ Within the next few years, it is expected that over hundred billion connected machines will exist throughout the world. The introduction of AI in the service sector distinguishes the fourth industrial revolution from the third.

In the field of industrial production, the term 'automatization' is characterized essentially by four elements: 1) The production is controlled by machines. Owing to the use of intelligent machines, production processes will be fully automated in the future, and humans will be used as a production factor only in individual cases. The so called 'smart factory', a production facility with few or without humans, is representative of this. 2) The real-time production is a core feature of Industry 4.0. An intelligent machine calculates the optimal utilization capacity of the production facility. Lead times are short in the production process, and standstills, except those caused by technical defects, can be avoided. Within the value creation chain, the coordination of materials, information and goods is tailored exactly to demand. Stocks are kept to a minimum, but if materials needed for production fall below a certain level, the machine orders more. The same applies to finished products; the machine produces depending on incoming orders and general demand, thus reducing storage costs. 3) The decentralization of production. The machine is essentially self-organized. This includes a network of the manufacturing units. In addition to material planning, the handling of orders is also fully automated. 4) The individualization of production even down to a batch of one unit. The machine of the future will be able to respond, within certain limits, to individual customer requests. No adjustments to the machines by humans are required. As a result, change-over times are eliminated. The smart factory adds certain components or, in a context of optimum distribution throughout the entire process, adapts individual stages of production to correspond with customer requests.¹⁵⁴

The term Industry 4.0 thus stands for the optimization of components involved in the production process (machines, operating resources, software, etc) owing to their independent communication with one another via sensors and networks.¹⁵⁵ This is supposed to reduce production costs, particularly in the area of staff

¹⁴⁸ LIMS, (2023), Nobody always sees the whole pictures, our AI do; available at: www.lmis.de/im-wandel-der-zeit-von-industrie-1-0-bis-4-0, accessed on 15 Aug 2023

¹⁴⁹ Hossain, K. A., (2023), An overview of merchant ships, International Journal of Novel Research and Development (IJNRD), Vol 8, Issue 6, June 2023, ISSN 2456-4184, accessed on 13 Aug 2023

¹⁵⁰ Hossain, K. A., (2023), An Overview of Naval Ships, Scientific Research Journal (SCIRJ) 11 (6), ISSN: 2201-2796, June 2023, accessed on 15 Aug 2023

¹⁵¹ Stiernerling, (2015), 'Künstliche Intelligenz' – Automatisierung geistiger Arbeit, Big Data und das Internet der Dinge', Computer und Recht 762 ff, accessed on 15 Aug 2023

¹⁵² Forschungsunion und acatech, (2013), 'Deutschlands Zukunft als Produktionsstandortsicherung: Umsetzungsempfehlung für das Zukunftsprojekt Industrie 4.0', Promotorengruppe Kommunikation der Forschungsunion Wirtschaft – Wissenschaft, accessed on 15 Aug 2023

¹⁵³ Arbeitsmarkt und Wirtschaft, (2015), Industrie 4.0 und die Folgen für IAB Forschungsbericht 8/2015, Institute for Employment Research, 12, accessed on 15 Aug 2023

¹⁵⁴ Hossain K A, (2023), Analysis of Present and Future Use of Artificial Intelligence (AI) in Line of 4th industrial Revolution (4IR), Scientific Research Journal 11 (8), ISSN: 2201-2796, Aug 2023, accessed on 14 Aug 2023

¹⁵⁵ Sandro Panagl, (2015), 'Digitalisierung der Wirtschaft - Bedeutung Chancen und Herausforderungen', Austrian Economic Chambers 5, accessed on 15 Aug 2023

planning, giving the company a better position in international competition.¹⁵⁶ Well-known examples from the field of robotics and AI are the so-called ‘smart factories’, driverless cars, delivery drones or 3D printers, which, based on an individual template, can produce highly complex things without changes in the production process or human action in any form being necessary. Well-known service models are, for example, networking platforms like Facebook or Amazon Mechanical Turk, the economy-on-demand providers Uber and Airbnb, or sharing services, such as car sharing, Spotify and Netflix. Studies show that merely due to sharing services the turnover of the sector will grow twentyfold within the next ten years. Old industry made progress by using economies of scale in an environment of mass production, but the new information economy lives on networking effects, leading to more monopolies.¹⁵⁷

In 21st century, advanced technology like IoT is revolutionizing computing by introducing networked devices into our daily lives that acquire and analyze information to serve an ever-increasing number of services and human life. IoT makes other technologies smarter by enabling automation, personalization, and remote control via networks of Internet-connected sensors.¹⁵⁸ At the same time, IoT technologies raise significant privacy concerns, which may hinder their wider adoption. IoT applications range from smart homes and wearable gadgets to industrial automation, agriculture, healthcare, transportation, ecosystem, warfare, business, education, so on. The IoT has the potential to completely transform our lives by enabling smarter, more connected, flexible, more relax, and more efficient systems. IoT has the potential to develop industries efficiency, increase productivity, and improve our daily lives. IoT will influence more in technology, and more things will

become internet-connected in future. It is an analytical paper to depict the influence of IoT on technologies and devices in our usual life, business, industry and other sectors along with challenges and suggestions for best harvest in this modern era.¹⁵⁹ Throughout the world, billions of embedded internet-enabled sensors provide an enormous amount of data that businesses can utilize to improve operational safety, track assets, and reduce human operations.¹⁶⁰

Machine data can be used to predict whether equipment will break, giving manufacturers a heads-up and avoiding lengthy periods of downtime.¹⁶¹ IoT devices can also be used by researchers to collect data, information, and other intelligence about client preferences and behavior, market demand, future requirements, potential risk, and so on. However, those may be serious implications for privacy and security.¹⁶² IoT has the potential to develop industries efficiency, increase productivity, and improve our daily lives. At the same time, IoT will have a serious influence on other technologies, and in the future, more things will be internet-connected. Today globally, there are around 17 billion active IoT devices, and more than 85% of firms have boosted their technical efficiency by implementing IoT technology into their products. The Internet of Things has been named ‘the next wave of innovation’

¹⁵⁶Hossain, K. A., (2023), Technological advancement and future of warship building, *International Journal of Research and Development (IJNRD)*, Vol 8, Issue 5, May 2023, ISSN 2456-4184, accessed on 13 Aug 2023

¹⁵⁷Bloomberg, (2016), available at: www.bloomberg.com/news/videos/2016-05-20/forward-thinking-march-of-the-machines, accessed on 15 Aug 2023

¹⁵⁸Hossain, K. A., (2023), Evaluation of Influence of Internet of Things (IOT) Technologies and Devices in 21 Century, *Scientific Research Journal* 11 (7), ISSN: 2201-2796, Jul 2023, accessed on 14 Aug 2023

¹⁵⁹Apthorpe, N., et al, (2019), Keeping the smart home private with smart(er) IoT traffic shaping, *Proceedings on Privacy Enhancing Technologies*, 2019 (3): 128–148

¹⁶⁰Hossain, K. A., (2023), The Potential and Challenges of Quantum Technology in Modern Era, *Scientific Research Journal* 11 (6), Jun 2023, accessed on 16 Aug 2023

¹⁶¹<https://www.mdpi.com/journal/IoT>, accessed on 31 May 2023

¹⁶²Desai, B.C., (2017), IoT: imminent ownership threat. In *Proceedings of the 21st International Database Engineering & Applications Symposium*, 82–89, accessed on 27 Aug 2023

as its impact on people's day to day lives evolves.¹⁶³ In fact, IoT is critical for operating large-scale businesses and the service industry in the twenty-first century. Fur-

thermore, it was shown that IoT has a considerable impact on decision-making and corporate operation management.¹⁶⁴



Figure 3: AI and future of life¹⁶⁵ and working relationship between human and robots¹⁶⁶

In 21st century, AI has been around everywhere for a great deal of time. The benefit of AI is steadily improving our everyday life. The technology is being used for robots that welcome at shopping centers or online search engines for offering suggestions.¹⁶⁷ Today, AI simulates human analysis in AI systems. It is the ability of the computer program to think and learn. Everything can be taken to be AI, if it involves a program that does something and that we usually think depends on human intelligence. Innovations in the AI space have led to several benefits across multiple industries and different sectors.¹⁶⁸ Now, AI has been around everywhere for a great deal of time. The benefit of AI is steadily improving our everyday life. The technology is being used for robots that welcome at shopping centers or online search engines for offering suggestions.¹⁶⁹ Today, AI simulates human analysis in AI systems. It is the ability of the computer program to think and learn. Everything can be taken to be AI, if it involves a program that does something and that we usually think depends on human intelligence. Innovations in the AI space have led to several benefits across multiple industries.¹⁷⁰

5.2 Prospect and Impact of AI and Robot in 21st Century

AI refers to systems that display intelligent behavior by analyzing their environment and taking actions with some sort of autonomy to attain specific goals. AI-based systems can be purely software-based, acting in the virtual world like voice assistants, image analysis

software, search engines, speech and face recognition systems; or AI can be embedded in hardware devices like advanced robots, autonomous cars, drones or Internet of Things (IoT's) applications. In the first decades of the 21st century, highly mathematical and statistical ML has dominated the field, and this technique has proved high success and helping to solve many challenging problems throughout industry and academia.¹⁷¹ The traditional goals of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception, and the ability to move and manipulate objects.¹⁷² General intelligence as the ability to solve an arbitrary problem and is among the field's long-term goals.¹⁷³ AI researchers have adapted and incorporated a wide range of problem solving techniques, like, search and mathematical optimization, formal logic, artificial neural networks, and methodologies based on statistics, probability, and economics, to solve these difficulties. AI also employs computer science, psychology, medicine, healthcare, language, philosophy, and a variety of other disciplines.¹⁷⁴ AI applications include advanced web search engines (like Google, Bing, Baidu, Yahoo), recommendation systems (like YouTube, Amazon, Netflix), understanding human speech (like Siri, Alexa), self-driving cars (like Waymo, AutoX, Cruise, Motional, Manga International), generative or creative tools (like ChatGPT, Microsoft Bing, Google Bard

¹⁶³ What is IoT: The Internet of Things explained | McKinsey. <https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-the-internet-of-things>, accessed on 31 May 2023

¹⁶⁴ <http://it-in-industry.org/index.php/itii/article/view/702>, accessed on 31 May 2023

¹⁶⁵ <https://stock.adobe.com/tw/search?k=%22future+world%22>, accessed on 27 Aug 2025

¹⁶⁶ <https://robinmarkphillips.com/marriage-humans-robots-part-2/>, accessed on 21 Aug 2025

¹⁶⁷ Housman M., (2018), Why 'Augmented Intelligence' Is a Better Way to Describe AI, AINews, 2018, accessed on 23 Jul 2023

¹⁶⁸ Jordan M.I., (2015), Mitchell, T.M. Machine learning: Trends, perspectives, and prospects. Science 2015, 349, 255–260, accessed on 29 June 2023

¹⁶⁹ Housman, M., (2018), Why 'Augmented Intelligence' Is a Better Way to Describe AI, AINews, 2018, accessed on 27 Aug 2023

¹⁷⁰ Jordan, M.I.; Mitchell, T.M. Machine learning: Trends, perspectives, and prospects. Science 2015, 349, 255–260

¹⁷¹ Russell Stuart J., et al., (2009), Artificial Intelligence: A Modern Approach (3rd ed.). Upper Saddle River, New Jersey: Prentice Hall, ISBN 978-0-13-604259-4, accessed on 23 Jul 2023

¹⁷² Crevier Daniel, (1993), AI: The Tumultuous Search for Artificial Intelligence, New York, NY: Basic Books, ISBN 0-465-02997-3, accessed on 23 Jul 2023

¹⁷³ Newquist HP, (1994), The Brain Makers: Genius, Ego, And Greed In The Quest For Machines That Think. New York: Macmillan/SAMS, ISBN 978-0-672-30412-5, accessed on 23 Jul 2023

¹⁷⁴ Poole David, et al., (2017), Artificial Intelligence: Foundations of Computational Agents (2nd ed.), Cambridge University Press, ISBN 978-1-107-19539-4, accessed on 23 Jul 2023

AI, Perplexity AI, AI art, Amazon Codewhisperer), automated decision-making, and competing at the highest level in strategic game systems (like chess, Go, Arimaa, Dameo).¹⁷⁵ In future AI affect, like optical character recognition is frequently omitted from things considered to be AI, having become a routine technology.¹⁷⁶

Today, there are also thousands of successful AI applications used to solve problems for specific industries or institutions. A few examples are energy storage,¹⁷⁷ deepfakes,¹⁷⁸ medical diagnosis, military logistics, foreign policy,¹⁷⁹ or supply chain management. AI will have a greater impact on technology in the future, by influencing every sector, machinery, equipment, and devices. With a 99% accuracy rate, AI has been applied in facial recognition systems. For example, of such are Apple's FaceID and Android's Face Unlock. Those two are employed in the protection of mobile devices. Google has utilized image labeling to detect products in photographs and to allow customers to search using a photo. It has also been shown to generate speech in order to describe visuals to blind persons.¹⁸⁰ It can predict or simplify the behavior of customers from their digital footprints.¹⁸¹ Online gambling companies, use AI to improve customer targeting.¹⁸² AI has been used to customize shopping options and personalize offers.¹⁸³ Intelligent personal assistants use AI to understand many natural language requests in other ways than elementary commands. For examples: Apple's Siri, Amazon's Alexa, and a more recent AI, ChatGPT by OpenAI.¹⁸⁴ ML can be used to fight against spam, scams, and

phishing. It can scrutinize the contents of spam and phishing attacks to identify any malicious elements.¹⁸⁵

AI has been used to automatically translate spoken language and written content.¹⁸⁶ Additionally, research and development is in progress to interpret and conduct animal communication.¹⁸⁷ While no system provides the ideal of fully automatic high-quality machine translation of unrestricted text, many fully automated systems produce reasonable output.¹⁸⁸ AI is going to produce superhuman in near future results in many games, like chess (DeepBlue), Jeopardy (Watson),¹⁸⁹ Go (AlphaGo),¹⁹⁰ poker (Pluribus and Cepheus),¹⁹¹ E-sports (StarCraft),¹⁹² AlphaZero, MuZero).¹⁹³ AI has replaced hand-coded algorithms in most chess programs.¹⁹⁴ However, poker lacks the perfect information of go or chess. Therefore, a poker playing program must be able to reason while facing unknowns. Players in the general population function based on information provided by the game system, rather than on the rules themselves. Institutions using AI to address global economic and social concerns are being supported by a new ITU effort called AI for Good. The University of Southern California has established the Centre for AI in Society to apply AI to social issues like homelessness. AI is being used by Stanford University to analyze satellite photos in search of pockets of concentrated poverty.¹⁹⁵ In agriculture, AI has

¹⁷⁵ Nilsson Nils, (1998), *Artificial Intelligence: A New Synthesis*. Morgan Kaufmann, ISBN 978-1-55860-467-4, accessed on 23 Jul 2023

¹⁷⁶ Russell Stuart J., et al., (2003), *Artificial Intelligence: A Modern Approach* (2nd ed.), Upper Saddle River, New Jersey: Prentice Hall, ISBN 0-13-790395-2, accessed on 23 Jul 2023

¹⁷⁷ Frangoul Anmar, (14 June 2019). "A Californian business is using A.I. to change the way we think about energy storage", CNBC, accessed on 23 Jul 2023

¹⁷⁸ Brown Eileen, (5 November 2019). "Half of Americans do not believe deepfake news could target them online", ZDNet, accessed on 23 Jul 2023

¹⁷⁹ Stephen Chen, (30 Jul 2018), "Artificial intelligence, immune to fear or favour, is helping to make China's foreign policy | South China Morning Post", 25 March 2023

¹⁸⁰ Heath Nick, (11 December 2020). "What is AI? Everything you need to know about Artificial Intelligence". ZDNet, accessed on 23 Jul 2023

¹⁸¹ Matz S. C., et al., (28 November 2017), "Psychological targeting as an effective approach to digital mass persuasion", *Proceedings of the National Academy of Sciences of the United States of America*, 114 (48): 12714–12719, accessed on 23 Jul 2023

¹⁸² Busby Mattha, (30 April 2018), "Revealed: how bookies use AI to keep gamblers hooked". The Guardian, accessed on 23 Jul 2023

¹⁸³ BBC News, (9 November 2020), How artificial intelligence may be making you buy things, accessed on 23 Jul 2023

¹⁸⁴ Rowinski Dan, (15 January 2013), *Virtual Personal Assistants & The Future Of Your Smartphone* (Infographic), ReadWrite, accessed on 23 Jul 2023

¹⁸⁵ Galego Hernandes, et al, (December 2021), "Phishing Detection Using URL-based XAI Techniques", 2021 IEEE Symposium Series on Computational Intelligence (SSCI): 01–06, accessed on 23 Jul 2023

¹⁸⁶ Clark Jack, (8 December 2015). "Why 2015 Was a Breakthrough Year in Artificial Intelligence". Bloomberg L.P

¹⁸⁷ The Guardian, (1 Aug 2022), Can artificial intelligence really help us talk to the animals?, The Guardian, original on 31 Aug 2022, accessed on 23 Jul 2023

¹⁸⁸ Melby Alan, (1995), *The Possibility of Language*, Amsterdam: Benjamins, 1995, 27–41, Benjamins.com. ISBN 9789027216144, accessed on 23 Jul 2023

¹⁸⁹ Markoff John, (16 February 2011), "Computer Wins on 'Jeopardy' Trivial, It's Not". The New York Times, accessed on 23 Jul 2023

¹⁹⁰ Steven Borowiec, et al., (12 March 2016), AlphaGo beats human Go champ in milestone for artificial intelligence, Los Angeles Times, accessed on 23 Jul 2023

¹⁹¹ Bowling Michael, (9 January 2015), Heads-up limit hold'em poker is solved, *Science*. 347 (6218): 145–149, accessed on 23 Jul 2023

¹⁹² WIRED, (9 Oct 2017), Facebook Quietly Enters StarCraft War for AI Bots, and Loses, WIRED, 2017, available at <https://www.wired.com/story/facebook-quietly-enters-starcraft-war-for-ai-bots-and-loses/>, accessed on 23 Jul 2023

¹⁹³ The Guardian, (16 February 2016), The superhero of artificial intelligence: can this genius keep it in check?, accessed on 23 Jul 2023

¹⁹⁴ K Bharath, (2 April 2021), AI In Chess: The Evolution of Artificial Intelligence In Chess Engines, Medium, accessed on 23 Jul 2023

¹⁹⁵ OFA INTELLIGENCE, (2016), *Preparing for the future of artificial intelligence*, National Science and Technology Council, OCLC 965620122, accessed on 23 Jul 2023

helped farmers identify areas that need irrigation, fertilization, pesticide treatments or increasing yield.¹⁹⁶ Today, agronomists use AI to conduct research and development. AI has also been used to predict the ripening time for crops such as tomatoes,¹⁹⁷ monitor soil moisture, operate agricultural robots, conduct predictive analytics,¹⁹⁸ classify livestock pig and cow call emotions, automate greenhouses,¹⁹⁹ detect diseases and pests,²⁰⁰ save water²⁰¹, etc. In future AI will be used to completely automate most cyber security operations over time.²⁰²

AI can create a dysfunctional situation with revenge effects,²⁰³ like technology that hinders students' ability to stay on task.²⁰⁴ AI can provide early prediction of student success in a virtual learning environment (VLE) like Moodle.²⁰⁵ In the education process, students can personalize their training with the help of AI. And for teaching professionals, the technology provided by AI can improve the quality of the educational process and teaching skills.²⁰⁶ AI is used to aid investment decisions at large financial firms. Aladdin, BlackRock's AI engine are used by the firm and its customers alike to make better investing choices. SQREEM (Sequential Quantum Reduction and Extrac-

tion Model) is a data mining tool used by financial institutions like UBS and Deutsche Bank to create client profiles and better tailor wealth management offerings to individual clients.²⁰⁷ Its functions include the use of natural language processing to analyze text like, news, broker reports, and social media feeds. Banks use AI to organize operations, for book-keeping, investing in stocks, and managing properties. AI can react to changes when business is not taking place.²⁰⁸ Today, AI is used to combat fraud and financial crimes by monitoring behavioral patterns for any abnormal changes or anomalies.²⁰⁹ The use of AI in applications such as online trading and decision making has changed major economic theories.²¹⁰ For example, AI-based buying and selling platforms estimate individualized demand and supply curves and thus enable individualized pricing. AI machines reduce information asymmetry in the market and make markets more efficient.²¹¹ Many banks, funds, and proprietary trading firms now have entire portfolios that are AI-managed. Automated trading systems are typically used by large institutional investors but include smaller firms trading with their own AI systems.²¹² There is a large array of applications where AI is serving common people in their day-to-day lives.

¹⁹⁶ Gambhire Akshaya, et al., (8 April 2020). Use of Artificial Intelligence in Agriculture, Proceedings of the 3rd International Conference on Advances in Science & Technology (ICAST) 2020, SSRN 3571733, accessed on 23 Jul 2023

¹⁹⁷ Intellias, (04 Aug 2023), AI in Agriculture, The Future of Farming, available at <https://intellias.com/artificial-intelligence-in-agriculture/>, accessed on 23 Jul 2023

¹⁹⁸ Zhavoronkov Alex, (1 January 2019), "Artificial intelligence for aging and longevity research: Recent advances and perspectives", *Ageing Research Reviews*, 49: 49–66. doi:10.1016/j.arr.2018.11.003, accessed on 21 Jul 2023

¹⁹⁹ Moreno Millán M., et al., (1 November 2011), "Population, Poverty, Production, Food Security, Food Sovereignty, Biotechnology and Sustainable Development: Challenges for the XXI Century", *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Veterinary Medicine*. 1 (68), accessed on 21 Jul 2023

²⁰⁰ Talaviya Tanha, et al., (2020), "Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides". *Artificial Intelligence in Agriculture*, 4: 58–73, accessed on 21 Jul 2023

²⁰¹ Olick Diana, (2022-04-18), "How robots and indoor farming can help save water and grow crops year round". *CNBC*, accessed on 21 Jul 2023

²⁰² VentureBeat, (6 Sep 2020), How AI will automate cybersecurity in the post-COVID world, available at <https://venturebeat.com/business/how-ai-will-automate-cybersecurity-in-the-post-covid-world/>, accessed on 21 Jul 2023

²⁰³ Anabel Quan Haase, (2020), *TECHNOLOGY AND SOCIETY: social networks, power, and inequality*. Oxford University Press. ISBN 978-0-19-903225-9, accessed on 21 Jul 2023

²⁰⁴ Richtel Matt, (21 November 2010), "Growing Up Digital, Wired for Distraction", *The New York Times*, accessed on 21 Jul 2023

²⁰⁵ Chen Hsing Chung, et al., (January 2022), "Week-Wise Student Performance Early Prediction in Virtual Learning Environment Using a Deep Explainable Artificial Intelligence", *Applied Sciences*. 12 (4): 1885, accessed on 21 Jul 2023

²⁰⁶ Yuskovych Zhukovska, et al., (23 Mar 2022), "Application of Artificial Intelligence in Education. Problems and Opportunities for Sustainable Development", *BRAIN: Broad Research in Artificial Intelligence and Neuroscience*. 13 (1Sup1): 339–356, accessed on 23 Jul 2023

²⁰⁷ Americanbanker, (5 Jan 2017), Beyond Robo-Advisers: How AI Could Rewire Wealth Management. 5 January 2017, accessed on 23 Jul 2023

²⁰⁸ O'Neill Eleanor, (31 July 2016), "Accounting, automation and AI", *icas.com*, Archived from the original on 18 November 2016, accessed on 23 Jul 2023

²⁰⁹ Chapman Lizette, (7 January 2019), "Palantir once mocked the idea of salespeople. Now it's hiring them". *Los Angeles Times*, accessed on 21 Jul 2023

²¹⁰ Marwala Tshilidzi, et al., (2017), *Artificial Intelligence and Economic Theory: Skynet in the Market*. London: Springer. ISBN 978-3-319-66104-9

²¹¹ Marwala Tshilidzi, et al., (2017), "Efficient Market Hypothesis", *Artificial Intelligence and Economic Theory: Skynet in the Market*, Cham: Springer International Publishing, doi:10.1007/978-3-319-66104-9_9

²¹² Investopedia, (2005), *Algorithmic Trading*, Investopedia, original 18 May 2005, accessed on 23 Jul 2023

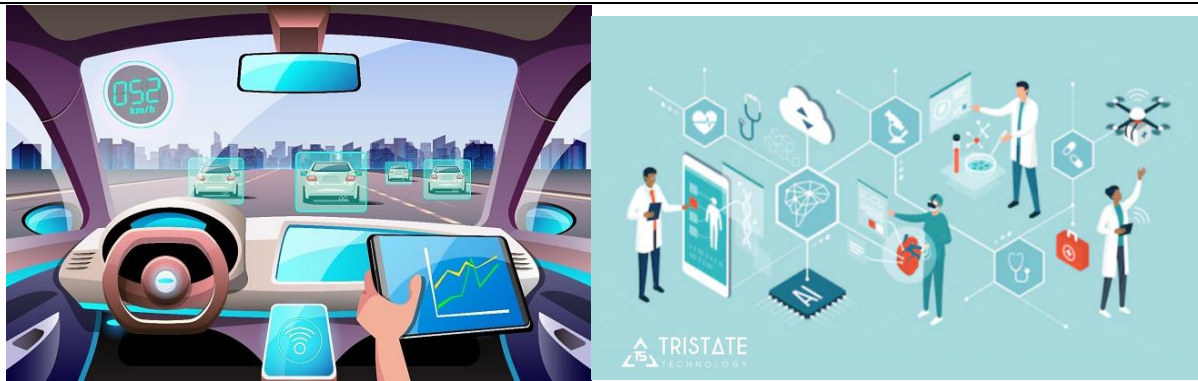


Figure 4: Benefit of AI in automobiles²¹³ and in healthcare²¹⁴

The explosion of technology in the modern era has coincided with an equally seismic shift in how we think and talk about it. AI is so advanced technology that can replicate the human brain or intelligence. It allows computer programs to learn from experience through iterative processing and algorithmic training. Every day, AI has become more practical and innovative in almost all aspects of life. AI has become a crucial issue in the modern era, as it might affect the job market and general employment. Most individuals wish to claim that the widespread usage of AI would result in employment losses for people.²¹⁵ However, People are gradually realizing that AI can improve the creative, lucrative, constructive, adaptable, and accessible nature of professions. AI could lead to a more innovative, diversified, and skilled economy.²¹⁶ We must need to change the education system, including the curriculum, teaching methods, and many things that need to be done for schooling. Our mass or general education system needs to be aligned with modern and advanced technology, which will change the whole school system and must be purposeful and sustainable for the long term. It is an analytical study in which the researcher has tried to evaluate the diversified use of AI and robots and the

consequences for the human future, emphasizing the global education system.

Robotics, AI, and machine learning have advanced significantly in recent years. Automation and extensive use of AI can help organizations, companies, or industries do better in production or service by reducing errors, improving quality and speed, accuracy and integrity, and, in most cases, achieving results that are impossible for humans.²¹⁷ Again, advances in AI and related automation technologies have led to growing fears about job losses and increasing inequality in society. This concern is widespread in high-income countries. Developing countries and emerging market economies should be even more concerned than high-income countries, as their comparative advantage in the world economy relies on abundant labour and natural resources.²¹⁸ Additionally, declining labour and natural resource returns, as well as the winner-take-all dynamics brought on by new information technologies, may lead to a further loss of control in the developing and labour-intensive world. This has the potential to slow the rapid progress made over the last fifty years. It may also jeopardize progress toward reducing poverty and inequality in societies around the world.

²¹³ <https://www.telematicswire.net/artificial-intelligence-and-its-use-cases-in-automotive-industry/>, accessed on 28 June 2023

²¹⁴ <https://www.tristatetechnology.com/blog/artificial-intelligence-in-healthcare-top-benefits-risks-and-challenges>, accessed on 28 June 2023

²¹⁵ Hossain K A, (2023), Analysis of Present and Future Use of Artificial Intelligence (AI) in Line of 4th industrial Revolution (4IR), Scientific Research Journal 11 (8), ISSN: 2201-2796, Aug 2023, accessed on 14 Aug 2023

²¹⁶ Hossain, K. A., (2023), Evaluation of Influence of Artificial Intelligence (AI) on Technologies in 21st Century, Journal of Electronics and Communication Engineering Research, Quest Journal, accessed on 15 Aug 2023

²¹⁷ Johnny ChLok · 2019, „Artificial Intelligence Future Ten Development Stages, Independently Published, ISBN:9781671040670, 1671040678

²¹⁸ Korinek, Anton and Joseph E. Stiglitz (2019), “Artificial Intelligence and Its Implications for Income Distribution and Unemployment,” in Agrawal et al.: The Economics of Artificial Intelligence, NBER and University of Chicago Press



Figure 5: AI is game changer in manufacturing industry²¹⁹ and AI will boost agriculture sector²²⁰

Future dangers from AI may be very significant. AI, IoT, ML, and automation will reduce the need for human workers and the size of the global economy. *AI in education is not about humanoid robots as a teacher to replace human teachers. However, it is about using computer intelligence to help teachers and students and improving and effective the education system.* In the future, the education system will have many AI tools that will shape the educational experience. Again, who knows, maybe even robot-human emotional relations will be possible in the future. There were already several movies playing with that idea. However, there is a high degree of uncertainty regarding the conceivable technological development scenarios and their effects.²²¹ So, substantial potential weaknesses and risks cannot be ignored. Economic analysis based on models suited to this new era has the potential to aid in the development of policies at both the global and national levels that can mitigate these negative effects. The big threat of AI is 'Singularity' in which AI machines take over and fundamentally alter human existence by making us dependent on them or eliminating us. This is another major threat to humanity on a global scale.

Today many people believe that the end of humanity is possible if super-intelligent robots gain access to nuclear weapons or develop biological or chemical agents. Those devastating

/horrifying tasks could be carried out at any time, either by super clever robots themselves or by some ignorant human acting out of anger, malice, or dictated by a stupid person. So, there should be appropriate procedures, rules and regulations for using advanced AI and robots. And such procedures and regulations should include ethical, privacy, and security concerns. Therefore, global coordination should guide AI development in a positive, gentle path.²²² On the other hand, AI technology has the potential to give benefits to different income choices and bring significant gains to both developed and developing countries.²²³ AI also has the potential to create new and innovative job opportunities, leading to a more productive and efficient economy.²²⁴ Any technology usually eliminates employment that creates. It is the reality that, with the advancement of AI, the world will become more complex and self-centred in the future, as well as there will not be enough jobs for all, or it will not ensure employment for everyone. So, the new generation needs to be educated with advanced technology and valuable skills. Therefore, the current education system must be transformed with a pragmatic solution.²²⁵

²¹⁹ <https://www.manufacturingtodayindia.com/sectors/10725-artificial-intelligence-a-game-changer-for-manufacturers>, accessed on 11 Oct 2023

²²⁰ <https://theconversation.com/using-ai-in-agriculture-could-boost-global-food-security-but-we-need-to-anticipate-the-risks-178104>, accessed on 11 Oct 2023

²²¹ Hossain, K. A., (2023), Evaluate the Mystery of Creation of Universe and Existence of Antimatter Dark Matter and Dark Energy, International Journal of Current Science Research and Review 6 (6), Jun 2023, accessed on 16 Aug 2023

²²² <https://nagalandpost.com/index.php/meta-scientist-yann-lecun-dismisses-ai-threat-to-humanity/>, accessed on 17 June 2023

²²³ Johnny ChLok, (2020), Artificial Intelligence How Impacts Global Economy, Independently Published, ISBN:9781661685263, 1661685269, accessed on 30 Aug 2023

²²⁴ Pablo Padula, (2023), Are You Going to Lose Your Job to Artificial Intelligence?, Amazon Digital Services LLC - Kdp, ISBN:9798391007401, accessed on 30 Aug 2023

²²⁵ Alexander J. Means, et al, (2020), Education and Technological Unemployment, Springer Nature Singapore, ISBN:9789811362255, 9811362254, accessed on 30 Aug 2025



Figure 6: **Home care robot**²²⁶ and AI will change the finance sector²²⁷

An algorithm is ‘a step-by-step procedure for solving a problem or accomplishing some end.’ In the field of AI, algorithms are automated instructions that tell a computer what to do. The instructions are mathematically driven and can be as simple as ‘if X, then Y’ actions or encompass complex mathematical layers of instructions to execute a task or find an answer to a problem.²²⁸ The algorithm manipulates data in a variety of ways, such as sorting, inserting, replacing, or searching for a data attribute. It solves problems when it carries out the instructions. ML can be supervised, unsupervised, semi-supervised, or reinforcement learning depending on the kind of data being input into the program and the type of outputs that can be expected.²²⁹ When we hear someone talk about a machine that learns, the machine is executing a structured set of mathematical procedures. The machine learns how to correct itself based on data used to train the application or by iterating on data used by the application once deployed. How the machine learns to correct itself depends on the mathematical models selected for the task.²³⁰ Data scientists and ML programmers are the team members who select and adjust the mathematical models used in applications.²³¹ In deep learning, a set of mathematical instructions such as an algorithm, which is called a *node*, works like a neuron to fire the algorithm, process it as instructed, and pass its information to another node in the computer. That algorithm is then used as input by another node in the neural network. Data move through the nodes in a direction specified by the algorithm. A deep learning model can contain billions of nodes embedded in many layers.

Future robotics and automation will be going to serve as assistants, workmates, teachers, surgeons, drivers, operators, and explorers. As engineers, tech-

nologist, and scientists continue to develop and advance robotics, the capabilities of this technology will only increase further. Today, in many ways, robots are already an integral part of daily life. They might even assist us in expanding our horizons on our planet and beyond, helping billions of people live better lives.²³² **Today, robots become human friend and have been among us for quite some time and are used to separate humans from dull, automated, dangerous or dirty jobs or tasks in warehouses and factories at the work place. When we are talking about replacing humans with robots, then safety is perhaps one of the most important factors.** Robots injuring or even worse, killing their human colleagues, is become even bigger issue as use of advanced AI increases or automation rises and many more factories are adapting automation. Forbes published the interesting story about the incident where a semi-autonomous driving Tesla car²³³ collided with a tractor-trailer in Florida, and subsequently killing its driver in 2016.²³⁴ Again in 2015, when an **industrial robot** killed a German factory employee and in 2017 another killed a Michigan worker. However, in the Future of Jobs Report, more than **80%** of business executives said that, they **are accelerating plans to digitize work processes** and deploy new technologies.²³⁵ And, 50% of employers are expecting to increase speed the automation of some roles in their companies. So, in the age of AI, the McKinsey Global Institute declared that, workforce transitions in a time of automation, estimates that as many as 375 million workers or roughly 14% of the global labor force may need to re-skill in **digitization**,

²²⁶ <https://www.theguardian.com/society/2020/sep/07/robots-used-uk-care-homes-help-reduce-loneliness>, accessed on 17 June 2023

²²⁷ <https://www.trickyenough.com/how-ai-is-changing-the-finance-sector-finance-to-fintech/>, accessed on 30 Aug 2025

²²⁸ Castellanos S. What exactly is artificial intelligence. The Wall Street Journal. 2018, accessed on 30 Aug 2025

²²⁹ Fumo D. Types of machine learning algorithms you should know. Towards Data Science, 2017, accessed on 30 Aug 2025

²³⁰ Menzies T., (2003), 21st-century AI: proud, not smug. IEEE Intell Syst. 2003;18(3):18–24, accessed on 30 Aug 2025

²³¹ Schatsky D, et al, (2014), Demystifying artificial intelligence: what business leaders need to know about cognitive technologies. Deloitte Insights, 2014, accessed on 17 June 2023

²³² <https://www.knowledgehut.com/blog/data-science/future-of-robotics>, accessed on 16 June 2023

²³³ https://www.tesla.com/en_eu, accessed on 16 June 2023

²³⁴ <https://www.forbes.com/?sh=12c92a752254>, accessed on 16 June 2023

²³⁵ <https://www.weforum.org/reports/the-future-of-jobs-report-2020>, accessed on 26 June 2023

automation and AI by 2030,²³⁶ in their report, 'Jobs lost, jobs gained.'²³⁷

An up-skilling worker seems to be the most popular course in all advanced company. For example, Amazon's 'Up-skilling 2025'²³⁸ initiative, has announced that it plans to spend US\$ **700 million** to retrain a third of its workforce with skills for automation or in AI training. Again, **52% of industrial workers** interviewed in the Digital Factories 2020 and 'Shaping the future of manufacturing'²³⁹ report by PricewaterhouseCoopers (PwC)²⁴⁰ believed their company lacks a true **digital culture**. They decided, **getting workers involved, and trained**, with technologies at the earliest stages can double-up with effective risk assessment and understanding potential safety hazards. **Actually, safety and training** can go hand-in-hand by ensuring each worker is trained to follow the safety protocol and avoid risks of on-site accidents and injuries; whatever their skill level. **Training of the safe use** of robots also goes beyond the technologies' installation. As the national safety guidelines for the manufacturing industry are always changing and periodic training must be delivered to workers to ensure they can operate the machinery safely. The safety of robots must also be guaranteed over the long-term for the betterment of human safety. One way to achieve this is being explored by MIT²⁴¹ in collaboration with the automobile manufacturer BMW²⁴². By using **simulations to develop algorithms** that help robots predict and respond to humans in close proximity, like, on a car production line. In addition, **effective maintenance** is absolutely crucial to the safe operation of robots.²⁴³ So, the future of AI and robotics will provide several fascinating opportunities with high pay and promising career advancement. The chances for new generation of having a rewarding job in the

production and service industry can be increased further by formal education, certification, practical training, work experience, and skill development.

Currently social robots are designed to interact in ways that make them human by responding to human interactions.²⁴⁴ Sophia is an example of a social robot conceived as a companion for older adults that demonstrates the potential of technologic advancements to improve how robots function.²⁴⁵ In 2018, Sophia was re-designed with mobility capabilities and is now the first robot to be given citizenship in a country (Saudi Arabia).²⁴⁶ Miko is kind of robot that understand human emotion. Miko's got dozens of emotions (and a few tricks up its sleeve). Not just recognizing you and calling you by name, but responding to your mood and getting to know you a little better each day. Need a joke when you're down? A dance when you're bored? Miko's on it. Because it's not just the smartest little robot you'll ever meet. It's also your friend. Miko's constantly exploring for fun, prompting you to play, and encouraging you to challenge your brain. As comfortable initiating a conversation as starting a dance party, the only thing Miko's missing is a partner-in-

²³⁶ <https://www.mckinsey.com/mgi/overview>, accessed on 26 June 2023

²³⁷ James Bessen, (2015), *learning by doing: The real connection between innovation, wages, and wealth*, Yale University Press, 2015, accessed on 26 June 2023

²³⁸ <https://www.aboutamazon.com/news/workplace/up-skilling-2025>, accessed on 26 June 2023

²³⁹ <https://www.pwc.nl/en/publicaties/digital-factories-2020-shaping-the-future-of-manufacturing.html>, accessed on 26 June 2023

²⁴⁰ <https://www.pwc.com/>, accessed on 26 June 2023

²⁴¹ <https://www.mit.edu/>, accessed on 26 June 2023

²⁴² <https://www.bmw.com/en/index.html>, accessed on 26 June 2023

²⁴³ <https://blog.wor-con.com/when-smart-technology-meets-manufacturing/?lang=en>, accessed on 17 June 2023

²⁴⁴ www.youtube.com/watch?v=mSBcG-SSStqc, accessed on 24 June 2023

²⁴⁵ Greshko M. Meet Sophia, the robot that looks almost human, National Geographic, 2018, accessed on 17 June 2023

²⁴⁶ Hatmaker T. Saudi Arabia bestows citizenship on a robot named Sophia, Tech Crunch, 2017, accessed on 17 June 2023

crime.²⁴⁷ PARO is an advanced interactive robot developed by AIST, a leading Japanese industrial automation pioneer. It allows the documented benefits of animal therapy to be administered to patients in environments such as hospitals and extended care facilities where live animals present treatment or logistical difficulties.²⁴⁸



Professor Einstein is a robot that teaches science and general information.²⁴⁹ ROBEAR is a nursing care robot.²⁵⁰ Vortex is a programmable robot that teaches kids STEM.²⁵¹ Pillo is an AI-powered health companion.²⁵² Buddy is a home robot.²⁵³



Figure 7: Example of few modern robots (Healthcare robot, Emotional robot)^{254,255}

As robots learn to perform nursing functions, such as ambulation support, vital signs measurement, medication administration, and infectious disease protocols, the role of nurses in care delivery will change.²⁵⁶ Research suggests that between 8% and 16% of nursing time is spent on non-nursing activities and tasks that should be delegated to others.²⁵⁷ Again from an example of a robot collaboration is found at Duke University Pratt School of Engineering and School of Nursing. Interdisciplinary teams are working on developing the Tele-Robotic Intelligent Nursing Assistant (TRINA), a remote-controlled robot, to address healthcare workers who are at “high risk for infection due to routine interaction with patients, handling of contaminated materials, and challenges associated with safely removing protective gear.”²⁵⁸ TRINA is tested in the nursing simulation lab and currently performs about 60% of predefined nursing tasks; however, it's 20 times slower than a nurse. The nurse will become the information integrator, health coach, and deliverer of human caring, supported by AI technologies, not replaced by them.

In 2017, the McKinsey Global Institute (MGI) published the report “Jobs Lost, Jobs Gained: Work-

force Transitions in a Time of Automation.”²⁵⁹ Although discussions of AI replacing human workers have taken place since the beginnings of the technology, this report stirred great debate about the global impact of AI. MGI models predict that by 2030, nearly 75 million to 375 million workers worldwide will need to switch occupations due to AI technologies. However, the report also emphasizes that new roles and jobs will be created. American Economic Association researchers agree with the MGI predictions, finding that some tasks will be favorable for automation, but few jobs can be fully automated. They also predict that workers will train into new roles.²⁶⁰ In 2011, computer scientist Andrew Ng proved that computers can learn what an object is without being told what it represents. His research used 10 million online videos of cats; over time, the computer learned what a cat was. This breakthrough technology is used today in speech recognition systems. Recent research predicts that global AI healthcare spending will equal US\$ 36.1 billion by 2025.²⁶¹ China announced in 2017 its goal to become a global leader in AI by 2030. The U.S. issued the executive order ‘Maintaining American Leadership in AI’ on February 11,

²⁴⁷ <https://miko.ai/>, accessed on 24 June 2023

²⁴⁸ <http://www.parorobots.com/>, accessed on 24 June 2023

²⁴⁹ <https://www.hansonrobotics.com/professor-einstein/>, accessed on 24 June 2023

²⁵⁰ www.riken.jp/en/pr/press/2015/20150223_2, accessed on 24 June 2023

²⁵¹ www.youtube.com/watch?time_continue=5&v=ssv7tcXJSnQ, accessed on 24 June 2023

²⁵² www.pillohealth.com, accessed on 24 June 2023

²⁵³ <https://buddytherobot.com/en/buddy-the-emotional-robot>, accessed on 24 June 2023

²⁵⁴ <https://www.japan-times.co.jp/news/2023/03/20/world/germany-taps-robots-elderly-care/>, accessed on 17 Sep 2023

²⁵⁵ <https://edition.cnn.com/2015/06/22/tech/pepper-robot-sold-out/index.html>, accessed on 18 Sep 2023

²⁵⁶ Finlay GD, et al, (2014), Measuring the modified early warning score and the Rothman Index: advantages of utilizing

the electronic medical record in an early warning system. *J Hosp Med*, 2014;9(2):116–119, accessed on 05 Oct 2023

²⁵⁷ Yen PY, et al, (2018), Nurses' time allocation and multi-tasking of nursing activities: a time motion study, *AMIA AnnuSympProc*, 2018;2018:1137–1146, accessed on 05 Oct 2023

²⁵⁸ Li J, et al, (2018), Thetele-robotic intelligent nursing assistant (TRINA), Duke University Pratt School of Engineering Intelligent Motion Laboratory. 2018, accessed on 05 Oct 2023

²⁵⁹ McKinsey Global Institute, Jobs lost, jobs gained: work-force transitions in a time of automation. 2017, accessed on 05 Oct 2023

²⁶⁰ Brynjolfsson E, et al (2018), What can machines learn, and what does it mean for occupations and the economy. *AEA Pap Proc*. 2018;108:43–47, accessed on 05 Oct 2023

²⁶¹ Bresnick J., (2018), Artificial intelligence in healthcare spending to hit \$36B, *Health IT Analytics*, accessed on 05 Oct 2023

2019, directing all federal government agencies to implement strategic objectives aimed at accelerating AI research and development.²⁶²

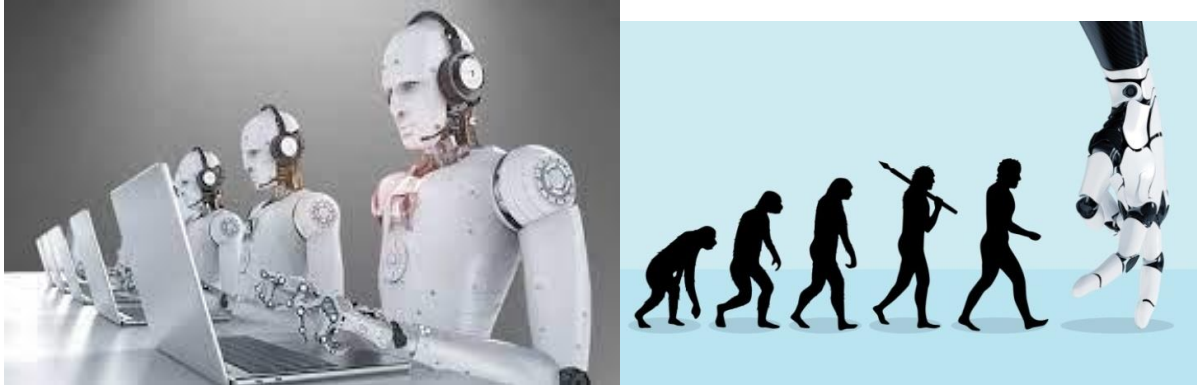


Figure 8: Machines may rule over humans in future²⁶³ both certainty and uncertainty of life²⁶⁴

The age of AI and 4IR is a transition, and it could take years or even decades for different parts of the workforce and almost every part of life to get used to it. So, these predictions are harder to make, but few gloomy experts worry that once AI is everywhere, these new jobs and the ones that were already there may start to go away. So, they wonder what will happen to those people in the long run. As we've seen in the past, there were ways to move from farming to making things to providing services. Now, that isn't true. What will happen to most people who work if all jobs are taken over by robots? As we've seen, technology makes more sense from a business point of view. For example, self-driving cars and AI concierges like Siri and Cortana could take away up to 8 million jobs in the US alone as these technologies get better. What about the rest of the

world? When all these jobs start to go away, we'll have to ask ourselves, 'What makes us useful?'²⁶⁵ How do we define productivity? We must face the ever-evolving reality and rethink the foundations upon which our civilization is built. What is it that we do that contributes to society and makes us valuable as individuals? Since the technology won't wait for us, we need to have this discussion ASAP. It's time for us to develop a moonshot mindset.²⁶⁶ To build inclusive, decentralized intelligent digital networks 'imbued with empathy'²⁶⁷ that help humans aggressively and ensure that technology meets social and ethical responsibilities.²⁶⁸ We need some effective and new level of regulatory and certification process to ensure the best use of AI for entire human race.²⁶⁹



Figure 9: In future robot will replace teacher²⁷⁰ and Modern classroom²⁷¹

²⁶²Federal Register. Executive order No. 13859 of February 11, 2019: maintaining American leadership in artificial intelligence, accessed on 05 Oct 2023

²⁶³www.quora.com/Will-machines-replace-humans-If-yes-when, accessed on 25 Sep 2023

²⁶⁴<https://time.com/6283958/darwinian-argument-for-worrying-about-ai/>, accessed on 25 Sep 2023

²⁶⁵YudkowskyEliezer, (2008), "Artificial Intelligence as a Positive and Negative Factor in Global Risk", Global Catastrophic

Risks, Bibcode:2008gcr..book..303Y, ISBN 9780198570509, accessed on 04 Oct 2023

²⁶⁶ <https://x.company/moonshot/>, accessed on 23 June 2023

²⁶⁷ <https://dharmaseed.org/talks/26820/>, accessed on 23 June 2023

²⁶⁸ <https://theshillongtimes.com/2022/10/16/we-care-foundation-philanthropy-imbued-with-empathy/>, accessed on 23 June 2023

²⁶⁹ <https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai>, accessed on 23 June 2023

²⁷⁰ <https://www.notredamecoll.ac.uk/news/will-robots-replace-teachers-zufar-hussain>, accessed on 29 Sep 2023

²⁷¹ <https://www.youtube.com/watch?v=1n1mzVoivL8>, accessed on 03 Oct 2023

6. Analysis of Life and Philosophy of Selected Successful and Great Entrepreneurs around the Globe

All great entrepreneurs in addition to establish enormously successful companies, they were also responsible for generating new ideas and products that have crafted and curated the world we live in today. Every aspect of our life from technology to entertainment has been impacted by the essence of entrepreneurship from the last two decades. Famous entrepreneurs have thrived with great success all over history, inspiring others with their ideas and the way they established their businesses. Some entrepreneurs achieve success by being patient and listening to the advice of their close partners. For others, it is superior knowledge and perseverance. For the majority, it involves the endeavor to exhibit courage, embrace risks, and pursue innovative experiences. John D. Rockefeller of Standard Oil and steel magnate Andrew Carnegie is among early entrepreneurs who built business empires. General Electric (GE) was established by Thomas Edison, while Henry Ford revolutionized manufacturing, making automobile accessible to the masses. Oprah Winfrey and John Johnson established extensive entrepreneurial portfolios that encompassed several industries, mediums, and consumer demographics. Tom Love, Charles Schwab, and Steve Jobs established enterprises that are well recognized and utilized throughout the nation.

The banking sector in America was revitalized by entrepreneurs such as JP Morgan, who revolutionized the way banking was conducted. In 1876, Alexander Graham Bell established the communication industry.²⁷² However, in 1973, Martin Cooper, a Motorola executive and researcher, made the first mobile telephone call from a handheld phone to his rival, Joel S. Engel of Bell Labs. Today, the industry is a multi-billion-dollar entity that is home to numerous mobile phone and telephone manufacturers and operators worldwide.²⁷³ In 1448, the printing press, invented by the German goldsmith Johannes Gutenberg, is recognized as one of the most significant inventions in history, as noted in the International Science Index, Management and Industrial Engineering Vol: 11, No: 9, 2017, available at waset.org/Publication/10007833. It significantly altered the way in which cultures disseminate knowledge and initiated a whole new sector of printing and publishing.²⁷⁴ Recently, entrepreneurs and innovators like Steve Jobs of Apple Computers, Bill Gates of Microsoft, Mark Zuckerberg of Facebook, Aliko Dangote of Dangote Group, Innoson of IVM Motors, Jeff Bezos of Amazon, Pierre Morad Omidyar, the French-born Iranian-American entrepreneur and

philanthropist who started eBay, Peng Lei and Jack Ma of Alibaba Group, Sim Shagaya, the Nigerian businessman and entrepreneur who started Konga, the biggest e-commerce website in West Africa, and Tunde Kehinde and Raphael Kofi Afaedor of Jumia, among others, have changed the way business is done and created new industries that have helped their economies grow and develop.

Before their transformative contributions to the economy these inventors, creators, innovators, and business entrepreneurs were neither acknowledged for their academic excellence, nor reported to have undergone any training in entrepreneurial education. Therefore, what about the entrepreneurs, inventors, and innovators in 21st century? Did their education in entrepreneurship serve as a stimulus for their entrepreneurial aspirations and engagement? What significance does entrepreneurship education (EE) hold in the expansion and advancement of enterprises and emerging industries for economic development and growth? Is there a correlation between an individual's entrepreneurial training and their pursuit of entrepreneurship? What is the role of entrepreneurship education (EE) in the 21st century in fostering the growth and development of a nation? Entrepreneurship has gathered enormous interest from both academics and practitioners as the driving force behind economic growth. The imperative of entrepreneurship as a strategic model for sustainable growth and development is gradually acknowledged by governments, organizations (both private and public), and the general populace in order to adapt quickly to the ever-changing business environment of the 21st century knowledge-technology-based economy. In its present state, entrepreneurship is a multi-layered and multidimensional spectacle that has been defined as a mindset, process, and resource by some.²⁷⁵

Most definitions of entrepreneurship have primarily focused on business and business startups, which create value at a cost. However, entrepreneurship is much more than that. It is not exclusively centered on business skills or opening a new business enterprise; it is generally a way of thinking, a mindset, and a behavioral pattern that is applicable to all facets of society and the economy at large. Individuals' response and reaction to the changes within and around their environments are reflective of the real-world nature of entrepreneurship.²⁷⁶ Two organizations operating within the same environment, confronted with the same challenges will differ in their responses and behaviors. To one, it would be a chance to convert challenges into opportunities by altering processes; however, to another,

²⁷² Library of Congress, (2017). Everyday Masteries: Fun Science Facts from the Library of Congress. (Online). www.loc.gov. Available from: <https://www.loc.gov/rr/scitech/mysteries/telephone.html> (Accessed 12 March, 2017), accessed on 20 Jul 2025

²⁷³ Ray, A., (2015). The History and Evolution of Cell Phones. (Online). The Art Institutes. Available from: <https://www.artinstitutes.edu/about/blog/the-history-and-evolution-of-cell-phones> (Accessed 7th April, 2017), accessed on 20 Jul 2025

²⁷⁴ Ps Print, (2017). The Invention of the Printing Press. (Online). Available from: <https://www.psprint.com/resources/printing-press/> (Accessed 13 March, 2017), accessed on 20 Jul 2025

²⁷⁵ Toma, S., Grigore, A. & Marinescu, P., (2014). Economic Development and Entrepreneurship. *Procedia Economics and Finance*, 8(2014), pp. 436–443, accessed on 20 Jul 2025

²⁷⁶ Wiczner, J., (2016). Apple Takes Back Title of World's Most Valuable Company. (Online). *Fortune.com*. Available from: <http://fortune.com/2016/02/03/apple-facebook-amazon-google/> (Accessed 14 March, 2017), accessed on 20 Jul 2025

it could destroy the business.²⁷⁷ The evidence of this is the shift in consumer preferences for mobile phones from traditional to smart phones. Apple was once the most valuable company in the world due to the significant profitability it achieved as a consequence of these changes. In the meantime, Nokia was deeply impacted by the same consumer shift in preference, resulting in substantial losses.^{278,279} The best entrepreneurs of all time who have transformed and improved through innovation and technology are discussed below. List may be longer, but selection has kept limited due to manage the research and analysis sensible and judicious.

❖ John D. Rockefeller

John D. Rockefeller was an American businessman and philanthropist. He was one of the affluent people in modern history as well as one of the wealthiest Americans ever.²⁸⁰ Rockefeller was also regarded as a proponent of capitalism based on a perception of social Darwinism, and he was quoted frequently as saying, "The growth of a large business is merely a survival of the fittest."²⁸¹ He adhered his father's guidance to "trade dishes for platters" and always get the superior part of any transaction.²⁸² Con artist William A. Rockefeller Sr. and Eliza Davison had six children, with being the Richford Rockefeller being the second, born in Richford, New York.²⁸³ Ohio, John D. Rockefeller, Buried in Cleveland, was considered the wealthiest man by most measures during his era. He acquired his wealth by extracting efficiencies through horizontal and vertical integrations, which rendered Standard Oil synonymous with monopoly. Consequently, the price of fuel for the everyday consumer decreased drastically. In 1911, government permanently dissolved Standard Oil.²⁸⁴ Rockefeller's contribution can still be evident in companies like Exxon and Conoco, which benefited from the R&D and infrastructure perceived as part of the dissolution. Rockefeller established the Standard Oil in 1870 and he oversaw it until 1897 while remaining its major shareholder.²⁸⁵ During his retirement, he engrossed his vigor and assets in philanthropy, with a special emphasis on modernizing the Southern United States, education, medicine and higher education. Rockefeller was the founder of Rockefeller University and the University of Chicago, and also financed for the establishment of Central Philippine University in the Philippines.²⁸⁶ At the century's turn, Rockefeller retired and dedicated the rest of his life to philanthropy. More

than 80 years after his demise, Rockefeller continues to be acknowledged as one of the most significant personalities of Wall Street.

John D. Rockefeller perceived entrepreneurship as a methodical approach that necessitating meticulous planning, persistent execution, and a strong emphasis on efficiency and cost reduction. He underscored the significance of establishing a robust foundation, comprehending the intricacies of his business, and assembling a proficient team. The strategies he employed included vertical integration, striking favorable deals, and adapting to altering market conditions. Rockefeller advocated for a structured and methodical business approach, which prioritized comprehensive record-keeping, performance monitoring, and cost optimization. Rockefeller argued for the comprehensive control of the production process, encompassing raw materials to distribution, to optimize efficiency and save costs. He acknowledged the significance of associating himself with talented individuals and fostering a cooperative environment. He prioritized the capacity to execute plans effectively over sheer ambition, concentrating on precision and detail in every facet of his operations. He had a distinct vision for the future of the oil industry and strategically aligned his organization to exploit growing opportunities. Rockefeller was recognized for his ability to acclimate to altering market conditions and adopt new technologies, which enabled him to sustain a competitive advantage. He recognized the significance of making logical, data-driven decisions and maintaining emotional composure, even in the face of adversity. In his later years, Rockefeller also underscored the significance of ethical behavior and social responsibility, primarily through philanthropy.

❖ Thomas Edison

Without a doubt, Thomas Edison was a brilliant businessman and inventor. Edison transformed innovation into the procedure that is now recognized as research and development. He sold his services to numerous other companies prior to establishing his own enterprise to generate most of the electrical power infrastructure of the United States. Edison is one of the founders of General Electric (GE), which was originally known as Edison General Electric.²⁸⁷ He established numerous devices in the disciplines of electric

²⁷⁷ Lee, T. B., (2017). How Apple Became the World's Most Valuable Company. (Online). Vox.com. Available from: <http://www.vox.com/cards/apple> (Accessed 14 March, 2017), accessed on 20 Jul 2025

²⁷⁸ Independent, (2012). Nokia Losses Grow as Sales Plunge Again. (Online). Independent.co.uk. Available from: <http://www.independent.co.uk/news/business/news/nokia-losses-grow-as-sales-plunge-again-8217113.html> (Accessed 14 March, 2017), accessed on 20 Jul 2025

²⁷⁹ Forbes, (2016). The World's Most Valuable Brands: 2016 Ranking. (Online). Forbes Magazine. Available from: <https://www.forbes.com/powerful-brands/list/#tab:rank> (Accessed 14 March, 2017), accessed on 20 Jul 2025

²⁸⁰ https://archive.nytimes.com/www.nytimes.com/ref/business/20070715_GILDED_GRAPHIC.html, accessed on 20 Jul 2025

²⁸¹ Schultz, Duane P.; Schultz, Sydney Ellen, A History of Modern Psychology, p. 128, accessed on 07 Jul 2025

²⁸² <https://www.challies.com/articles/the-philanthropists-john-d-rockefeller>, accessed on 07 Jul 2025

²⁸³ Newton, David E. (2013). World Energy Crisis: A Reference Handbook. Santa Barbara, CA: ABC-CLIO. p. 201. ISBN 978-1-61069-147-5, accessed on 07 Jul 2025

²⁸⁴ <https://www.law.cornell.edu/supremecourt/text/221/1>, accessed on 07 Jul 2025

²⁸⁵ Coffey, Ellen Greenman; Shuker, Nancy (1989), John D. Rockefeller, empire builder, Silver Burdett, pp. 18, 30, accessed on 07 Jul 2025

²⁸⁶ <https://cpu.edu.ph/weekly-centralian-link-june-15-2018/>, accessed on 07 Jul 2025

²⁸⁷ Hope, Adrian (May 11, 1978), "100 Years of Microphone", New Scientist, Vol. 78, No. 1102, p. 378. ISSN 0262-4079, accessed on 11 Jul 2025

power generation, mass communication, sound recording, and motion pictures.²⁸⁸ The modern industrialized world has been significantly impacted by these inventions, which include the phonograph, the motion picture camera, and early versions of the electric light bulb.²⁸⁹ He was among the first inventors to apply the principles of organized science and teamwork to the process of invention, collaborating with numerous researchers and employees. The first industrial research laboratory was established by him. Edison was raised in the American Midwest and began his career as a telegraph operator, which served as the inspiration for some of his earliest inventions.²⁹⁰ He founded his inaugural laboratory facility in 1876, located in Menlo Park, New Jersey, where numerous early ideas were conceived. Subsequently, in collaboration with businessmen Henry Ford and Harvey S. Firestone he established a botanical laboratory in Florida and a laboratory in New Jersey, that featured the world's first film studio, the Black Maria.²⁹¹ Edison is considered as the most prolific inventor in American history, holding 1,093 US patents along with patents in other countries.²⁹²

Edison had little inclination to become a "business tycoon" and devote his time overseeing an extensive industrial empire. He wanted to stay in the laboratory, and his real task was the innovation of new products, at which he was extremely successful. Edison perceived his primary job as that of inventor and he was frequently took part in crucial management decisions of the companies that were established to exploit on his inventions. Moreover, the origins of his inventive approach can be traced back to his tenure in the emerging telegraph industry.²⁹³ His contribution in the telegraph industry significantly enhanced his entrepreneurial success in subsequent endeavor.²⁹⁴ Additionally, Edison's expertise in the telegraph industry provided him an abundance of business experience that was inaccessible to other inventors of his time. Considering the slow world of legislative filibustering business-minded Edison had overvalued the significance of speed. Edison determined on his way home, to never invent anything that did not have what he referred to as "commercial demand."²⁹⁵ Throughout the research and development work on a new technology, he provided careful consideration to minimize operating and manufacturing costs and approaches of adapting the technology to the requirements of users. Edison committed a substantial

amount of devotion to refining the manufacturing processes with the aim to diminish the cost of the new technology when he initiated commercial introduction of it. Correspondingly, he continued to carry out research and development to better adapt his products to meet the specification of the users. Edison as the quintessential American inventor who provided no attention to business resonates more with Hollywood trends than the historical record.

❖ Henry Ford

Henry Ford was a legendary American industrialist and business magnate, holding the status of one of the most prominent and successful entrepreneurs throughout the ages. He is regarded as a pioneer in the development of Fordism, an approach that made automobiles affordable for middle-class Americans. This approach was established by the founder of the Ford Motor Company.²⁹⁶ Henry Ford is extensively recognized as one of the dominant innovators and industrialists of all time. He "initiated" the industrial revolution with his innovative assembly line, made significant contributions to aviation, established educational systems, published a controversial newspaper, and unsuccessfully ran for the U.S. Senate in 1918. Ford was considered a pacifist, yet he produced more than 1,000,000 vehicles, aircraft, and other machinery that contributed to the Allied victory during World War II.²⁹⁷ Ford was born in a farmhouse in Springwells Township, Michigan, and left home at the age of 16 to pursue employment in Detroit.²⁹⁸ Several years prior, Ford first encountered automobiles, and during the latter half of the 1880s, he commenced repairing and subsequently constructing engines, while in the 1890s, he collaborated with a branch of Edison Electric. He founded the Ford Motor Company in 1903 following previous commercial failures, yet achieved success in automotive manufacturing.²⁹⁹ The automobile was not invented by Henry Ford. He was one of a group of persons who were participated in the development of motorcars and was questionably not even the most talented of them. Nevertheless, these competitors were offering their cars for a price that deemed them a luxury possession of the affluent. Ford revolutionized mass production by offering Americans with access to transportation that was not exclusively reserved for the affluent. His Ford Model T was the first automobile that was intended for the majority of Americans. Ford's relentless quest of improved, speedier, and more cost-effective automo-

²⁸⁸ <https://web.archive.org/web/20121030164753/http://www.coned.com/history/electricity.asp>, accessed on 11 Jul 2025

²⁸⁹ <https://web.archive.org/web/20130305131049/http://fi.edu/franklin/inventor/edison.html>, accessed on 11 Jul 2025

²⁹⁰ Conot, Robert (1979). *Thomas A. Edison: A Streak of Luck*. New York: Da Capo Press, accessed on 11 Jul 2025

²⁹¹ Cosden, M. (2015). *Edison and Ford in Florida*. Arcadia Publishing. ISBN 9781467114646, accessed on 11 Jul 2025

²⁹² Boyer, Paul S., ed. (2001). *The Oxford Companion to United States History*. Oxford University Press. p. 211. ISBN 978-0-19-989109-2, accessed on 11 Jul 2025

²⁹³ A. Millard, (1990), *Edison and the Business of Innovation*. Baltimore, MD: Johns Hopkins, 1990

²⁹⁴ B. McCormick, *At Work with Thomas Edison*. Irvine, CA: Entrepreneur, 2001, *The Papers of Thomas A. Edison* (vol. 1-5). Baltimore, MD: Johns Hopkins [Online]. Available: <http://edison.rutgers.edu>,

²⁹⁵ <https://ieeecincinnati.org/2005/03/04/48/#>,

²⁹⁶ Goodman, Peter (June 10, 2024). "Lessons From Henry Ford About Today's Supply Chain Mess". *The New York Times*, accessed on 11 Jul 2025

²⁹⁷ https://www.ltbn.com/hall_of_fame/Ford.html,

²⁹⁸ Lewis, David L. (1995). "Henry Ford and His Magic Beanstalk". *Michigan History*. 79 (3): 10–17. Ford's interest in soybeans and plastics, accessed on 11 Jul 2025

²⁹⁹ Ford, Henry (2019). *My Life and Work*. Columbia. pp. 12–17. ISBN 9781545549117, accessed on 11 Jul 2025

biles, coupled with his progressive labor policies, guaranteed that his employees and the general populace would associate Ford with automobile purchases.³⁰⁰ Success is constructed on inspiration, and inspiration is stimulated by love. Behind this magnificent man was the great woman, Clara Bryant. Henry Ford conveyed his gratitude to his beloved wife for her unwavering support and confidence in his capability to succeed, asserting, "I attribute whatever I may have been able to accomplish in life far more to my wife than to anything else and to everything else put together."

Ford was an advocate of vertical integration and operation. He transformed consumerism in middle-class and rural America by altering the moving assembly-line mode of production. He specified, "I will construct a new car for the vast majority of the population, using the finest materials and the most talented individuals accessible for employment. The design will be as simple as modern engineering can invent, and it will be priced so low that no individual earning a decent salary will be incapable to own one, and he and his family will be able to enjoy hours of pleasure." Ford concealed optimistic beliefs regarding his promise to the welfare of his employees.³⁰¹ He was first and foremost of the belief that excess funds should be distributed to his employees. Additionally, he unlocked employment opportunities for women, the blind, and physically disabled veterans. He attempted to found a school within his company to support immigrant workers in learning English, providing essential instructions, and providing guidance on sanitation and bank savings in order to incorporate them into American society. The intention of introducing them to the American way of life and prosperity was to serve as a sustaining practice for his diverse workforce and to assist them in integration into the local community. He was of the view that surplus wealth should be allocated to the creation of additional employment opportunities and the enhancement of human happiness in an increasing number of lives. He was even a devotee of the idea that financial security and consumerism are a means to preserve world peace. Talented teams are the most effective at attaining success. The similar was true for Ford. One of his most outstanding abilities was the ability to recognize and attract exceptional individuals. He employed a group of able young men who were dedicated to his vision and would work tirelessly to transform Ford Motor Company into one of the most successful industrial enterprises in the world. He was of the opinion that accomplishment is to "do more for the world than the world does for you." "The endowed man bears his gifts into the world not for his own benefit, but for the people among whom he is placed; for the gifts are not his, he himself is a gift to the community," he stated. He maintained a youthful spirit and enthusiasm throughout his existence.

❖ Oprah Winfrey

Oprah Winfrey, one of the wealthiest and most influential women, commenced her career as a news anchor and evolved into a prominent entrepreneur. In 1986, her program, "The Oprah Winfrey Show," was syndicated nationwide. It was the most highly regarded talk program in the United States, and fetched Winfrey numerous Emmy Awards. Furthermore, she has featured in multiple animated films, both as a voice actress and in prominent roles. Winfrey is a trailblazer in the field of entrepreneurship, having established an on-air book club in 1996 and subsequently founded O, the Oprah Magazine in 2000. In 2006, she launched a satellite radio channel and co-founded Oxygen Media, a cable television network exclusively for women. Her most remarkable achievement was the establishment of Oprah's Angel Network, which supported charitable initiatives worldwide. Winfrey has not only facilitated opportunities various businesswomen, but she also unswervingly exemplifies the effective use of entrepreneurial power for the greater good. Oprah underscores the significance of identifying one's personal vocation and ensuring that business pursuits are in alignment with it. She is of the opinion that success is accomplished by recognizing one's passions and exploiting them to benefit others. Oprah is of the belief that real achievement is attained by contributing to society and having a positive influence on the world. She perceives entrepreneurship as a chance to generate value for others and make a positive impact on society. Oprah's entrepreneurial strategy is dynamic; she demonstrates the requirement of adapting and evolving in response to changing circumstances. She advocates for entrepreneurs to remain inquisitive, pursue knowledge, and seize new opportunities for expansion. She emphasizes authenticity, service, and continuous learning, viewing entrepreneurship as a means to achieve personal fulfillment and societal impact.

Oprah is an advocate of the alignment of business decisions with a more profound feeling of purpose and the development of a comprehensive vision for one's life. Her method emphasizes the significance of establishing a robust personal brand that is founded on values and genuine connections with others, as well as demonstrating passion and resilience. She promotes for deriving lessons from failures and use them as foundations for further accomplishments. She contends that setbacks are unavoidable yet should not dissuade entrepreneurs from striving towards their objectives.³⁰² Oprah fosters the integrity and transparency of entrepreneurs, both in their interactions with themselves and their audience. Her own career trajectory exemplifies how she transformed from anchoring talk shows exclusively to harnessing her platform to promote positive change. She also emphasizes the significance of maintaining one's values and establishing boundaries, even in the face of adversity.³⁰³ She contends that authenticity nurtures trust and develops customer loyalty. Her

³⁰⁰ Wallace, Max (2003). *The American axis: Henry Ford, Charles Lindbergh, and the rise of the Third Reich*. New York: St. Martin's Press. ISBN 978-0-312-29022-1, accessed on 11 Jul 2025

³⁰¹ <https://www.linkedin.com/pulse/philosophy-epic-entrepreneurs-henry-ford-haralabidou-ph-d-/>,

³⁰² <https://www.linkedin.com/pulse/oprah-winfreys-wisdom-inspiring-entrepreneurial-joanne-debenham-ma-7mbre/>,

³⁰³ <https://www.linkedin.com/pulse/what-oprah-winfrey-has-say-accountants-majaliwa-bass/>,

career trajectory illustrates how she transformed from simply a talk show host to harnessing her platform as a catalyst for positive change. Oprah advocates for entrepreneurs to represent authenticity and transparency, both in self-reflection and in their interaction with audiences. She underscores the significance of maintaining boundaries and adhering to one's principles, exclusively in the face of adversity. Her journey demonstrates an enthusiasm to learn from instances and to perpetually enhance her methodology. She stated, "You are accountable for your existence." One cannot eternally blame one's dysfunction to another individual. Life fundamentally revolves around progression. Emulate the mindset of a sovereign. A queen exhibits no fear of failure. Failure serves as an additional stepping stone toward greatness. Your greatest fear has no authority. Your apprehension is what possesses the power. Confronting the truth will indeed liberate you."³⁰⁴

❖ John Johnson

John H. Johnson, recognized as the preeminent African American publisher in American history, was born on January 19, 1918, in Arkansas City, Arkansas, to Leroy and Gertrude Johnson Williams. Johnson's father passed away at the age of six, requiring that all members of his family contribute in order to survive. Johnson repeated the eighth grade to further his education, as there were no high schools available to black students in Arkansas City during his childhood. Johnson joined DuSable High School and graduated with honors shortly after relocating to Chicago with his family. While attending the University of Chicago, Johnson continued to work for the Supreme Life Insurance Company subsequently graduating from high school. During his tenure at Supreme, he was charged with the responsibility of accumulating weekly news clippings for his supervisor. This experience ultimately inspired him to create his first publication, *Negro Digest*. After graduating from the University of Chicago in 1942, Johnson explored this concept and established *Negro Digest*, which was subsequently renamed *Black World*. Johnson secured a \$500 loan against his mother's furniture and raised \$6,000 through charter subscriptions. Three years later, he launched *Ebony*, which has upheld its status as the most prominent African American publication worldwide each year since its commencement. Johnson Publishing evolved once more in 1951 with the formation of *Jet*, the world's largest African American news weekly publication.³⁰⁵ By founding the biggest black-owned publishing company in the United States, John H. Johnson arose from impoverishment to become one of the most influential media pioneers in the world. But more significantly, Johnson provided African-Americans with a voice and a face, as well as, in his own words, "a new sense of somebody-ness," through the revolutionary magazines he initiated, *Jet* and *Ebony*. This was a time when blacks were essentially unnoticeable in mainstream American society.³⁰⁶

Johnson also extended his career from magazine to book publishing, and he was the founder of Fashion Fair Cosmetics, the most prominent black-owned cosmetics company in the world, Supreme Beauty Products, and produced television specials. Johnson subsequently acquired the position of chairman and CEO at Supreme Life Insurance, where he had started his professional career. John Johnson, born in Arkansas in 1918, is widely acknowledged as one of the most dominant African American publishers in the annals of American history. Johnson established *Negro Digest* in 1942 and attained success. Afterward, he published *Ebony*, which has been the most extensively read African American periodical worldwide since 1945. *Jet*, the most substantial weekly African American news magazine, was founded by Johnson six years later.³⁰⁷ Nevertheless, Johnson did not halt his endeavors with publishing. He eventually bought Fashion Fair Cosmetics, the world's biggest Black-owned cosmetics corporation. Furthermore, he ultimately accepted the position of chairman and CEO of Supreme Life Insurance. The Presidential Medal of Freedom, the nation's most prestigious civilian honor, was conferred upon Johnson by prior President Bill Clinton in 1996. He stated, "I cry and curse when I confront a barrier, and subsequently, I acquire a ladder and ascend it." He conveys his sentiment by asserting, "My mother had the most significant impact on my life." She fostered in me the belief that I would eventually gain success. She demonstrated perseverance, a quality that is crucial in the business world. I always inspire young people to dream big, as small goals can be accomplished. When a small desire is realized and a small success is achieved, it boosts confidence in the individual to move forward to the next level."³⁰⁸ He also commented, "I am an advocate of hands-on, hands-in, hands-wrapped-around management, which comprises the daily check-in on individuals and the free delegation of obligations." Analysis is the most crucial skill that a manager can attain, as it facilitates them to swiftly conceive solutions to complex situations."

❖ Dr Muhammad Yunus

He is a Bangladeshi economist, statesman, civil society leader, and great entrepreneur who has been working as the Chief Adviser of the interim government of Bangladesh. He is acknowledged with pioneering the modern concept of microcredit and microfinance, for which he was bestowed the Nobel Peace Prize in 2006 as the first Bangladeshi. Poverty constitutes a significant enterprise. The poverty industry, which encompasses payday loan centers, pawnshops, credit card companies, and microfinance providers, produces revenue from the poorer sections of the population, is worth approximately \$33 billion annually, regardless of the fact that the United States is one of the

³⁰⁴ <https://www.uschamber.com/co/start/strategy/inspirational-oprah-winfrey-quotes#>,

³⁰⁵ <https://www.blackenterprise.com/john-h-johnsons-enduring-lessons-on-growing-black-businesses/>,

³⁰⁶ <https://www.entrepreneur.com/growing-a-business/john-h-johnson/197650>,

³⁰⁷ <https://www.thehistorymakers.org/biography/john-h-johnson-40>, accessed on 11 Jul 2025

³⁰⁸ <https://walton.uark.edu/insights/john-h-johnson-advice.php>,

prosperous nations in the world.³⁰⁹ Grameen Foundation serves the world's impoverished, explicitly women, in enhancing their standards of life and overcoming poverty by facilitating the acquisition of appropriate financial services and the creation of novel income-generating strategies in Bangladesh. We have assisted millions in avoiding poverty by improving the effectiveness of local microfinance institutions and other poverty-focused entities.³¹⁰ Grameen Bank is established by Dr Yunus.³¹¹ Following the catastrophic famine of 1974, Yunus initiated efforts to alleviate poverty in Bangladesh. He commenced his experimentation with microfinance in the late 1970s. The Grameen Bank was founded in 1983.³¹² The Grameen microfinance model's success served as a catalyst for similar initiatives in approximately 100 developing countries, as well as in developed nations such as the United States, China, and the European Union.³¹³

In 2006, Dr. Yunus was awarded the Nobel Peace Prize for his revolutionary work in microcredit and microfinance, as well as for establishing the Grameen Bank.³¹⁴ Dr. Muhammad Yunus has been awarded numerous national and international accolades, such as the Congressional Gold Medal in 2010 and the United States Presidential Medal of Freedom in 2009.³¹⁵ Dr Yunus also worked in the board of directors of the United Nations Foundation, a public charity that promotes UN causes, from 1998 to 2021.³¹⁶ He formed an alliance with the Global Esports Federation in 2022 as part of the Esports for Development (E4D) program to promote the advancement of esports.³¹⁷ In 2025, he was named one of Time Magazine's 100 Most Influential People in the World.³¹⁸ The Yunus Centre, established in 2008 and headed by Dr. Yunus, is a think tank in Dhaka devoted to social business, poverty alleviation, and sustainability, promoting his ideology and working as a resource center for related activities. The center's initiatives encompass poverty alleviation campaigns, research and publishing, assistance for social enterprise start-ups, coordination of the Global Social Business Summit, and the formulation of academic programs on social business in collaboration with interna-

tional universities.³¹⁹ Dr. Muhammad Yunus's renowned work, "A World of Three Zeroes" (zero poverty, zero unemployment, and zero carbon emissions), challenges young people, business and political leaders, and ordinary citizens worldwide to adopt a novel form of capitalism and enhance the world for all before it is too late.³²⁰ The Nobel laureate anticipates an adverse future unless we promptly address the failure of our economic system. The youthful individuals who possess superpowers and the social enterprises that are intended to address issues are introduced. He continued, stating that capitalism, which is the driving force of that machine, had transformed individuals into "profit-maximizing robots." Nevertheless, young people had the capacity to reclaim a sense of humanism and optimism.³²¹ furthermore, he proposed that universities highlight the development of young individuals into successful entrepreneurs, rather than merely job seekers."³²²

An idea that has reached its prime cannot be stopped by anything. Microfinance is right now in an unstable state. This paradigm is considered to be outdated. It provoked more queries than it has addressed. It is an ambitious assertion that claims that we will be able to mitigate poverty. Microfinance has made numerous promises than it has actually accomplished, caused more issues than it has resolved, and continues to make far more promises than it has actually implemented. (Jairam Ramesh, Indian Minister of Rural Development, 2012). There are currently between 1.2 and 1.5 billion individuals living in extreme poverty on a global scale, and 162 million children are still suffering from chronic undernutrition. The United Nations has defined this figure as "unacceptable".³²³ Microfinance, which involves the providing of small loans to impoverished individuals in order to alleviate their poverty, is a critical poverty reduction strategy that has achieved extensive and rapid momentum over the past two decades. Currently, it is operational in over 60 countries.³²⁴ Many researchers and policymakers believe that microfinance promotes entrepreneurship, increases income-generating activity, and empowers the impoverished,

³⁰⁹ Rivlin G (2010) *Broke USA: From Pawnshops to Poverty, Inc. How the Working Poor Became Big Business*. New York: HarperCollins, accessed on 11 Jul 2025

³¹⁰ Grameen Foundation (2012) <https://www.globalgiving.org/donate/11232/grameen-foundation/info/>, accessed on 11 Jul 2025

³¹¹ Yunus, Muhammad (1999). *Banker to the Poor: Micro-Lending and the Battle Against World Poverty*. New York: PublicAffairs. ISBN 978-1-58648-198-8, accessed on 11 Jul 2025

³¹² Yunus, Muhammad (1976). "Muhammad Yunus". *Encyclopedia of Corporate Social Responsibility*. Chittagong University. pp. 1728–1730. doi:10.1007/978-3-642-28036-8_715. ISBN 978-3-642-28035-1

³¹³ <https://www.thehindu.com/todays-paper/tp-business/article3208913.ece>, accessed on 11 Jul 2025

³¹⁴ <https://www.nobelprize.org/prizes/peace/2006/yunus/biographical/>, accessed on 11 Jul 2025

³¹⁵ <https://web.archive.org/web/20180829110121/https://www.speaker.gov/press-release/house-senate-leaders-announce-gold-medal-ceremony-professor-muhammad-yunus>, accessed on 11 Jul 2025

³¹⁶ <https://unfoundation.org/>, accessed on 11 Jul 2025

³¹⁷ <https://www.globalesports.org/post/gef-partners-yunus-sports-hub-e4dmovement>, accessed on 11 Jul 2025

³¹⁸ <https://time.com/collections/100-most-influential-people-2025/7273785/muhammad-yunus/>, accessed on 11 Jul 2025

³¹⁹ <https://www.muhammadyunus.org/pages/1806/who-we-are>, accessed on 11 Jul 2025

³²⁰ Yunus, Muhammad; Weber, Karl (30 October 2017). *A World of Three Zeroes*. Scribe. ISBN 978-1-925322-47-7, accessed on 11 Jul 2025

³²¹ <https://www.pioneerspost.com/news-views/20211214/muhammad-yunus-the-superhuman-generation-and-social-businesses-can-save-us>,

³²² <https://www.theguardian.com/sustainable-business/2017/mar/29/we-are-all-entrepreneurs-muhammad-yunus-on-changing-the-world-one-microloan-at-a-time>,

³²³ http://www.undp.org/content/undp/en/home/mdgover-view/mdg_goals/mdg1/, accessed on 11 Jul 2025

³²⁴ Bateman M, Chang HJ (2012) Microfinance and the illusion of development: From hubris to nemesis in thirty years. *World Economic Review* 1: 13–36, accessed on 11 Jul 2025

particularly women in developing countries, thereby reducing poverty.³²⁵ it strengthens the social capital of impoverished and vulnerable communities, as well as the accessibility of health and education.³²⁶ Studies of market-based measures for reducing poverty have also gained substantial attention in the management literature. Scholars have devised concepts such as "base-of-pyramid" and "creating shared value" to explore what businesses can do to lessen poverty and boost social welfare.³²⁷

❖ Jack Ma Yun

He is a Chinese industrialist and philanthropist, and he is regarded as one of the most natural entrepreneurs of all time. He is the founder of the Jack Ma Foundation and a co-founder of Yunfeng Capital and Alibaba Group. Ma's net worth was projected to be \$27.2 billion as of May 2025. He has been acknowledged as a global ambassador of Chinese commerce and a prominent figure. Ma (Ma Yun) was born on September 10, 1964, in Hangzhou, Zhejiang. As a young boy, he showed an interest in acquiring the English language and began to practice it with English-speaking visitors who frequented the Hangzhou International Hotel. Ma purchased a portable radio at the age of 12 and started to listen to English radio stations on a regular basis. Ma rode his bicycle for 27 km (17 miles) each day to work as a tour guide in Hangzhou for foreigners for nine years, which turned into a possibility for him to improve his English.³²⁸ Ma experienced academic difficulties and required two years to secure enrollment to a conventional Chinese high school. His mathematics score on the Chinese high school entrance exam was a mere 31 points. Ma failed the Chinese college entrance exam on his first attempt at the age of 18 in 1982, earning only 1 point in mathematics. Subsequently, he and his cousin submitted applications to become servers at a hotel in the neighborhood. Ma was rejected because of his "too skinny, too short, and in general, protruded a bad physical appearance that may have conceivably ended up hurting the restaurant's image and possibly undermining its reputation." Afterwards, his cousin was hired.³²⁹ He stated that, "If you don't give up, you still have a chance."

Ma acquired a Bachelor of Arts degree in English from Hangzhou Normal University in 1988. Later on, he was appointed as a lecturer in English and international trade at Hangzhou Dianzi University.³³⁰ Ma has submitted application to Harvard Business School on a ten year-consecutive basis, but he has been rejected each time regardless of his unwavering dedication. Ma's autobiographical speech implies that following his graduating from Hangzhou Normal University in 1988, he filed application for 31 different odd entry-level positions, all of which were declined.³³¹ He traveled to the United States in early 1995 on behalf of the Hangzhou municipal government, accompanied by colleagues who had assisted in his introduction to the Internet.³³² Ma began his initial business, Hangzhou Haibo Translation Agency, in 1994, after becoming aware of the Internet.³³³ Ma and his business companion, He Yibing, who is a computer instructor, launched the initial office for China Pages in April 1995. Subsequently, Ma founded their second company. The domain chinapages.com was registered in the United States by the couple on May 10, 1995. China Pages earned approximately 5,000,000 RMB in profit over the course of three years, which is equal to approximately \$1.18 million in today's currency. Ma enlisted the assistance of acquaintances in the United States to develop websites for Chinese companies.³³⁴ Alibaba was founded in 1999 by him and a group of 18 friends in his apartment.³³⁵ He stated, "I always find people smarter than I am. Then my job is to make sure smart people can work together." He co-founded Alibaba Group, which started as a business-to-business (B2B) e-commerce marketplace and eventually evolved into a multinational technology conglomerate.³³⁶ Following his criticism of China's financial regulators for prioritizing risk control over innovation, the anticipated initial public offering (IPO) of his digital payments company, Ant Group, was halted by Chinese regulators in 2020, resulting in a decline in his popularity.³³⁷ Jack Ma as Corporate When he elected to launch a blistering public attack on the country's financial watchdogs and banks, China's shiniest star and proprietor of Ant Group has listed on the stock market in a record \$37 billion

³²⁵ https://www.researchgate.net/publication/326672285_A_comparative_study_on_the_role_of_microcredit_and_social_business_in_sustainable_poverty_reduction, accessed on 11 Jul 2025

³²⁶ Khandker SR (2005) Microfinance and poverty: Data from Bangladesh. *World Bank Economic Review* 19(2): 263–286, accessed on 11 Jul 2025

³²⁷ <https://environz.wordpress.com/wp-content/uploads/2012/11/creating-shared-value-porter-and-kramer-harvard-business-review-article.pdf>, accessed on 11 Jul 2025

³²⁸ https://books.google.com.bd/books?id=fWUaDQAAQBAJ&redir_esc=y, accessed on 11 Jul 2025

³²⁹ Zhang, Yan; 张燕 (2013). *Wo de ren sheng zhe xue : Ma Yun xian gei nian qing ren de 12 tang ren sheng zhi hui ke* (Di 1 ban ed.). Beijing Shi. ISBN 978-7-5502-2059-1, accessed on 11 Jul 2025

³³⁰ "Charlie Rose Talks to Alibaba's Jack Ma". *Bloomberg.com*. 29 January 2015, accessed on 11 Jul 2025

³³¹ Ma, Yun (Jack) (2017). Public Lecture to the University of Nairobi (Speech). Nairobi, Kenya. Archived from the original on 21 December 2021, accessed on 11 Jul 2025

³³² Clark, Duncan (12 April 2016). *Alibaba: The House That Jack Ma Built*. HarperCollins. ISBN 9780062413420,

³³³ Ibid

³³⁴ D'Onfro, Jillian. "How Jack Ma Went From Being A Poor School Teacher To Turning Alibaba Into A \$160 Billion Behemoth". *Business Insider*, accessed on 11 Jul 2025

³³⁵ Popovic, Stevan (4 May 2014). "Jack Ma: The man leading the Chinese e-commerce market". *Hot Topics*. Archived from the original on 12 January 2016, accessed on 14 Jul 2025

³³⁶ "Jack Ma Outlines Bold Vision For His Philanthropy Foundation". *Forbes*. 2 December 2019, accessed on 14 Jul 2025

³³⁷ Zhong, Raymond (6 November 2020). "In Halting Ant's I.P.O., China Sends a Warning to Business". *The New York Times*. ISSN 0362-4331. Retrieved 7 February 2023, accessed on 14 Jul 2025

deal. During a summit in Shanghai on October 24, billionaire Ma stated that the regulatory system was stifling innovation and must be reformed to stimulate development. The summit was attended by the elite of China's financial, regulatory, and political establishment.³³⁸ He stated, "Learn from the mistakes of others, rather than their successes." furthermore, he stated, "Intelligent individuals require a fool to guide them." It is advisable to have a peasant as the leader when the team consists entirely of scientists. He thinks differently. It is simpler to prevail when individuals possess diverse viewpoints. "I refer to Alibaba as the 1,001 mistakes," Jack Ma stated. The lessons I have acquired from the challenging times at Alibaba are that it is imperative to cultivate a team that is driven by innovation, vision, and value.

❖ Steve Jobs

He was a co-founder of Apple, which was one of the few technology companies to pose a substantial challenge to Microsoft's dominance. As one of the most outstanding natural entrepreneurs of all time, he has demonstrated the ability to achieve greatness from a position of zero. Jobs' influence on Apple was characterized by creative surges in contrast to Gates' methodical expansion. When Jobs returned to Apple, it was a struggling computer company. However, he evolved it into one of the world's leading technology companies. The iPod, iPhone, and iPad are the growth engines that have carried Apple toward the previously unassailable Microsoft. It is impossible to compile a list of the finest entrepreneurs that is self-respecting without including Steve Jobs. Jobs withdrew from college due to his family's inability to support the full cost of his education. He unofficially continued to audit courses, relying on free meals from the local Hare Krishna temple and returning Coke bottles for change to cover his expenses. Jobs acknowledged the calligraphy class he attended as the source of inspiration for Mac's innovative typefaces and font design. Jobs subsequently established the Apple Computer Company with his childhood companion and electronics expert, Steve Wozniak, in the course of an extraordinary and remarkable career. Steve Jobs, who is frequently referred to as "The Grandfather of the Digital Revolution," revolutionized the consumer electronics industry. His influence will be felt for many digital generations to come.³³⁹

Steve Jobs was adopted soon after his birth. Jobs was biologically half Arab. His mother was American, and his biological father was Syrian. Jobs encountered financial difficulties while attending classes without official authorization. He lived on complimentary meals provided by the nearby Hare Krishna temple, returned Coke bottles for cash, and slept on the floors of his friend's dormitories. He spent seven months traveling throughout India, where he experimented with psychotropic drugs and ultimately adopted Zen Buddhism practices. Jobs filed an application to become a civilian

astronaut on the Space Shuttle right after being terminated from his position at Apple. However, his application was denied, and he even explored the possibility of establishing a computer company in the Soviet Union. Bill Clinton once extended an invitation to Jobs to spend the night in the Lincoln stateroom of the White House. When Jobs passed away, the flags of Apple, Microsoft, and Disney properties (including Disneyland and Disney World) were lowered to half-staff. Jerry Brown, the governor of California, proclaimed Sunday, October 16, 2011, as Steve Jobs Day. He stated, "That has been one of my guiding principles: simplicity and concentration." Complexity can be more challenging than simplicity: It is necessary to put in effort to organize one's thoughts in order to simplify them. However, the final result is worthwhile, as it is possible to move mountains once one has arrived. He is renowned for his statement, "Focus means declining the hundred other good ideas that exist."³⁴⁰ This emphasizes the significance of prioritizing initiatives to establish a clear vision and making difficult decisions. Jobs was influential in the transformation of seven industries: personal computing, animated movies, music, phones, tablet computing, retail stores, and digital publishing. Because of this, he is a member of the pantheon of America's greatest innovators, which includes Thomas Edison, Henry Ford, and Walt Disney. History will remember how these men applied imagination to technology and commerce long after their personalities are forgotten, despite the fact that none of them was a saint.³⁴¹

He was a proponent of adaptability and the ability to figure out when to pivot or exit a project. He strived to develop products that would have an enduring influence on the world, rather than merely generating revenue. Steve Jobs perceived entrepreneurship as an unwavering aspiration to "make a dent in the universe" through innovation, passion, and hard work. He highlighted the necessity of adaptability and the ability to decide when to alter course, in addition to the significance of perseverance. He was committed to the development of a robust team, the prioritization of user experience, and the development of products that provided a comprehensive solution rather than individual components.³⁴² Jobs underscored the requirement of a profound devotion to overcome the obstacles of entrepreneurship. He was of the belief that perseverance is a crucial factor in distinguishing between successful and unsuccessful entrepreneurs. He also believed in extending the limits of what was feasible, sometimes even before consumers were aware of their preferences. He engrossed on the development of innovative products that provided a comprehensive solution and an exceptional user experience. He never refuses to confront failure, viewing it as an opportunity for learning and the chance to refine and enhance his skills. Jobs promoted the pursuit of innovative solutions and

³³⁸ <https://www.reuters.com/article/us-ant-group-ipo-suspension-regulators-i-idCAKBN27L1BB>, accessed on 14 Jul 2025

³³⁹ <https://unboxingstartups.com/unfolding-steve-jobs-and-apple-story/>, accessed on 14 Jul 2025

³⁴⁰ <https://www.inc.com/jeff-haden/why-steve-jobs-most-valuable-piece-of-advice-for-entrepreneurs-applies-to-anyone-doing-any-thing.html>,

³⁴¹ <https://hbr.org/2012/04/the-real-leadership-lessons-of-steve-jobs>,

³⁴² <https://www.youtube.com/watch?v=gxo2rGr7Yfg>,

the challenge of conventional thinking among entrepreneurs. He stated, "Innovation is the defining characteristic that differentiates a leader from a follower." Avoid wasting your time by living the existence of another individual, as time is a finite resource. Do not allow the noise of others' opinions to block out your own inner voice. It is not sufficient to inquire about the preferences of consumers and then attempt to fulfill them. They will wish something new by the time you complete the construction. We are present to make an imprint in the cosmos. Otherwise, what is the aim of being present?"³⁴³

❖ **Brian Chesky**

He is the founding partner of Airbnb. "Build something that 100 people love, not something that 1 million people kind of like," as the renowned entrepreneur once said. It began operation in 2008 and right now has a user base of over 40 million. Chesky and his roommate Joe Gebbia, who were then unemployed art school graduates, initiated the process by renting out floor space in their apartment. Finally, they developed a website to enable others to replicate their efforts. 2010 marked the site's graduation from the Y Combinator start-up incubator and its initial round of venture capital funding. In response to Airbnb's recent declaration that their corporate governance is going to consider the opinions and priorities of all stakeholders, including low-level employees and hosts, and also investors, Chesky, the Co-Founder of Airbnb, is currently in the process of developing the concept of a stakeholder-based world.³⁴⁴ Chesky prioritizes the formation of a company culture that is both purpose-driven and positive. He is of the mindset that a robust culture is necessary for the purpose of attracting and retaining talent, promoting innovation, and developing a sense of community among employees. Chesky considers community engagement as an investment, acknowledging the significance of establishing robust relationships with consumers, hosts, and the broader community.³⁴⁵

Entrepreneurship is considered by Chesky as an effective driver of positive change, with a specific focus on its contribution to wealth generation, societal transformation, and individual empowerment. He truly believes that entrepreneurs can foster innovation and influence a more favorable future by visualizing a different world and constructing it. He urges for entrepreneurs to establish a transparent vision of their objectives and to pursue them with utmost dedication.³⁴⁶ He is of the view that the world does not solely metamorphose according with our ambitions; rather, it necessitates individuals who are willing to dream up an alternative reality and endeavor to make it a reality. The essence of resilience in the context of obstacles is underscored by Chesky's experience with Airbnb. He

stresses the necessity of adapting to evolving conditions, making tough choices, and gaining knowledge from setbacks in order to grow more resilient. Chesky's industrial design heritage has fostered in him an intense admiration for the ability of design to generate exceptional user experiences. He is of the belief that each interaction with a product or service presents an opportunity to surpass expectations and cultivate loyalty. He is unafraid to take calculated risks and make bold moves in order to foster innovation and development. He is of the opinion that it is imperative to engage in calculated risk-taking in order to remain at the cutting edge of the industry and adjust to the constantly evolving business environment. He also emphasizes the significance of perpetually iterating and enhancing, even in the presence of victory.³⁴⁷ He is of the mind that it is crucial to learn from both successes and setbacks in order to foster ongoing growth and development. He urges for enterprises that maintain an optimal balance between autonomy and support, acknowledging that a structured framework can promote individual creativity and contribution.³⁴⁸

❖ **Bill Gates**

He is a co-founder of Microsoft. According to him, "It is fine to celebrate success but it is more important to heed the lessons of failure." He is regarded as one of the greatest natural entrepreneurs of any era. Bill Gates is a topic of conversation whenever there is a discussion about Microsoft, as this is the image and persona that he established on the minds of all individuals. Gates had an intense fascination in computer programming from his young age. He established Microsoft and invented the Windows operating system, which remains enormously popular. Bill Gates, like several other prominent industrialists, is also recognized for his philanthropic endeavors, which include significant contributions to charitable organizations. For instance, in 2000, Gates formed the Bill and Melinda Gates Foundation, a private philanthropic organization that is committed to the alleviation of poverty, the expansion of education opportunities, the provision of technology access worldwide, and the improvement of health care. Gates has personally contributed more than \$28 billion to the foundation, which he remains to stand for. He stated, "If you fail to realize your aspirations, someone else will employ you to construct theirs."³⁴⁹

Bill Gates is of the view that entrepreneurs should prioritize the development of an enduring legacy and the generation of a positive global influence. Gates is of opinion that entrepreneurship requires embracing of calculated risks, which can result in substantial success. Nevertheless, he also highlights the essence of meticulously evaluating the potential outcomes of those risks. Emphasizing the significance of innovation, calculated

³⁴³ <https://www.uschamber.com/co/start/strategy/steve-jobs-quotes-for-business-owners#>

³⁴⁴ <https://unboxingstartups.com/brian-chesky-the-successful-journey-of-airbnb-co-founder/>, accessed on 14 Jul 2025

³⁴⁵ <https://www.inc.com/kerry-close/4-lessons-from-airbnb-co-founder-on-building-your-own-company.html>,

³⁴⁶ <https://fastercapital.com/articles/Brian-Chesky-s-Impact-on-Entrepreneurship--A-Comprehensive-Guide.html>,

³⁴⁷ <https://www.entrepreneur.com/growing-a-business/first-on-entrepreneur-airbnbs-brian-chesky-shares-his/293442>,

³⁴⁸ <https://timesofindia.indiatimes.com/business/india-business/10-quotes-by-brian-chesky-on-entrepreneurship-and-innovation/photostory/100841167.cms?picid=100841317>,

³⁴⁹ <https://zakkann.com/bill-gates-quotes/#>,

risk-taking, and learning from both successes and failures, he considers entrepreneurship as a way of achieving one's own aspirations and leaving an enduring impact. He urges for aspiring entrepreneurs to be their own bosses, move quickly, continually innovate. Gates reinforces the significance of acquiring knowledge from both successes and failures. He stated, "It's fine to celebrate success, but it is more important to heed the lessons of failure." He is of belief that failures offer valuable insights that can be applied to enhance and progress.³⁵⁰ He is of the opinion that in order to stay competitive, businesses must analyze emergent patterns and develop innovative products and services. He advises for entrepreneurs to remain resilient in the face of adversity and to be receptive to evolving circumstances. He is of view that setbacks are unavoidable, but it is crucial to learn from them and continue to progress.³⁵¹ Gates stressed the significance of sales skills for entrepreneurs, claiming that success is contingent upon the ability to persuade consumers, investors, and employees. He stated, "Starting a business isn't about money".

❖ Mark Zuckerberg

He is one of the greatest natural entrepreneurs of any period and one of the co-founders of Facebook. His father is a dentist and his mother is a psychologist, and he was born in 1984 into a Jewish American family. He has a strong passion for technology. Mark Zuckerberg, who pulled people closer together and revolutionized the way the world communicates. Mark was compelled to make numerous sacrifices in order to pursue his professional aspirations, including withdrawing from Harvard and declining substantial quantities of money. His success as it stands today is a testament to his dedication and determination. Zuckerberg is presently one of the "talented youth" characters, and his influence is pervasive. He frequently attracts a large number of followers with each action he takes.³⁵² He is of the belief that, as he stated, "I think a simple rule of business is, if you do the things that are easier first, then you can actually make a lot of progress. Mark Zuckerberg, who founded Facebook from his dormitory in 2004, represents a prime example of a college student entrepreneur. In 2019, Facebook announced a market capitalization of approximately \$546 billion and reported revenue of approximately \$27.6 billion. The most impressive feature of Zuckerberg is his ability to sustain his position as the CEO of Facebook and the company's founder at such a young age. His concentration on the testing of Facebook and social media innovation has resulted in Facebook evolving into the most prominent social platform on a global scale. One of Zuckerberg's strategies was to establish distinct areas of expertise and surround himself with individuals who were more intelligent than he

was. An instance is the appointment of Sheryl Sandberg as the Chief Operating Officer, who is also the owner of LeanIn.Org. Zuckerberg's entrepreneurial legacy is undeniable, despite the controversy surrounding Facebook's privacy practices for selling user data. He stresses the significance of comprehending and prioritizing user requirements and experiences. He claims that success requires the development of an exceptional product that resonates with consumers.³⁵³ Zuckerberg's methodology prioritizes the utilization of data to enhance products and services and inform decision-making.

The significance of constantly adapting and learning from setbacks is underscored by Zuckerberg's journey with Facebook. He holds the opinion that a distinct, firm mission is necessary for retaining focus and guiding decision-making, particularly during difficult periods.³⁵⁴ Zuckerberg's entrepreneurial philosophy focuses primarily on the notion that businesses should endeavor to address issues and effect positive change, rather than just concentrating on making a profit. He is of the mindset that success will ensue if a company prioritizes doing good. His stance on entrepreneurship concentrates on the resolution of real-world issues and the promotion of positive change, rather than the sole emphasis on the formation of a business. He is of the belief that entrepreneurs should be inspired by a distinct vision, a passion for their work, and a desire to make a lasting impact. Furthermore, he underscores the significance of prioritizing user experience, learning from errors, and moving quickly. He emphasizes the significance of possessing an intense passion for the issue that an entrepreneur is seeking to resolve and a well-defined vision. He is of the view that this enthusiasm is the source of the motivation to conquer obstacles and establish a prosperous enterprise.³⁵⁵ He promotes for a "move fast and break things" method by inspiring experimentation and learning from mistakes.³⁵⁶ He is dedicated to enhancing the product and user experience by continually adapting to new information and feedback. Further, he is of the mind that that the creation of a successful product or service is contingent upon the creation of a positive and engaging user experience. Zuckerberg's philosophy, which prioritizes the importance of learning from mistakes and taking calculated risks, is characterized by the phrase "move fast and break things."³⁵⁷ He also believes that entrepreneurship is the process of utilizing business as an engine for positive change, which is motivated by a clear vision, an enthusiasm for problem-solving, and a readiness to alter and learn as one progresses.

❖ Sam Walton

³⁵⁰ <https://blog.taskque.com/entrepreneur-lessons-bill-gates/#>,

³⁵¹ <https://www.youtube.com/watch?v=W5g4sPi1wd4>,

³⁵² <https://economictimes.indiatimes.com/news/international/business/5-lessons-entrepreneurs-can-learn-from-mark-zuckerberg/entrepreneurship-a-journey/slideshow/98911759.cms?from=mdr>,

³⁵³ <https://www.youtube.com/watch?v=HVwfQSNemcw>,

³⁵⁴ https://www.researchgate.net/publication/362246205_Mark_Zuckerberg_a_portrait_of_successful_high-tech_Entrepreneur,

³⁵⁵ <https://visualisesolutions.co.uk/what-mark-zuckerberg-can-teach-us-to-be-a-better-entrepreneur/>,

³⁵⁶ <https://www.youtube.com/watch?v=Lb4IcGF5iTQ>,

³⁵⁷ <https://www.ideatovalue.com/insp/nickskillicorn/2017/06/mark-zuckerbergs-advice-new-entrepreneurs-eureka-moment-lie/>,

Walmart was founded by Sam Walton. "Outstanding leaders go out of their way to boost the self-esteem of their personnel," is an opinion of one of the greatest natural entrepreneurs of all time. It is remarkable what individuals can achieve when they have confidence in themselves. Sam Walton selected a market that was not in demand and afterwards established a distribution system that had not been explored in the retail industry. Walton could reduce shipping costs and expedite the delivery of products to his busy Walmart stores by constructing warehouses between multiple locations. A state-of-the-art inventory control system enabled Walton to significantly reduce his cost margins in comparison to his direct competitors. Walton transferred the savings to the consumer, rather than recognizing them as profits. Walton attracted an increasing volume of business to the location where he established his business by consistently offering low prices. Ultimately, Walton relocated Walmart to the city in order to compete with the larger corporations on margins. Since then, the beast of Bentonville has never turned back.³⁵⁸ He also employed a straightforward formula: purchase products in bulk at reduced prices and resell them at a reasonable price. For instance, if a consumer enters a Walmart store with the intention of purchasing \$5 products, but discovers a reasonable price in the store, they end up purchasing \$10 products, resulting in a \$5 profit for Walmart.

Walton attracted an increasing volume of business to each location where he established a business by consistently offering low prices. Ultimately, Walton relocated Walmart to the large city in order to compete with his rivals on margins, and the beast of Bentonville has never looked back. Human Rights Watch uncovered that Walmart's anti-union apparatus is both extensive and aggressive, in contrast to the numerous American corporations that make an effort to prevent workers from organizing.³⁵⁹ His entrepreneurial approach was distinguished by a strong commitment to employee empowerment, customer satisfaction, and the relentless pursuit of value and efficiency. He was a proponent of a hands-on, down-to-earth management style, continuous learning, and hard labor. Walmart's strategy was innovative at the time, as it was centered on providing value and convenience to customers in smaller towns. He had a distinct vision for the company.

He urged his team to go above and beyond to guarantee that consumers had a positive experience and felt valued. Walton advocated for the treatment of employees as partners and the sharing of profits, which fostered a sense of ownership and motivation.³⁶⁰ Sam Walton's entrepreneurial philosophy was developed on the basis of a hands-on, adaptable, and visionary leadership style, which was characterized by a relentless pursuit of efficiency and value, employee empowerment, and consumer focus. He emphasized the importance of open communication and urged all employees to express their ideas and concerns, as he believed

that comprehension is the precursor to compassion. Walton famously stated, "There is only one boss, the customer." He stressed the significance of comprehending and satisfying consumer requirements, consistently endeavoring to offer them value and reduce their expenses. Saturday morning meetings served as a forum for associates to engage in brainstorming, problem-solving, and the exchange of best practices, thereby cultivating a culture of perpetual improvement.³⁶¹ Sam Walton focused heavily on managing expenses, acknowledging it as a critical competitive advantage. He emphasized on optimizing logistics, streamlining operations, and identifying methods to deliver products efficiently, thereby enabling him to offer lower prices. He was renowned for his hands-on approach, which involved spending time on the sales floor and engaging with consumers and employees.³⁶² Regardless his success, he maintained a humble demeanor and consistently endeavored to learn from others and adjust to evolving circumstances.

❖ Larry Page

He is one of the founding partners of Google. "If you're changing the world, you're working on important things. You are enthusiastic about rising in the morning" suggested the renowned natural entrepreneur, Larry. No one can ignore Larry Page when it pertains to Google. Currently, we are simultaneously collecting data from Google while writing. Therefore, can you anticipate the extent to which individuals are dependent on Google, or equivalently, how much Google has influenced us? Larry Page's establishment of the world's largest search engine, Google, is comparable to the inability to exist without it. It is no wonder that Larry Page developed an interest in and subsequently became an entrepreneur in the computer science sector. Larry came across Sergey Brin, a Stanford student, in 1995. They formed the company Google Incorporated in 1996 after becoming close friends and eventually going into business together. Larry and his colleague Brin served as co-presidents of Google Inc. until the company appointed Eric Schmidt as its CEO. He urges entrepreneurs to challenge conventional wisdom and think creatively. Larry Page's perspective on entrepreneurship is distinguished by a combination of pragmatism, ambition, and a profound dedication to the development of positive change through innovation and the development of strong teams. He stated, "My responsibility as a leader is to ensure that all employees have access to exceptional opportunities and that they feel they are making a significant contribution."

Larry and Brin received a \$25 million investment from Kleiner Perkins Caufield and Sequoia Capital in 1999, just three years after they established their business, in response to investor pressure. Google, a multinational internet service corporation, is headquartered in California, United States, and was established in 1998. Google, which was initially conceived as a web search engine that operated on the PageRank algorithm,

³⁵⁸ <https://unboxingstartups.com/flipkart-acquire-walmart-launches-walmart-wholesale/>, accessed on 14 Jul 2025

³⁵⁹ <https://www.hrw.org/news/2007/04/30/us-wal-mart-denies-workers-basic-rights#>, accessed on 14 Jul 2025

³⁶⁰ https://seaopenresearch.eu/Journals/articles/NIS_16_2.pdf,

³⁶¹ <https://www.quora.com/What-was-Sam-Walton-like>,

³⁶² <https://www.archbridgeinstitute.org/sam-walton-how-curiosity-and-humility-built-the-worlds-largest-company/>,

now provides a wide range of online, mobile, and desktop products.³⁶³ Google generates a substantial portion of its revenue from advertising on platforms such as YouTube and Google Search. Apart from selling hardware such as smartphones and Chromecast devices, Google also generates revenue from the sale of digital content and applications on the Google Play Store. Google Cloud is an additional income source that is growing for the organization. In 2001, Google, which had become a global entity, generated profits exceeding \$100 million. By 2003, these profits had increased to \$960 million, representing a tremendous growth in a mere two years. According to 2018 data, Google's aggregate revenue was \$136.81 billion. According to Statista, Google's revenue exceeded \$89.52 billion in the first quarter of 2025.³⁶⁴ Page recognizes that impactful solutions can originate from a variety of disciplines, regardless his status as a tech innovator. Page's ideology recognizes the significance of learning from failures and refining ideas.³⁶⁵

Page highlights the significance of a flat organizational structure, open communication, and collaboration, in which ideas are valued irrespective of their status. He is of belief that a positive work environment and the respect of employees are prerequisites for success and productivity.³⁶⁶ He considers entrepreneurship as an influential driver of positive change, stressing the significance of ambitious objectives, impactful innovation, and a concentration on resolving real-world issues.³⁶⁷ He is dedicated to the development of strong teams, the promotion of collaboration, and the establishment of a culture that prioritizes both entrepreneurs and engineers. His approach is centered on the creation of solutions that are 10 times more effective than those that are gradually improved, along with the prioritization of a strong network and individual strengths.³⁶⁸ He stresses the importance of identifying genuine problems and building businesses that address them. His philosophy centers on creating solutions that are significantly better than existing ones, rather than just incremental improvements. He believes in building on individual strengths and focusing on what a company does best.³⁶⁹ Google's design is still visible today as a result of Page and Brin's prioritization of user experience and simplicity. He urges for the establishment of a concentrated, interconnected network as opposed to a single, expansive one. The significance of adaptability and continuous learning is illustrated by

Page's personal journey, which began with his dismantling of things as a child and resulted in his leadership of Google.³⁷⁰ He wonder, "What is the one sentence summary of how you change the world? Consistently put effort on something that is as thrilling as equally uncomfortable. If you are not engaging in activities that are unconventional, then you are engaging in the incorrect activities. The most talented individuals are eager to tackle the most significant challenges. Build new solutions and maintain a healthy skepticism toward the impossibility of the situation."

❖ Jeff Bezos

Jeff Bezos, the founder of Amazon, is considered one of the greatest entrepreneurs in history. As a child, he transformed his parent's garage into a laboratory, driven by his persistent curiosity about the workings of objects. He obtained a dual degree in electrical engineering and computer science from Princeton University. He was hired as the youngest senior vice president at D.E. Shaw in 1990. Nevertheless, he resigned from his position in 1994, despite his success, to pursue a career in e-commerce, regardless of being aware of the potential risks. He relocated to Seattle and established Amazon as an online bookstore, which eventually evolved into a company valued at trillions of dollars.³⁷¹ Amazon is an American multinational technology corporation that is involved in the development of artificial intelligence, cloud computing, online advertising, digital streaming, and e-commerce. The company, which was initially established in 1994 by Jeff Bezos in Bellevue, Washington, began as an online marketplace for books. Over time, it expanded its offerings to encompass a diverse array of product categories, getting it the title of "The Everything Store".³⁷² Currently, Amazon is regarded as one of the Big Five American technology enterprises, with the other four being Alphabet, Apple, Meta, and Microsoft. In 2017, Amazon acquired the Whole Foods Market supermarket chain.³⁷³ It is the leading e-retailer in the United States, with net sales of approximately US\$178 billion in 2017. It maintains more than 300 million active user accounts worldwide.³⁷⁴ In the fiscal year 2021, Amazon disclosed earnings of US\$33.36 billion and annual revenue of US\$469.82 billion, representing a 21.7% increase from the previous fiscal cycle. Cross-dock centers, fulfillment centers, sortation centers, delivery stations, Prime now hubs, and Prime air hubs are among the many kinds of distribution facilities that Amazon keeps. With more than 125,000 employees, there are 75 fulfillment

³⁶³ <https://www.statista.com/statistics/266206/googles-annual-global-revenue/>,

³⁶⁴ <https://www.statista.com/statistics/report-content/statistic/266206>, accessed on 14 Jul 2025

³⁶⁵ <https://www.linkedin.com/pulse/titans-entrepreneurship-series-larry-page-zafar-khan/>,

³⁶⁶ <https://youexec.com/questions/what-are-larry-page-s-values-and-beliefs>,

³⁶⁷ <https://www.entrepreneur.com/leadership/12-quotes-from-googles-larry-page-on-drive-success/290765>,

³⁶⁸ <https://www.theguardian.com/sustainable-business/2014/jul/23/entrepreneur-larry-page-google-innovation-change>,

³⁶⁹ <https://stec.univ-ovidius.ro/html/anale/RO/2021-2/Section%203/8.pdf>,

³⁷⁰ <https://www.ukessays.com/essays/business/larry-page-google-case-study-4039.php>,

³⁷¹ <https://entrepreneurshares.com/entrepreneurs/jeff-bezos/>,
³⁷² Intelligence, fDi (June 2023). "Top 100 global innovation leaders". www.fdiintelligence.com, accessed on 14 Jul 2025

³⁷³ Kakutani, Michiko (October 28, 2013). "Selling as Hard as He Can". The New York Times. ISSN 0362-4331. Archived from the original on October 29, 2013, accessed on 14 Jul 2025

³⁷⁴ Schmidt, Gordon B. (2020), "Amazon", The SAGE International Encyclopedia of Mass Media and Society, Thousand Oaks, California: SAGE Publications, Inc., doi:10.4135/9781483375519.n28, ISBN 978-1-4833-7551-9, accessed on 14 Jul 2025

centers and 25 sortation centers.³⁷⁵ Amazon ranked 36th in Forbes Global 2000 2023.³⁷⁶ He stated, **"If you decide that you're going to do only the things you know are going to work, you're going to leave a lot of opportunity on the table."**³⁷⁷

In business, Bezos emphasizes the importance of a long-term perspective, arguing that concentrating on what remains constant (such as customer preferences for fast delivery and low prices) enables more strategic and sustainable development.³⁷⁸ Additionally, he is of the belief that concentrating on the customer is crucial. He recommends entrepreneurs to emphasize comprehending customer needs, including those that customers may not yet perceived they have, and to work consistently to encounter and surpass those needs. His opinion on entrepreneurship is rooted in customer obsession, long-term vision, and an openness to experiment and innovate. He points out the significance of grasping customer needs, employing a backward approach to product and service development, and embracing failure as an integral component of the innovation process.³⁷⁹ furthermore, he emphasizes the necessity of both flexibility in tactics and determination in vision. He acknowledges that innovation necessitates experimentation and that failure is an inherent component of the process. He advocates for entrepreneurs to view failure as a learning opportunity and to be prepared to take calculated risks. Additionally, he is of the opinion that entrepreneurs should possess both flexibility and stubbornness.³⁸⁰ They should remain firm in their vision while also being prepared to modify their strategies and tactics to defeat challenges and adjust to evolving circumstances. He differentiates between founders who are sincerely dedicated to their product or service (missionaries) and those who are predominantly driven by profit (mercenaries). He values the missionary approach, as he is of believe that it results in long-term success and increased customer satisfaction. He suggests that entrepreneurs prioritize the most critical areas by employing their initial resources to systematically identify and eliminate risks. He recommends that entrepreneurs should pinpoint the fundamental components of their business that will endure over time and develop their strategies based on these constants.³⁸¹ He emphasizes the significance of sustaining an entrepreneurial spirit even as a company

evolves, encouraging for a balance between robustness and nimbleness.

❖ Elon Musk

Elon Musk one of the great natural entrepreneurs in all time was born to a well-off family in Pretoria in June 28, 1971, South Africa. He is recognized for his leadership of Tesla, SpaceX, X (formerly Twitter), and the Department of Government Efficiency (DOGE).³⁸² Forbes estimates Musk's net worth to be US\$424.7 billion as of May 2025; he has been recognized as the world's wealthiest individual since 2021.³⁸³ Musk, born into a rich family in Pretoria, South Africa, immigrated to Canada in 1989. He obtained bachelor's degrees from the University of Pennsylvania in 1997 before relocating to California, United States, to engage in entrepreneurial endeavors. In 1995, Musk co-established the software enterprise Zip2. After its sale in 1999, he co-founded X.com, an online payment enterprise that subsequently combined to become PayPal, which was bought by eBay in 2002. During that year, Musk acquired U.S. citizenship.³⁸⁴ Musk launched the space technology company SpaceX in 2002, and he has since served as its CEO and principal engineer. SpaceX has been at the leading edge of advancements in commercial spaceflight and reusable rockets. Musk became the CEO and product architect of Tesla in 2008 after joining the company as an early investor in 2004. Tesla has since become a leader in the field of electric vehicles.³⁸⁵

In 2015, he co-founded OpenAI to foster artificial intelligence research but subsequently departed; increasing dissatisfaction with the organization's trajectory in the 2020s prompted him to create xAI. In 2022, he bought the social network Twitter, enacting substantial modifications and rebranded it as X in 2023.³⁸⁶ In January 2025, he was selected as the leader of Trump's newly established DOGE. His further enterprises encompass the neurotechnology firm Neuralink, which he co-established in 2016, and the tunneling enterprise the Boring Company, which he launched in 2017. In the 2024 U.S. presidential election, Musk has actively engaged in politics as a prominent advocate for Trump. Musk was the biggest contributor in the 2024 U.S. pres-

³⁷⁵ Routley, Nick (September 8, 2018). "Amazon's Massive Distribution Network in One Giant Visualization". Archived from the original on July 7, 2019, accessed on 14 Jul 2025

³⁷⁶ <https://web.archive.org/web/20240226095032/https://www.forbes.com/lists/global2000/?sh=4f5ab07e5ac0>, accessed on 14 Jul 2025

³⁷⁷ <https://croud.com/en-gb/resources/amazon-founder-and-ceo-jeff-bezos-gives-us-6-business-lessons-to-learn-from/#anchor-3-think-long-term>,

³⁷⁸ <https://www.forbes.com/sites/tomtaulli/2021/02/03/jeff-bezos-the-lessons-for-entrepreneurs/>,

³⁷⁹ https://www.researchgate.net/publication/349380465_A_view_on_transformational_leadership_The_case_of_Jeff_Bezos,

³⁸⁰ <https://haris-m.medium.com/jeff-bezoss-decades-old-talk-is-a-masterclass-on-entrepreneurial-mindset-1dd9f3e9b441>,

³⁸¹ <https://www.inc.com/john-brandon/jeff-bezos-used-only-9-words-to-perfectly-describe-entrepreneurial-success.html>,

³⁸² <https://www.theguardian.com/technology/shortcuts/2018/feb/21/meet-elon-musk-family>,

³⁸³ <https://www.nytimes.com/2022/05/05/world/africa/elon-musk-south-africa.html>,

³⁸⁴ Mattioli, Dana (April 16, 2025). "The Tactics Elon Musk Uses to Manage His 'Legion' of Babies—and Their Mothers". The Wall Street Journal, accessed on 14 Jul 2025

³⁸⁵ Osborne, Simon (February 21, 2018). "Meet the Musks: who's who in Elon's extended family?". The Guardian. ISSN 0261-3077, accessed on 14 Jul 2025

³⁸⁶ Schilling, Melissa (2018). Quirky: The remarkable story of the traits, foibles, and genius of breakthrough innovators who changed the world. PublicAffairs. ISBN 978-1-61039-792-6, accessed on 14 Jul 2025

idential election and endorses global far-right individuals, initiatives, and political parties.³⁸⁷ According to the Bloomberg Billionaires Index, Elon Musk is the richest person in the world, with an projected net worth of US\$330 billion as of March 2025,³⁸⁸ and \$359.5 billion reported by Forbes,³⁸⁹ predominantly from his ownership stakes in SpaceX and Tesla.³⁹⁰ Bloomberg reports that Elon Musk's net worth will surpass \$400 billion by December 2024, marking him as the first individual to achieve this milestone.³⁹¹ He stated that he aimed to "*change the world and help humanity*. To transform space technology, with the ultimate goal of empowering people to live on other planets."³⁹²

He regards entrepreneurship as a path that is both challenging and rewarding, driven by a desire to address significant issues and a willingness to take substantial risks. He highlights the significance of establishing a strong team, achieving product excellence, and working meticulously. Musk also advocates for entrepreneurs to view failure as a learning opportunity and to consistently aspire for improvement.³⁹³ He is of belief that entrepreneurs should concentrate on the development of businesses that contribute to society and resolve significant issues. He emphasizes the significance of taking calculated risks and not being afraid of failure, viewing it as a learning opportunity. He emphasizes the necessity of making product quality a top priority and consistently striving for improvement. Musk is of the opinion that it is crucial to surround oneself with individuals who are both talented and dedicated in order to establish a successful company. He urges entrepreneurs to embrace change as a catalyst for progress, challenge the status quo, and think outside the box.³⁹⁴ Furthermore, he is of the view that entrepreneurs should consistently evaluate the value they are generating, as it is of the utmost importance to provide consumers with value. He is recognized for his unwavering commitment to his work ethic, frequently dedicating 80-100 hours per week to his endeavors.³⁹⁵ He is of the opinion that success requires diligent effort. He stresses the significance of maintaining a constant dedication to one's vision and persevering through challenging circumstances.³⁹⁶ His entrepreneurial philosophy is a combination of innovative thinking, hard labor, a willingness to take risks, and a focus on the development of products and services that have a positive impact on the world.

❖ Tom Love

He was a renowned American entrepreneur and billionaire businessman who served as the founder, proprietor, and executive chairman of Love's Travel Stops & Country Stores. If you have traveled on an American highway, it is likely that you encountered one of the more than 600 Love's Travel Stops and Country Stores distributed over 42 U.S. states.³⁹⁷ Tom Love launched an enterprise with over 38,000 employees employed in convenience stores across the nation, renowned for its 24-hour access, restaurant offerings, and travel items. Moreover, Love hires employees at their corporate office in Oklahoma City. A Chickasaw Nation member, Love and his spouse Judy leased their inaugural gas station in Watonga, Oklahoma, during the 1960s. In 2019, Love was admitted into the tribe's hall of fame, emphasizing that "the same love and attributes that define Love's Travel Stops represent the Chickasaw Nation".³⁹⁸ In October 1937, Thomas E. Love was born in Oklahoma City, the youngest of six siblings. He departed home at the age of 13 to pursue an education as a boarder at St. Gregory's High School in Shawnee, where he was a renowned football player. Love attended St. John's University in Collegeville, Minnesota, but he quit after less than one semester.^[5] He afterwards enlisted in the U.S. Marine Corps and achieved the rank of corporal over the course of a three-year career. Initially, love was the owner of car washes and restaurants. However, he stumbled upon an opportunity in abandoned filling stations. In 1964, Love and his wife Judy leased a self-service petrol station in Watonga, Oklahoma. Love owned a lucid business vision and the capacity to motivate others to achieve it. Love established his organization on the basis of strong ethical principles. He was unafraid to question the status quo and investigate novel opportunities.

He was a visionary entrepreneur who established a successful business by concentrating on customer requirements and innovative solutions. He is the founder of Love's Travel Stops & Country Stores. He is remembered as a compassionate leader who prioritized integrity, perseverance, and a dedication to serving others. Love's Travel Stops was established in response to the demand for sanitary and convenient facilities for truckers while on the road. The tagline, "Clean Places, Friendly Faces" of Love is indicative of his dedication to delivering a positive customer experience.³⁹⁹ Love

³⁸⁷ Lepore, Jill (April 4, 2025). "Opinion | The Rise and Fall of Elon Musk". The New York Times. ISSN 0362-4331, accessed on 14 Jul 2025

³⁸⁸ "Bloomberg Billionaires Index". Bloomberg L.P. Archived from the original on March 29, accessed on 14 Jul 2025

³⁸⁹ <https://www.forbes.com/sites/forbeswealthteam/article/the-top-ten-richest-people-in-the-world/>, accessed on 14 Jul 2025

³⁹⁰ <https://people.com/elon-musk-welcomed-13th-child-5-months-ago-with-ashley-st-clair-11680525>, accessed on 14 Jul 2025

³⁹¹ <https://edition.cnn.com/2024/12/11/business/elon-musk-400-billion-net-worth/index.html>, accessed on 14 Jul 2025

³⁹² <https://medium.com/@nickjwaghorn/3-inspiring-entrepreneurial-lessons-i-learned-from-elon-musk-8857c329f38f>,

³⁹³ <https://www.linkedin.com/pulse/elon-musk-method-6-keys-entrepreneurial-success-steve-peterson-bsee-samsc/>,

³⁹⁴ <https://magazine.startus.cc/elon-musk-and-his-must-read-advice-for-entrepreneurs-startups/>,

³⁹⁵ <https://evmagazine.com/top10/top-10-thought-leaders>,

³⁹⁶ <https://www.meydanfz.ae/blog/5-lessons-for-every-entrepreneur-from-elon-musk#>,

³⁹⁷ <https://web.archive.org/web/20171215112426/https://www.ques-tia.com/newspaper/1P2-5853400/the-century-club-tom-love-ceo-of-love-s-country>, accessed on 14 Jul 2025

³⁹⁸ <https://hof.chickasaw.net/Members/2019/Tom-Love.aspx>, accessed on 14 Jul 2025

³⁹⁹ <https://www.forbes.com/profile/judy-love/>, accessed on 14 Jul 2025

has broadened its products to encompass food, technology, and additional services, indicating a readiness to adapt and evolve. Love was an unwavering supporter for Oklahoma and its business sector, urging others to chase their entrepreneurial aspirations. Love recognized the significance of his employees and consumers in establishing a prosperous enterprise.⁴⁰⁰ He confronted difficulties and adversity with resolve and dedication to his objectives. Love esteemed his staff and stressed the significance of their contributions to the company's success. Tom Love's legacy beyond his entrepreneurial achievements. He is honored as a model for entrepreneurs and an example to the efficacy of hard work, ingenuity, and a dedication to serving people.

❖ **Mukesh Dhirubhai Ambani**

He is a successful businessman, entrepreneur, and Indian billionaire who serves as the chairman and managing director of Reliance Industries.⁴⁰¹ Mukesh Ambani is a globally renowned successful entrepreneur, predominantly for his leadership in the development of Reliance Industries into a global conglomerate. He was influential in the company's diversification from textiles to petrochemicals, refining, oil and gas, retail, and telecommunications, particularly with the introduction of Reliance Jio. With a net worth of US\$108 billion, he is the 13th wealthiest individual in the globe and the wealthiest individual in Asia as of May 2025. Ambani was the first-ranked individual on Forbes' list of India's 100 wealthiest tycoons in October 2024, with a net worth of \$119.5 billion.⁴⁰² Ambani's business endeavors have profoundly influenced the Indian economy and the international economic environment. Ambani was born on April 19, 1957, in the British Crown province of Aden (now Yemen) to a Gujarati Hindu household, the child of Dhirubhai Ambani and Kokilaben Ambani. His father was the owner and CEO of Reliance Industries, which is right now the largest public company in India by market capitalization.⁴⁰³ He has two sisters, Nina Bhadrashyam Kothari and Dipti Dattaraj Salgaonkar, as well as a younger sibling named Anil Ambani. He stated, "Trust and relationships." This is the foundation of life. and "It is crucial to accomplish our objectives; however, we must not sacrifice them." He has been a pivotal figure in the digital revolution in India, highlighting the potential of digital services and life. Ambani emphasizes the significance of a "can-do" attitude, self-assurance, and resilience in dealing with obstacles and attaining success. He is of view that entrepreneurs should be passionate, adventurous, and daring in their pursuit of their goals. He draws inspiration from his father, Dhirubhai Ambani, notably his emphasis on the capacity to transform dreams into reality, self-belief, and courage.

Mukesh Ambani stayed briefly in Yemen when his father decided to return to India in 1958 to establish a trading enterprise specializing in spices and textiles.⁴⁰⁴ His businesses encompass multiple sectors, including technology, banking, and consumer goods, considerably contributing to India's economic expansion. Ambani pioneered the establishment of the world's largest grassroots petroleum refinery in Jamnagar, India. He also founded Reliance Retail, a wide retail network that includes both online and brick-and-mortar locations.⁴⁰⁵ His reputation as a prominent global entrepreneur and a key figure in Indian business has been solidified by his strategic vision and ability to execute large-scale projects, such as the Jamnagar refinery. Ambani has demonstrated a readiness to take calculated risks, such as investing heavily in Jio's infrastructure and services, which yielded handsomely. He has exhibited the capacity to adjust to changing market conditions and diversify Reliance's portfolio, entering into new sectors like retail and green energy. This story inspires aspiring entrepreneurs by illustrating the potential for development and innovation in emerging markets.⁴⁰⁶ Ambani thinks that growth is an ongoing process and integral aspect of life for his organization. He regarded relationships and trust to be essential to success. He recognizes that failure is a part of the journey and that one should not be disheartened by initial obstructions. Ambani has emphasized the necessity for businesses to adjust and innovate to remain relevant, mainly in the face of evolving market dynamics. He recognizes that failures are an inherent aspect of the entrepreneurial journey and inspires learning from them instead of being discouraged.

❖ **Ratan Tata**

Ratan Tata was an Indian industrialist, philanthropist and one of the most successful **entrepreneurs** and businessman in all time. From 1991 to 2012, he served as the chairman of Tata Group and Tata Sons. He is renowned as a visionary entrepreneur and leader who converted the Tata Group into a global powerhouse while stressing ethical practices and social impact.⁴⁰⁷ He is recognized for his strategic acquisitions, innovative product creation (such as Tata Nano), and noteworthy investments in startups, especially within the Indian tech sector. Ratan Tata was the son of Naval Tata, who was adopted by Ratanji Tata, the son of Jamshedji Tata, the founder of the Tata Group. He acquired a bachelor's degree in architecture from Cornell University College of Architecture. In 1975, he also partic-

⁴⁰⁰ <https://www.loves.com/AboutUs.aspx>, accessed on 14 Jul 2025

⁴⁰¹ https://web.archive.org/web/20150416033537/http://ril.com/html/aboutus/Mukesh_Ambani.html, accessed on 14 Jul 2025

⁴⁰² <https://www.forbes.com/sites/chase-withorn/2024/04/02/forbes-worlds-billionaires-list-2024-the-top-200/>, accessed on 14 Jul 2025

⁴⁰³ <https://www.forbesindia.com/article/explainers/top-10-companies-india-market-valuation/86307/1>, accessed on 14 Jul 2025

⁴⁰⁴ <https://www.rediff.com/money/special/pix-special-how-dhirubhai-ambani-changed-the-idiom-of-doing-business/20150114.htm>, accessed on 14 Jul 2025

⁴⁰⁵ <https://www.britannica.com/money/Mukesh-Ambani>, accessed on 14 Jul 2025

⁴⁰⁶ <https://thebusinessfame.com/mukesh-ambani-success-story/>, accessed on 14 Jul 2025

⁴⁰⁷ <https://www.independent.co.uk/news/business/analysis-and-features/what-makes-the-tata-empire-tick-10024897.html>, accessed on 14 Jul 2025

ipated in the Harvard Business School (HBS) Advanced Management Program.⁴⁰⁸ He became a member of Tata Group in 1962, commencing on the shop floor of Tata Steel. After J. R. D. Tata's retirement in 1991, he succeeded him as chairman of Tata Sons.⁴⁰⁹ In an effort to transform Tata from a mainly India-centric organization into a global enterprise, the Tata Group acquired Jaguar Land Rover, Corus, and Tetley during his tenure.⁴¹⁰ Ratan Tata's success story illustrates his progression from a modest origin to transformation of Tata Group into a global powerhouse via visionary leadership and innovation. Ratan Tata's success story illustrates his progression from modest origins to the transformation of Tata Group into a global powerhouse via visionary leadership and innovation. Tata emphasizes that success is derived from taking action and implementing ideas. He urges entrepreneurs to have unwavering faith in their vision and to boldly implement it. He highlights the significance of ethical business conduct and societal accountability. He urges them to establish enterprises that generate enduring influence and provide value for all stakeholders.⁴¹¹ He inspires perseverance and the capability to recover from setbacks.

His story emphasizes the significance of perseverance and determination when confronted with adversity, stressing that failures can serve as learning experiences and possibilities for progress. Ratan Tata directed the expansion of the Tata Group into many areas, including steel, autos, telecommunications, and software, utilizing both organic development and smart acquisitions of companies such as Tetley, Corus, and Jaguar Land Rover. He advocated for the creation of the Tata Nano, the world's most economical automobile, exemplifying a dedication to enhancing product accessibility for a broader consumer demographic. Following his retirement, Ratan Tata emerged as an active investor in Indian startups, sponsoring multiple enterprises across diverse sectors and facilitating the expansion of the Indian startup ecosystem.⁴¹² His leadership was defined by an enduring commitment to ethical business practices, corporate social responsibility, and charity, which positively influenced Indian society. Under his leadership, the Tata Group experienced substantial revenue and profit development, evolving from a predominantly India-focused enterprise to a global conglomerate.⁴¹³ Ratan Tata's entrepreneurial legacy is characterized by strategic vision, innovative spirit, ethical lead-

ership, and dedication to social responsibility, rendering him a respected and esteemed person in the corporate realm and beyond.⁴¹⁴ His outstanding approach to corporate leadership, ethical commitment to entrepreneurship, and philanthropic initiatives continue to inspire millions of young entrepreneurs globally. Tata claims that enterprises ought to enhance societal welfare using diverse methods. Tata recommends entrepreneurs to choose sustained growth over short-term profits. He urges entrepreneurs to adopt new technologies and remain receptive to change. Tata thinks that setbacks are a natural part of the entrepreneurial process and serve as useful learning experiences.⁴¹⁵ Ratan Tata is recognized for his sincerity and grounded mentality. He stresses the significance contributing to the community and making a positive impact on society.

❖ Lee Byung-Chul

He launched Samsung and is widely acknowledged for his crucial contributions to South Korea's economic advancement. Lee Byung-chul developed Samsung into an international tech giant. Lee established Samsung in 1938, at the age of 28. On 1 March 1938, Lee founded a transportation and real estate enterprise in Daegu, which he labeled as Samsung Trading Co, the precursor of Samsung, signifying "three stars."⁴¹⁶ He is considered as the most successful business tycoon in South Korea's history. Lee Byung-chul founded Samsung as a small trading company in Daegu. He joined high school at Joongdong High School in Seoul, and in 1929, he enlisted in the Department of Political Economy at Waseda University in Tokyo. However, he did not complete his studies and ultimately decided to withdraw out in 1931.⁴¹⁷ Lee acquired an honorary doctorate from Boston College in 1982. In his later years, Lee held the position of chairman of the Federation of Korean Industries and was recognized as the richest man in Korea.

Lee launched Samsung in 1938, which evolved into the largest conglomerate in South Korea. He is regarded as one of the most successful business magnates in Korean history. He had a crucial role in positioning Samsung as a leader in the electronics sector, especially in consumer electronics. He is acknowledged as one of the most significant leaders in South Korea's economic advancement, converting the nation from an agrarian community into a global economic powerhouse.⁴¹⁸ Lee Byung-chul's tactics and investments in research and development were important in establishing Samsung

⁴⁰⁸ <https://www.businesstoday.in/technology/news/story/from-ola-paytm-lenskart-to-urban-company-ratan-tatas-most-successful-startup-investments-449455-2024-10-10>, accessed on 14 Jul 2025

⁴⁰⁹ <https://www.hbs.edu/creating-emerging-markets/interviews/Pages/profile.aspx?profile=mtata>, accessed on 14 Jul 2025

⁴¹⁰ <https://timesofindia.indiatimes.com/gadgets-news/ratan-tata-invests-in-companionship-startup-goodfellows-why-he-invested-the-business-model-and-other-details/articleshow/93613980.cms>, accessed on 14 Jul 2025

⁴¹¹ <https://www.cnbctv18.com/entrepreneurship/ratan-tatas-advice-to-entrepreneurs-strongly-believe-in-your-idea-2607861.htm>,

⁴¹² <https://www.thedailystar.net/tech-startup/news/10-business-lessons-ratan-tata-3724566>,

⁴¹³ Naidu, Shantanu (2021). *I Came Upon a Lighthouse: A Short Memoir of Life with Ratan Tata*. Sanjana Desai. HarperCollins India. ISBN 978-93-90327-52-2, accessed on 14 Jul 2025

⁴¹⁴ <https://www.cheggindia.com/earn-online/success-story-of-ratan-tata/>, accessed on 13 Jul 2025

⁴¹⁵ <https://economictimes.indiatimes.com/news/india/famous-quotes-of-ratan-tata-indias-most-humble-business-man/articleshow/114096699.cms?from=mdr>,

⁴¹⁶ <https://www.koreaittimes.com/news/articleView.html?idxno=7223>, accessed on 13 Jul 2025

⁴¹⁷ <https://www.koreaittimes.com/news/articleView.html?idxno=7223>, accessed on 13 Jul 2025

⁴¹⁸ https://pantheon.world/profile/person/Lee_Byung-chul, accessed on 17 Jul 2025

as a worldwide entity.⁴¹⁹ His contributions assisted the development of contemporary South Korea, converting it into a significant economic power. Lee Byung-chul's legacy extend beyond the Samsung brand, embracing his vision for industrial advancement and national growth. He established elevated criteria and intended his employees to comply with them. Nonetheless, he possessed a distinct vision for Samsung's future, pushing the business to attain worldwide leadership across multiple sectors. He pioneered innovative management strategies, such as empowering subordinates, advancing women to leadership positions, and integrating international talent. He conceptualized a leadership approach that amalgamated autocratic governance with a strong vision and an emphasis on national advancement.⁴²⁰ He valued in the significance of quality, innovation, and discipline within his organization.

❖ Chung Ju-yung

He was one of the great **entrepreneurs in South Korea's** economic development is the founder of Hyundai. He stated, **"It is not necessary to remember one's success. That should be remembered by others instead."** Hyundai's remarkable journey from a small repair shop to a global powerhouse, is a story of resilience, innovation, and bold leadership. Central to this development is Chung Ju-yung, a rural youth who overcame poverty and hardship to establish one of the largest companies globally.⁴²¹ By the late 1950s, Hyundai emerged as a pioneer in Korea's reconstruction, and its achievements contributed significantly to the nation's rapid economic advancement. Chung Ju-yung was born into an impoverished family in Tongchon County, Korea, which was then part of the Empire of Japan, today known as Kangwon Province. He originally aimed to become a schoolteacher; however, his family did not possess the financial resources to facilitate his study.⁴²² When not engaged in work on the family farm, Chung attended his grandfather's Confucian school. His business aptitude became evident during travels to town, where he sold wood to financially assist his family. In 1946, following Korea's independence from Japanese rule, Chung established Hyundai and Hyundai Civil Industries, foreseeing the post-war reconstruction and industrialization.⁴²³ Chung secured government contracts and was charged with constructing a significant portion of South Korea's transportation infrastructure, including the Soyang Dam in 1967, the

Gyeongbu Expressway in 1970, the world's largest shipyard in Ulsan, and the Kori Nuclear Power Plant, among others.⁴²⁴ Chung's cooperation with the government in the 1950s was crucial, as Hyundai was among the "chaebols," family-owned conglomerates that obtained financial assistance to stimulate industrial development. He had a pivotal role in establishing Hyundai Heavy Industries, the largest shipbuilding company globally, and Hyundai Motor Group, a prominent automobile manufacturer. Chung Ju-yung's son guided Samsung's evolution into a global technology powerhouse, focusing on semiconductors, cellphones, and electronics.⁴²⁵

Chung Ju-yung's journey was defined by conquering several challenges, transitioning from modest origins to becoming a multinational corporation. He regarded failures as chances for learning and advocated for an unwavering quest for solutions in the face of challenges. He was unafraid of questioning conventional norms and prevailing common sense when he saw it beneficial to advancement.⁴²⁶ Hyundai's innovative approach to a variety of industries was significantly influenced by this willingness to consider outside the box. Under the leadership of Chung Ju-yung, Hyundai expanded its operations to include infrastructure initiatives, automobiles, and shipbuilding. Hyundai, a company that was pivotal in the economic expansion of South Korea following the conflict, was established by him. Chung Ju-yung was of belief that the combination of a strong will to succeed and one's potential could generate an powerful force for growth and innovation. He urged individuals to surpass their perceived limitations and realize their maximum potential.⁴²⁷ Chung Ju-yung highlighted that success is mostly a consequence of determination, with confidence playing a vital role. He supposed that tackling every task with a concentrated and persistent mindset was crucial. He emphasized the significance of putting in one's all, irrespective of the task's magnitude.⁴²⁸ He was acknowledged for his trust in putting utmost effort and pursuing the optimal outcome, rather than accepting to mediocrity.⁴²⁹ He perceived entrepreneurship as a combination of firm determination, diligent effort, and a readiness to challenge established norms. He held a conviction in the efficacy of personal endeavor and the capacity for collective success through inventive thought and a strong work ethic.

⁴¹⁹ https://www.samsungfoundation.org/html/eng/foundation/culture_foundation.asp, accessed on 13 Jul 2025

⁴²⁰ <https://www.thedailystar.net/toggle/news/the-man-who-built-samsung-tale-strategy-controversy-success-1985029>, accessed on 13 Jul 2025

⁴²¹ <https://www.linkedin.com/pulse/chung-ju-young-story-from-farmboy-founder-dollar-empire-wilson-luna-vktdc>, accessed on 17 Jul 2025

⁴²² <https://www.koreatimes.co.kr/lifestyle/people-events/20110907/5-chung-ju-yung-embodiment-of-koreas-economic-miracle>, accessed on 17 Jul 2025

⁴²³ Steers, Richard M. (1999). *Made in Korea: Chung Ju Yung and the Rise of Hyundai*. New York, NY: Routledge. ISBN 9780415920506, accessed on 17 Jul 2025

⁴²⁴ Richard M. Steers (1999). *Made In Korea: Chung Ju Yung and the rise of Hyundai*. Routledge. ISBN 0-415-92050-7, accessed on 17 Jul 2025

⁴²⁵ Kirk, Donald, 1938- (2015). *Korean dynasty : Hyundai and Chung Ju Yung*. London: Routledge. ISBN 9781315483191, accessed on 17 Jul 2025

⁴²⁶ Steers, Richard M. (1999). "11: Passing the Torch". *Made in Korea: Chung Ju Yung and the Rise of Hyundai*. New York, New York: Routledge. pp. 170–182. ISBN 0-415-92050-7, accessed on 17 Jul 2025

⁴²⁷ Cha, Victor D. (2013). *The Impossible State: North Korea, Past and Future*. Internet Archive. New York: Ecco. pp. 386–387. ISBN 978-0-06-199850-8, accessed on 17 Jul 2025

⁴²⁸ <https://koreajoongangdaily.joins.com/news/article/article.aspx?aid=2754257>, accessed on 17 Jul 2025

⁴²⁹ <https://www.koreaherald.com/article/3090349>, accessed on 17 Jul 2025

❖ **Kiichiro Toyoda**

He is one of the greatest entrepreneurs and business leaders of all time who established Toyota. He was a Japanese engineer and entrepreneur, and the son of Sakichi Toyoda, the founder of Toyoda Loom Works. His decision to shift Toyoda's emphasis from automatic loom production to automotive manufacturing established what subsequently evolved into Toyota. Toyoda was born on June 11, 1894, in the town of Yoshitsu, Yamaguchi, Shizuoka Prefecture, Japan, as the eldest son of Sakichi Toyoda and Tami Sahara.⁴³⁰ Sakichi Toyoda, his father, was a distinguished innovator who transformed the textile business with his automatic loom. Raised in such an environment, Kiichiro was inherently inclined to engineering and innovation. He acquired a degree in engineering from the University of Tokyo, prepared to follow in his father's footsteps. He recalled an encounter in which a friend advised him, "If you want to know where you're going, you need to understand where you've been." This insightful advice lingers in my mind whenever I ponder the legendary individuals who have influenced the world. Kiichiro Toyoda exemplifies the transforming journey of a corporation renowned for its creative engineering and global presence. Who would have anticipated that an individual from a little family weaving enterprise could found Toyota, a colossus in the automotive industry? Sakichi Toyoda established the groundwork with his invention of the automatic loom and the creation of Toyoda Automatic Loom Works, whereas Kiichiro is acknowledged as the founder of Toyota Motor Corporation.⁴³¹ He led the company's evolution from textiles into automotive manufacturing. He intended to produce affordable, reliable, and high-quality vehicles for the masses, transitioning from his family's successful loom business to car manufacturing.

His dream encompassed a promise to uninterrupted improvement, social responsibility, and contributing to the local community. Kiichiro was driven by the widespread use of vehicles in the United States and aimed to introduce similar technology to Japan, thereby making cars attainable for the general populace. Although the indisputable triumph of the Toyoda Loom Works, Kiichiro envisioned a future where engines produced a different tune.⁴³² Between 1955 and 1980, automotive production in Japan rose from 70,000 to 11.4 million, exceeding the United States' production in 1980. He became intrigued by the emerging world of vehicles and their mechanical wonders. He is the son of Sakichi Toyoda and is recognized for expanding the family enterprise into the automobile sector. He is recognized as the "King of Japanese Inventors" and concentrated on enhancing textile machinery. He founded

Toyoda Automatic Loom Works. Kiichiro Toyoda established this corporation, which subsequently evolved into one of the leading automotive manufacturers globally. He is also recognized for establishing the Toyota Production System, which prioritizes efficiency and the removal of waste. He advocated continual improvement ("Kaizen") and an unwavering commitment to quality, which became a defining characteristic of Toyota's success.⁴³³ The company's dedication to the local community, as shown by Kiichiro's vision, cultivated strong local support. He adopted innovative technologies and manufacturing methods, despite encountering initial obstacles and postwar limitations. Kiichiro prioritized the well-being of the local community surrounding Toyota's facility, seeking to enhance the pleasure of both employees and townspeople.⁴³⁴ Toyota's viewpoint of continuing improvement in processes and products was a vital force of its efficiency and quality.

❖ **Shibusawa Eiichi**

Shibusawa served a crucial role in the modernization of Japan by establishing more than 500 businesses, including the first bank, Oji Paper, and Tokyo Gas. He stressed ethical business practices and contributed importantly to the development of Japan's contemporary corporate structure. Shibusawa Eiichi, frequently referred to as the "father of Japanese capitalism," founded various enterprises and advocated for corporate ethics. He claimed that wealth production might be a commendable activity if conducted ethically and contributing to societal welfare. He highlighted the significance of devotion to family, friends, and the nation, asserting that business should function to the advantage of all stakeholders. Shibusawa's entrepreneurial style was not exclusively centered on profit. He also stressed the significance of social duty and contributing to the collective welfare. Shibusawa consistently championed the notion that ethical principles and business practices should coexist together. Shibusawa regarded entrepreneurs as key agents of economic advancement and modernization. He founded and assisted in the management of approximately 500 enterprises, encompassing banks, insurance firms, and other industrial enterprises.⁴³⁵ Shibusawa is featured on the 10,000 Japanese yen note, part of the new designs that began circulation on 3 July 2024. Shibusawa was printed on banknotes issued by the Korea First Bank, which he owned, in 1902.⁴³⁶

He was significant in formulating the legal framework for a national banking system and founding the First National Bank, the inaugural modern bank in Japan based on joint stock ownership. Through this bank, he established numerous other joint stock corporations

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<https://www.facebook.com/groups/650508077280772/posts/792287466436165/>, accessed on 17 Jul 2025

⁴³¹

https://www.wikiwand.com/en/articles/History_of_Toyota, accessed on 17 Jul 2025

⁴³²

<https://global.toyota/en/company/vision-and-philosophy/production-system/>, accessed on 17 Jul 2025

⁴³³

<https://global.toyota/en/newsroom/corporate/23493360.html>, accessed on 17 Jul 2025

⁴³⁴

<https://www.history.com/this-day-in-history/march-27/toyota-founder-dies>, accessed on 17 Jul 2025

⁴³⁵

<https://theemperorandthespy.com/overview/>, accessed on 17 Jul 2025

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https://english.kyodonews.net/articles/-/48464#google_vignette, accessed on 17 Jul 2025

across the country. He vigorously advocated for socially responsible business practices and aimed to enhance the perception of business within society. Additionally, he promoted open communication and cooperation between the business sector and the government. Shibusawa's entrepreneurial philosophy went beyond mere profit maximization; he stressed the significance of social responsibility and contributions to the collective welfare.⁴³⁷ He asserted that a prosperous nation necessitated a stability between economic advanced and social welfare, and that entrepreneurs played a crucial role in attaining this balance. He regarded entrepreneurs not merely as wealth generators, but as individuals intensely associated to the nation's development and ethical practice. He asserted that business ought to serve the public good and be governed by strong ethical norms, a notion he referred to as the unity of morals and economics. Shibusawa rejected the conventional Confucian perspective that deemed commerce as inherently devoid of virtue. Shibusawa advocated the priority of public interest and societal welfare before economic maximization. He asserted that enterprises ought to contribute to the advancement of the nation and its people. He engaged in various social welfare groups and educational activities, displaying his dedication to societal improvement.⁴³⁸ His legacy endures in motivating entrepreneurs to think about the wider societal implications of their commercial endeavors. He asserted that a strong ethical foundation was essential for enduring commercial success and national prosperity.

❖ **Akio Morita**

Morita co-founded Sony, an enterprise that transformed consumer electronics with internationally recognized goods. His vision and marketing skill contributed to Sony's worldwide brand recognition. He was an innovative Japanese entrepreneur, born into an affluent family in the Nagoya region of central Japan. His ancestors had been producing sake since the early seventeenth century, and Morita, as the eldest son of the firm's president, was groomed from the age of four to assume leadership of the company.⁴³⁹ He graduated from Osaka Imperial University with a degree in physics in 1944. He was subsequently commissioned as a sub-lieutenant in the Imperial Japanese Navy and served during World War II. While serving, Morita encountered his future business associate Masaru Ibuka at a study group focused on the development of infrared-guided bombs (Ke-Go) within the Navy's Wartime Research Committee. Morita significantly influenced the development of the worldwide electronics sector. In 1946, he collaborated with Masaru Ibuka to found Tokyo Tsushin Kogyo (subsequently renamed Sony),

where they launched innovative devices like as the transistor radio and the Walkman, transforming consumer electronics.⁴⁴⁰ Former Japanese Prime Minister Keizo Obuchi characterized Akio Morita, a pivotal figure in marketing and management, as "an engine that fueled the Japanese economy" ("The Father of Sony" 1999). Morita's vision and marketing strategies were pivotal in the worldwide success of the Sony Walkman, a product that transformed personal listening and altered the manner in which individuals engaged with music. Morita was instrumental in positioning Sony as a worldwide brand associated with superior quality and innovative consumer electronics.

Morita was a visionary entrepreneur acknowledged for his global perception and concentrate on innovation. He advocated "global localization," stressing the significance of understanding and adjusting to local markets while preserving a global outlook. Morita advocated in creating markets for products and encouraging new lifestyles, rather than responding to existing demand. He also emphasized the significance of quality, risk-taking, and promoting open debate within his organization.⁴⁴¹ He urged companies to act as a good neighbor in their global operations, inspiring employees to learn local languages and integrate with communities. He was committed in developing products that resonated globally while also adjusting to local needs and preferences. Morita's management philosophy, which prioritizes quality, innovation, and employee empowerment, has impacted numerous generations of entrepreneurs and business executives. He urged Japanese corporations to adopt more global business methods, including as listing on international stock exchanges and participating in worldwide marketplaces. Morita emphasized the significance of possessing the courage to decline both external influences and internal demands to guarantee optimal decision-making. Morita esteemed his staff and advocated for cultivating a culture of open discourse and collaboration. He notably asserted that educational background shouldn't be an impediment to success and advocated for a meritocratic culture at Sony. Morita underscored the significance of quality and innovation in product development. He was an ardent advocate for risk-taking and contesting traditional corporate methods.⁴⁴² Morita was opposed to the notion of merely satisfying existing demands. He regarded the entrepreneur's role as establishing new markets and motivating new lifestyles through inventive products.

❖ **Richard Charles Nicholas Branson**

He is an English business tycoon who co-founded the Virgin Group in 1970, and, as of 2016, oversaw five

⁴³⁷ Odagiri, Hiroyuki (1996). *Technology and Industrial Development in Japan*. Oxford University Press. pp. 72–73. ISBN 978-0-19-828802-2, accessed on 17 Jul 2025

⁴³⁸ <https://theemperorandthespy.com/2020/02/history-has-its-mysteries-recently-discovered-1908-photo-frank-a-vanderlip-the-future-president-of-japan-society-of-new-york-city-leads-the-first-formal-u-s-business-delegation-to-japan-to-meet-w/>, accessed on 17 Jul 2025

⁴³⁹ <https://www.sony.com/en/SonyInfo/CorporateInfo/History/SonyHistory/1-01.html>, accessed on 17 Jul 2025

⁴⁴⁰ Nobuo Abiko (March 26, 1966). "Pioneering firm upsets Japan hiring: Pattern broken". *The Christian Science Monitor*. p. 14, accessed on 17 Jul 2025

⁴⁴¹ <https://www.sony.com/en/SonyInfo/News/Press/199801/ibuka-e.html>, accessed on 17 Jul 2025

⁴⁴² Yochelson, John N. (2016). *Loving and Leaving Washington: Reflections on Public Service*. University of Nebraska Press. ISBN 9781612348353, accessed on 17 Jul 2025

companies.⁴⁴³ Richard Charles Nicholas Branson was born on 18 July 1950 in Blackheath, Royal Borough of Greenwich, London, to Edward James Branson (1918–2011), a barrister, and Evette Huntley Branson, a former ballet dancer and air hostess. He has two younger siblings, Lindy and Vanessa.⁴⁴⁴ Branson stresses the significance of engaging in endeavors that you are passionate about. He asserts that passion for one's profession enhances motivation to conquer hurdles and attain achievement. Branson emphasizes that work ought to be pleasurable. He advocates for entrepreneurs to discover methods to render their work enjoyable and captivating, potentially resulting in enhanced creativity and productivity. Branson has dyslexia and exhibited poor academic performance; on his final day at school, his headmaster, Robert Drayson, informed him that he would either face imprisonment or become a millionaire. Branson has openly discussed his experience with attention deficit hyperactivity disorder (ADHD). Branson's parents provided unwavering support for his pursuits from a young age. His mother was an entrepreneur; one of her most prosperous enterprises involved the construction and sale of wooden tissue boxes and wastepaper bins.⁴⁴⁵ Branson voiced his aspiration to become an entrepreneur in his youth. At the age of 16, he started on his first business endeavor, a magazine titled *Student*. In 1970, he established a mail-order record enterprise. In 1972, he established a series of record stores, initially named Virgin Records, which later became known as Virgin Megastores.

His Virgin brand had significant growth in the 1980s, as he established the Virgin Atlantic airline and expanded the Virgin Records music company. In 1997, he established the Virgin Rail Group to compete for passenger rail franchises amid the privatization of British Rail.⁴⁴⁶ His philosophy is "Screw it, let's do it." The statement symbolizes Branson's approach of taking charge and the willingness to embrace new challenges, regardless of their intimidating nature. Richard Branson's entrepreneurial philosophy stresses the importance of risk-taking, viewing failure as a valuable learning opportunity, and promoting individuals and enjoyment within the workplace. He advocates for pursuing one's passions, creating something exceptional, and contributing to the community. He thinks that courage is important for success in business. He advises for entrepreneurs to embrace measured risks and to perceive failure as a catalyst for attaining greatness.⁴⁴⁷ He emphasizes the significance of fostering a positive and

encouraging workplace, empowering workers and appreciating their contributions. Branson is an ardent advocate of community philanthropy. He claims that businesses have a responsibility to exert a positive influence on the world. Branson recognizes that errors are unavoidable in business.⁴⁴⁸ He urges entrepreneurs to derive lessons from their errors and progress, rather than obsessing on them. Branson asserts that enterprises ought to endeavor to produce something extraordinary that surpasses the competitors. He highlights the significance of innovation and differentiation.

❖ Carl (or Karl) Friedrich Benz

He was a German engine designer, automobile engineer, and a prominent entrepreneur in history. Carl Benz, originally named Karl Friedrich Michael Vailant, was born on 25 November 1844 in Mühlburg, a modern region of Germany. His parents were Josephine Vaillant and locomotive engineer Johann Georg Benz, whom she married a few months subsequently. Although residing in near poverty, his mother endeavored to provide him with a quality education. Benz attended the local school in Karlsruhe and was an exceptional student. In 1860, at the age of 15, he successfully completed the admission examination for mechanical engineering at the Karlsruhe Polytechnic School, which he later attended. Benz graduated on July 9, 1864, at the age of 19. In 1871, at the age of twenty-seven, Benz partnered with August Ritter and founded the Iron Foundry and Mechanical Workshop in Mannheim, subsequently renamed the Factory for Machines for Sheet-metal Working.⁴⁴⁹ Benz completed his two-stroke engine on 31 December 1879, and was issued a patent for it on 28 June 1880.⁴⁵⁰ Carl Benz's actual genius was evident via his subsequent innovations that were recorded during the development of what would establish the production standard for his two-stroke engine. Following years of experimentation and alterations, Benz developed the first commercial vehicle, the Model 3, a car using a four-stroke engine of his own design positioned between the rear wheels. The vehicle was driven by gasoline, with power transmitted by two roller chains to the rear axle, which had wooden wheels. This was the first manufactured vehicle.⁴⁵¹ The Benz Patent-Motorwagen, produced in 1885, is regarded as the first practical modern automobile and the first vehicle to undergo mass production. He was granted a patent for the motorcar in 1886, the same year he publicly operated the Benz Patent-Motorwagen for the first time. Benz & Cie, located in Mannheim, was the inaugural automotive manufacturing facility globally and the largest of

⁴⁴³ <http://www.flixens.com/director/richard-charles-nicholas-branson>, accessed on 14 Jul 2025

⁴⁴⁴ <https://www.telegraph.co.uk/news/obituaries/law-obituaries/8501350/Edward-Branson.html>, accessed on 14 Jul 2025

⁴⁴⁵ <https://www.theguardian.com/uk/1999/jul/21/3>, accessed on 14 Jul 2025

⁴⁴⁶ <https://web.archive.org/web/20110303202728/http://www.thisislondon.co.uk/standard-home/article-23897620-londons-1000-most-influential-people-2010-tycoons-and-retailers.do>, accessed on 14 Jul 2025

⁴⁴⁷ Sterngold, James (December 20, 1997). "Masaru Ibuka, 89, Engineer And Sony Co-Founder, Dies". *The New York*

Times. ISSN 0362-4331. Archived from the original on March 28, 2023, accessed on 17 Jul 2025

⁴⁴⁸ <https://www.forbes.com/profile/richard-branson/>, accessed on 14 Jul 2025

⁴⁴⁹ <https://web.archive.org/web/20170102082130/https://www.dpma.de/service/klassifikationen/ipc/ipcprojekt/einekurze-geschichtedesautomobils/geburtstagesautos/index.html>, accessed on 14 Jul 2025

⁴⁵⁰ G.N. Georgano *Cars: Early and Vintage, 1886–1930*. (London: Grange-Universal, 1985), accessed on 14 Jul 2025

⁴⁵¹ <https://www.carlbenzschool.kit.edu/cbs-history.php>, accessed on 14 Jul 2025

its era. In 1926, it amalgamated with Daimler Motoren Gesellschaft to establish Daimler-Benz, which manufactures the Mercedes-Benz and other brands. Benz is commonly acknowledged as "the father of the car" and "the father of the automobile industry".⁴⁵²

The journey to success was filled with challenges for Benz. He encountered various obstacles, such as financial limitations, technological issues, and skepticism from both the public and authorities. Nevertheless, he persisted, consistently enhancing his designs and ultimately introducing his innovation to the market. Carl Benz, the pioneer of the inaugural gasoline-powered automobile, regarded entrepreneurship as an unyielding quest for invention and a readiness for overcoming challenges. He held a conviction in the power of personal vision, the significance of practical engineering, and the necessity to adapt and change in accordance with market demands. He was motivated by a compelling vision to develop a horseless carriage, an idea that was groundbreaking for his era.⁴⁵³ He not only imagined it; he methodically designed the inaugural practical automobile, the Benz Patent Motorwagen. Benz recognized the necessity to modify his designs and business tactics to align with evolving market conditions. He launched several versions of his automobile, the Benz Patent Motorwagen, in reaction to preliminary criticism and obstacles. He also diversified his firm to encompass more engine ideas and ventured into new sectors including as racing, which further advanced the Mercedes-Benz brand.⁴⁵⁴ Benz's entrepreneurial spirit extended beyond mere immediate profit. He aspired to establish a profound influence, a legacy of innovation that would revolutionize personal transportation. This is demonstrated by the merger of his company, Benz & Cie., with Daimler, resulting in the renowned Mercedes-Benz brand. Benz was an innovator who recognized the need of practicality. His ideas, however innovative, were also practical and intended to meet a genuine demand for personal mobility. Carl Benz's entrepreneurial philosophy encompassed imaginative thinking, steadfast tenacity, adaptation, and an emphasis on practical solutions. He was not merely an engineer; he was a pioneer who influenced the automobile industry and made a significant impact on the world.

❖ August Horch

He was a German engineer, an automobile pioneer, the founder of the manufacturing company that ultimately became Audi, and a remarkable entrepreneur in all time history. Horch was born in Wittingen, Rhenish Prussia. He initially worked as a blacksmith before receiving his education at Hochschule

Mittweida (Mittweida Technical College). Upon obtaining an engineering degree, he was employed in the shipbuilding industry. Horch was employed by Karl Benz starting in 1896, subsequently establishing A. Horch & Co. in November 1899 in Ehrenfeld, Cologne, Germany.⁴⁵⁵ The inaugural Horch vehicle was manufactured in 1901. The company relocated to Reichenbach in 1902 then to Zwickau in 1904.⁴⁵⁶ Horch resigned from the company in 1909 following a disagreement and established a competing enterprise in Zwickau. Horch quit from Audi in 1920, relocated to Berlin, and undertook several employment opportunities. He released his memoirs, *I Built Cars (Ich Baute Autos)*, in 1937. He additionally sat on the board of Auto Union, the successor to Audi Automobilwerke GmbH, which he had established.

He was a German engineer and a pioneer in the automotive sector, perceiving entrepreneurship as a means for innovation and advancement, motivated by a passion for engineering and an aspiration to develop superior products. He established two prosperous automotive enterprises, Horch and Audi, exemplifying his entrepreneurial aptitude while encountering obstacles and conflicts. Horch's entrepreneurial pursuits were driven by his conviction in the automobile's potential and his aspiration to enhance previous designs. He was dissatisfied with the status quo and attempted to develop superior, more modern cars.⁴⁵⁷ His journey encountered numerous hurdles. He encountered conflicts with his colleagues and even legal problems on the utilization of his own name in his second enterprise, Audi. Nevertheless, he persisted and continued to follow his mission, exemplifying perseverance and determination.⁴⁵⁸ Horch's entrepreneurial acumen resulted in the establishment of two notable automotive brands, Horch and Audi. These enterprises, especially Audi, epitomized German engineering prowess, solidifying his reputation as an industry pioneer. Horch's enterprises were distinguished by their emphasis on quality and engineering excellence. This dedication to quality characterized his entrepreneurial strategy and facilitated the development of his enterprises.

❖ Bernard Jean Etienne Arnault

He is a French entrepreneur, investor, art collector, and a prominent figure in entrepreneur history. He serves as the chairman and CEO of LVMH, the leading luxury goods conglomerate globally. As of May 2025, Arnault is among the wealthiest individuals globally, with an estimated net worth of \$148.7 billion according

⁴⁵² Fanning, Leonard M. (1955). *Carl Benz: Father of the Automobile Industry*. New York: Mercer Publishing, accessed on 14 Jul 2025

⁴⁵³ https://web.archive.org/web/20150324020255/http://www.emercedesbenz.com/Sep08/12_001387_eMercedesBenz_Feature_The_Worlds_First_Production_Car_The_Benz_Patent_Motor_Car_Velocipede_Of_1894.html,

⁴⁵⁴ <http://www.bertha-benz.de/indexen.php?inhalt=home>, accessed on 17 Jul 2025

⁴⁵⁵ <https://www.fundinguniverse.com/company-histories/crain-communications-inc-history/>, accessed on 17 Jul 2025

⁴⁵⁶ Baldwin, Nick; Laban, Brian (1987). *The World guide to automobile manufacturers*. Facts on File Publications. p. 43. ISBN 978-0-8160-1844-4, accessed on 17 Jul 2025

⁴⁵⁷ Huber, Peter (January 1990). "Manufacturing the Audi Scare". Manhattan Institute for Policy Research, accessed on 17 Jul 2025

⁴⁵⁸ https://web.archive.org/web/20130114004911/http://www.audi.com/com/brand/en/company/audi_history/personalities/august_horch.html, accessed on 17 Jul 2025

to Forbes⁴⁵⁹ and \$155 billion according to the Bloomberg Billionaires Index.⁴⁶⁰ Arnault was born on March 5, 1949, in Roubaix. His mother, pianist Marie-Josèphe Savinel, a daughter of Étienne Savinel, possessed a "fascination for Dior".⁴⁶¹ His father, industrialist Jean Léon Arnault, a graduate of École Centrale Paris, owned the civil engineering firm Ferret-Savinell. In 1971, he earned his degree from the École Polytechnique, France's premier engineering institution. Arnault's impact transcends LVMH, encompassing investments in technology firms and philanthropic activities, especially in the arts. He has participated in renowned real estate and yacht enterprises. His leadership has resulted in LVMH becoming the largest corporation by market capitalization in the Eurozone.⁴⁶² Although controversies, especially his pursuit of Belgian citizenship, Arnault's financial skill has entrenched his position as a pivotal role in the global luxury industry. He stresses the need of establishing enduring brands via high-quality products and cultivating an environment that supports creative talent.

He is perpetually ranked among the wealthiest individuals worldwide, and his leadership at LVMH has proven him as a significant role in the luxury industry.⁴⁶³ Arnault has transformed LVMH into a worldwide luxury empire through strategic acquisitions and an emphasis on reviving historic brands. In 1984, he notably acquired Christian Dior and significantly contributed to the establishment of LVMH in 1987 by merging Louis Vuitton with Moët Hennessy. Arnault is recognized for his propensity to undertake calculated risks, investing in underperforming companies and revitalizing them through strategic modifications. He advocates for innovation, continuously striving to expand the limits of luxury and design.⁴⁶⁴ Despite being a vast conglomerate, LVMH has cultivated a decentralized framework, allowing each brand to function with significant autonomy under the leadership of its own artistic director. His entrepreneurial strategy is defined by a long-term perspective, emphasizing the development of sustainable brands and the nurturing of durable associations with customers.⁴⁶⁵ Arnault has expressed disapproval of the French business climate, indicating that it is not consistently conducive to businesses and that certain measures may obstruct economic growth. He has championed a more empathetic and sympathetic attitude to business and entrepreneurship in France.⁴⁶⁶ Arnault asserts that the success of luxury brands is contin-

gent upon the quality of their products, which is intrinsically linked to the skill and commitment of artisans. He allocates resources to training and development initiatives to cultivate future generations of artisans.

❖ Pavel Valeryevich Durov

He is a Russian technology entrepreneur renowned as the founder and chief executive officer (CEO) of Telegram, a messaging network established in 2013, and is regarded as one of the prominent entrepreneurs in Russia. Durov was born in Russia and co-founded the social networking platform VKontakte (VK) in 2006. While attending university, Durov established the well acclaimed forum spbg.ru. In 2006, he encountered his former classmate Vyacheslav Mirilashvili in Saint Petersburg. Vyacheslav introduced Durov to the increasingly popular Facebook, leading the buddies to establish a new Russian social network. Lev Binzumovich Leviev, an Israeli classmate of Vyacheslav Mirilashvili, emerged as the third co-founder. Durov assumed the role of chief executive officer (CEO) and enlisted his elder brother Nikolai, a multiple champion of international mathematics and programming competitions including the International Mathematical Olympiad, to assist in the site's development. Durov founded beta testing of VKontakte in September 2006. In the subsequent month, the domain name Vkontakte.ru was registered. The new project was established on 19 January 2007 as a Russian private limited company. The user base attained 1 million in July 2007 and 10 million in April 2008. In December 2008, VK defeated its competitor Odnoklassniki to become Russia's most popular social networking service. The company reached a valuation of US\$3 billion.⁴⁶⁷

He resigned from VK in 2014 due to conflicts with the company's new ownership and heightened pressure from Russian authorities, which subsequently compelled him to exit the country. In 2013, he and his elder brother, Nikolai Durov, established Telegram, and in 2017, they relocated to Dubai, United Arab Emirates, where its headquarters are currently situated. Durov was included on Forbes's billionaires list in 2023, possessing a net worth of \$11.5 billion. His wealth is largely derived on his ownership of Telegram. As of 25 August 2024, Durov ranked as the 120th wealthiest individual globally, possessing a net worth of \$15.5 billion, as reported by Forbes.⁴⁶⁸ In 2022, Forbes acknowledged him as the wealthiest expatriate in the United Arab Emirates. In February 2023, Arabian Busi-

⁴⁵⁹ <https://www.forbes.com/profile/bernard-arnault/?list=billionaires>, accessed on 17 Jul 2025

⁴⁶⁰ <https://www.bloomberg.com/billionaires/profiles/bernard-j-arnault/>, accessed on 17 Jul 2025

⁴⁶¹ <https://www.france24.com/en/20200122-bernard-arnault-france-s-wolf-in-cashmere-billionaire>,

⁴⁶² Hossain K A, (2024c), Analysis of ship recycling, ISBN-13, 979-8343259971, Oct 2024, Amazon, US

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<https://www.forbes.com/sites/hannahelliott/2010/11/04/in-luxury-bernard-arnault-alone-makes-the-most-powerful-list/>, accessed on 17 Jul 2025

⁴⁶⁴ Friedman, Vanessa; Paton, Elizabeth (30 October 2020). "Tiffany Deal Is a Signature Move by the Sun Tzu of Luxury". The New York Times. ISSN 0362-

4331. Archived from the original on 18 May 2021, accessed on 17 Jul 2025

⁴⁶⁵ Greenhouse, Steven (17 December 1989). "A LUXURY FIGHT TO THE FINISH". The New York Times. ISSN 0362-4331. Archived from the original on 17 July 2020, accessed on 17 Jul 2025

⁴⁶⁶ <https://www.brusselstimes.com/354763/worlds-richest-family-speculation-looms-about-lmvh-line-of-succession>, accessed on 17 Jul 2025

⁴⁶⁷ <https://fortune.com/longform/telegram-pavel-durov-mobile-world-congress/>, accessed on 17 Jul 2025

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<https://web.archive.org/web/20240318080314/https://www.forbes.com/billionaires/>, accessed on 17 Jul 2025

ness designated him as the most influential entrepreneur in Dubai.⁴⁶⁹ Durov advocates for Internet freedom and opposes the establishment's attempts to restrict it.⁴⁷⁰ Durov advocates for Internet freedom and opposes the establishment's attempts to restrict it. Since 2021, he has possessed citizenship in Russia, Saint Kitts and Nevis, the United Arab Emirates,^[12] and France. On 24 August 2024, Durov was caught by French authorities on criminal charges pertaining to an alleged deficiency in content moderation on Telegram and a refusal to cooperate with law enforcement, which supposedly encouraged the increase of illegal activities.⁴⁷¹ Durov was born on October 10, 1984, in Leningrad, Russian SFSR, Soviet Union, to a Russian family. His father, Valery Durov, is a professor of philology. Pavel Durov and his elder brother Nikolai spent the majority of their youth in Turin, Italy, where their father was worked. From 2002 until 2006, Durov pursued studies in English and Translation at Petersburg State University, where his father was employed. Pavel Durov's grandfather, Semyon Petrovich Tulyakov, served in World War II. He was a member of the 65th Infantry Division of the Soviet Red Army.⁴⁷²

He co-founded VKontakte, the most popular social media site in Russia, and subsequently developed Telegram, a secure messaging application. Durov's entrepreneurial journey entailed moving through the changing digital world and confronting problems associated with governmental pressure, finally resulting in his relocation to Dubai. Initially recognized as the "Russian Zuckerberg" for VK, he later quit the country following disputes with authorities, mainly around user data and freedom of expression on his social network. Durov's story illustrates the problems and possible conflicts that businesses in Russia have while functioning in an environment characterized by substantial official influence and control. He asserted that Russia is "incompatible with internet business," suggesting a conviction that the political climate and regulatory framework were unfavorable for cultivating a prosperous technology sector. Durov is characterized by a libertarian perspective, prioritizing personal liberty and little governmental interference. This position conflicted with the perceived growing dominance of the Russian state over online platforms. Durov has developed an international view for his initiatives, especially Telegram, which he manages from Dubai. This indicates a wish to function beyond the restrictions he identified in Russia.

Durov's experience has certainly instilled a chilling effect on many Russian tech entrepreneurs, rendering them more reluctant to confront authority or function autonomously from the state. Durov's experience underscores the necessity of diminishing the influence of authorities and security forces in the Russian economy to foster authentic entrepreneurial endeavors. Pavel Durov's views on entrepreneurship in Russia are shaped by his state experiences and his belief in individual liberty and minimum government involvement. His situation exemplifies the difficulties encountered by entrepreneurs in a nation where the government wields considerable control over the economy and digital platforms.

❖ Ren Zhengfei

He is a famous Chinese entrepreneur. He is an engineer and the founder and CEO of Huawei Technologies, situated in Shenzhen, China, and is the largest global manufacturer of telecommunications equipment and the second largest manufacturer of smartphones. Ren was born on October 25, 1944, in Zhenning County, Guizhou.⁴⁷³ His grandpa, Ren Sanhe, was a master chef from Zhejiang who specialized in ham curing. His father, Ren Musheng, did not complete his university studies following the death of his grandfather a year before his graduation. During the Japanese occupation, his father relocated to Guangzhou to serve as an accounting clerk in a military factory. Ren has five younger sisters and one younger brother.⁴⁷⁴ During his primary and middle school years, Ren was characterized as withdrawn and unsociable, resulting in his rejection from the Communist Youth League due to an inadequately formed sense of collectivism.⁴⁷⁵ During high school, he consistently wore a single-layer coat owing to financial constraints. In 1960, during his third year of high school, a severe famine occurred in Guizhou Province. To alleviate hunger, Ren frequently ventured into the mountains to gather wild fruits rather than grains. Regardless of his hunger, he refrained from consuming his family's food. In 1963, 19-year-old Ren was enrolled in Chongqing Institute of Architectural Engineering to specialize in building services engineering. He withdrew from college and independently studied computers, digital technology, automation, logic, philosophy, and three foreign languages. In 1970, he complied with a directive requiring all college students to depart from their studies to enlist in the military for training.

⁴⁶⁹ <https://www.arabianbusiness.com/powerlists/dubai-100-people>, accessed on 17 Jul 2025

⁴⁷⁰ Mozur, Paul; Satariano, Adam (26 August 2024). "How Telegram's Founder Went from Russia's Mark Zuckerberg to Wanted Man". The New York Times. ISSN 0362-4331. Archived from the original on 27 August 2024, accessed on 17 Jul 2025

⁴⁷¹ Kasprzak, Michal (2004). "Radio Free Europe and the Catholic Church in Poland During the 1950s and 1960s". Canadian Slavonic Papers / Revue Canadienne des Slavistes. 46 (3/4): 315–

341. doi:10.1080/00085006.2004.11092362, accessed on 17 Jul 2025

⁴⁷² https://www.nytimes.com/2014/12/03/technology/once-celebrated-in-russia-programmer-pavel-durov-chooses-exile.html?ref=technology&_r=1, accessed on 17 Jul 2025

⁴⁷³ Yu Shenghai 余胜海 (1 February 2017). [The Way of Survival: No Future Without Struggle]., [Ren Zhengfei and Huawei: very human and very moral] (in Chinese). Wuhan City, Hubei Province: Changjiang Literature and Art Publishing House. ISBN 978-7-5354-7702-6, accessed on 17 Jul 2025

⁴⁷⁴ <https://www.forbes.com/profile/ren-zhengfei/>, accessed on 17 Jul 2025

⁴⁷⁵ Tao; Huawei, (2017) [Huawei: Leadership, corporate culture, openness] (Библиотека Сбербанка. Т. 71 ed.). Москва: Олимп-Бизнес. ISBN 978-5-6040009-9-1, accessed on 17 Jul 2025

In 1974, in accordance to build for industrial modernization, he developed Liaoyang Petrochemical Fiber General Factory in Liaoyang. Within same year, Ren was inducted into the army and enlisted the 22nd separation from the Infrastructure Engineering Corps of the Chinese People's Liberation Army (PLA).⁴⁷⁶ He worked as a technician and engineer, working on automation processes in the chemical industry. During most of his military career, Ren was rejected entry to the Communist Party owing to his parents' social background and his father's work for the Nationalist government. He was capable to join the Party soon prior his retirement. Ren was displaced to a scientific research base. Ren Zhengfei, has establish Shenzhen Huawei Technology Co., Ltd. in 1987. At the starting of founding the company, friends suggested him to generate money with high profits, but Ren believed that was not an enduring solution. However, develop the entrepreneurship gradually and firmly. He has served president of Huawei since 1988.⁴⁷⁷ Ren has required to integrate CCP philosophy into Huawei's management and corporate culture. He said that if a dispute between the interests of Huawei and those of the CCP's rose, he would "choose the CCP whose interest is to assist the people and all human beings" and that he could not deceive the principle of helping all human beings.⁴⁷⁸ Ren Zhengfei intentions to expand global market share in four phases: the first is to penetrate the neighboring Hong Kong market; the second is to increase market share in Russia and South America; the third is intended to Southeast Asia, the Middle East, and Africa; and the fourth is to designed to developed countries. According to access the global market, Ren proposed the idea of "Huawei globalization": the globalization of management, R and D, talent, sales, and corporate culture. Since 1996, Ren has engaged IBM and various American and British firms to restructure Huawei's research and development, supply chain, financial, and market systems, as well as to consolidate its product development system, supply chain, human resource management, financial management, and quality control. In 2017 the company had an annual revenue of US\$92.5 billion.⁴⁷⁹ Huawei operates independently of Ren, as its shares are owned by employees; yet, the ownership structure remains ambiguous.⁴⁸⁰ Ren Zhengfei perceives entrepreneurship as a dynamic and developing process that necessitates a clear sense of purpose, a dedication to innovation, and an openness to adapt and learn from both successes and setbacks.

Ren Zhengfei asserts that a specific aim is essential for entrepreneurial success. The European Business

Review indicates that he perceives Huawei's objective as enabling clients to achieve their aspirations via communication technology, which is central to the company's operations. He urges staff to adopt this aim and strive tirelessly to attain it. He perceives entrepreneurship as a process of perpetual learning, adaptability, and steadfast dedication to consumer value. He stresses the significance of a purpose-oriented strategy, technical advancement, and a synergistic interaction between the government and private sector.⁴⁸¹ He also recognizes that the business environment is ever changing and emphasizes the necessity for entrepreneurs to be lifelong learners. He explained the difficulties he encountered in the initial stages, lacking comprehension of things such as supermarkets and bathrooms in their modern context. This stresses the significance of adjusting to new technologies and business models. He highlights the necessity of deriving lessons from errors and setbacks, perceiving them as chances for development. He considers technical innovation to be a fundamental catalyst for success in the 21st century. He has continuously emphasized the significance of research and development, especially in fundamental sciences and mathematics. He asserts that strong foundations in these domains is essential for sustained competitiveness and success. Ren promotes a synergistic partnership between the government and private sector entities.⁴⁸² He believes that a legalized and market-oriented environment, where the government administers according to law, is essential for fostering economic vitality. He also emphasizes the importance of enterprises focusing on value creation, technological breakthroughs, and law-abiding operations.⁴⁸³ He acknowledge the significance of sustainable development and social responsibility. Ren has advocated for company investment in education and development. He recognizes the necessity of overcoming obstacles and adjusting to global changes like U.S. chip restrictions.

✦ Liu Chuanzhi

He established Lenovo and is regarded as one of the prominent entrepreneurs in Chinese history. He was born on 29 April 1944 into a modest Chinese household. Lenovo is the preeminent global vendor of personal computers by unit sales. Liu was concerned about his financial situation; in 1984, he had an expanding family but a salary of merely 100 RMB per month. By the early 1980s, Liu had attained considerable success as a computer scientist yet remained dissatisfied with his career. Although his contributions to magnetic data storage were significant, they did not possess immediate practical applicability. He stated, "We were the

⁴⁷⁶ Marquis, Christopher; Qiao, Kunyuan (2022). *Mao and Markets: The Communist Roots of Chinese Enterprise*. Kunyuan Qiao. New Haven: Yale University Press. doi:10.2307/j.ctv3006z6k. ISBN 978-0-300-26883-6. JSTOR j.ctv3006z6k. OCLC 1348572572. S2CID 253067190, accessed on 17 Jul 2025

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<https://finance.ifeng.com/business/renwu/20130206/7650057.shtml>, accessed on 17 Jul 2025

⁴⁷⁸ <https://blogs.cisco.com/news/huawei-and-ciscos-source-code-correcting-the-record>, accessed on 17 Jul 2025

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<https://web.archive.org/web/20180803044919/https://www.d>

igianalysys.com/huawei-achieves-annual-revenue-of-92-5-bn/, accessed on 17 Jul 2025

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<https://www.huawei.com/en/corporate-governance#board-of-directors>, accessed on 17 Jul 2025

⁴⁸¹ <https://www.tbsnews.net/world/global-economy/huawei-founder-says-confident-firms-ability-survive-pressure-198859>, accessed on 17 Jul 2025

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<https://www.europeanbusinessreview.com/leading-huawei-seven-leadership-lessons-of-ren-zhengfei/#>,

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<https://www.globaltimes.cn/page/202506/1335800.shtml#>, accessed on 17 Jul 2025

premier computer technology research organization in China." We established the first electron-tube computer and the first transistor-based computer. However, we created only one of each item. Subsequently, we proceeded to create something distinct. The work was merely archived".⁴⁸⁴ Liu established Lenovo (formerly named Legend) in 1984 alongside a group of ten engineers in Beijing, utilizing 200,000 yuan and occupying an office of 20 square yards in area. Liu conceived the idea to establish Lenovo due to insufficient financing at the Chinese Academy of Sciences (CAS). Liu's superior arranged a loan of 200,000 yuan from the academy to him and the other co-founders. The founders of Lenovo, all scientists and engineers, encountered challenges due to their unfamiliarity with market-driven business processes, traditional Chinese ambivalence towards trade, and anti-capitalist communist ideology. Lenovo attempted, but did not succeed, in marketing a digital watch. Liu identifies Hewlett-Packard as a significant source of inspiration for Lenovo. Lenovo's subsequent acquisition of IBM's personal computing division positioned him as the first Chinese CEO to oversee the takeover of a significant American company.⁴⁸⁵ Liu Chuanzhi, the 75-year-old owner of Lenovo Group, has retired as chairman of Legend Holdings, the parent company of the world's greatest personal computer manufacturer in 2019.⁴⁸⁶

He respects personalities like Bill Gates for their philanthropic initiatives, proposing that entrepreneurs should endeavor to balance business success with social contributions. He highlights the significance of effective risk management, especially in acquisitions, taking into account brand awareness, employee retention, and cultural integration. He promotes establishing a solid basis for the organization, emphasizing a comprehensive understanding of the sector, adaptability to market fluctuations, and a constructive corporate culture. He contends that successful entrepreneurs need to be conscious of their societal impact and proactively engage in its enhancement. He perceives entrepreneurship as a journey necessitating not only business expertise but also a profound sense of social responsibility and a dedication to establishing a healthy, sustainable enterprise.⁴⁸⁷ He stresses the significance of foresight, an efficient team, and a sound management foundation, while also emphasizing the necessity for honesty and integrity in business transactions. Liu emphasizes the necessity of predicting and planning for market uncertainty, urging entrepreneurs to adopt a proactive approach to overcome problems. He asserts that cultivating a trustworthy and dependable team is essential for sustained success, highlighting the significance of col-

lective strength over individual excellence. Liu emphasizes the significance of integrity and ethical behavior in all business transactions, cautioning against actions that could tarnish the reputation of Chinese entrepreneurs.⁴⁸⁸ He recommends that leaders of major corporations prioritize establishing a strong management foundation, which include identifying suitable personnel, formulating an effective plan, and guaranteeing proficient execution. Liu recognizes that setbacks and failures are unavoidable, encouraging entrepreneurs to maintain persistence and concentration on their objectives.⁴⁸⁹ Liu also recognizes the necessity for innovation and adaptation, particularly in the digital age. He stated, entrepreneurship is comprehensive, involving not only the quest of profit but also the establishment of a sustainable and responsible company that contributes to society.

7. Analysis of Lessons Learn from Successful Entrepreneurs and Business Ventures

There are ups and downs, wins and losses, on the road to becoming an entrepreneur. It's about beginning from scratch and never giving up on their idea until they become a hero in their own right. Resilience, adaptability, and a desire to learn from both successes and setbacks are all essential components of a successful business. Some important lessons include regarding failure as a chance to learn, working with others to establish great teams, and always seeking fresh information and diverse points of view. Additionally, for long-term success, it's essential to understand the importance of vision, passion, risk tolerance, and customer relationships. Successful business owners see failures as chances to learn, not as reasons to give up. Entrepreneurs are always looking for fresh information and ways to adapt to the changing times in their company. They should be passionate enough about their firm and its objective to keep going and come up with new ideas. They should understand that taking calculated risks is essential for progress and be prepared to adjust their plan when necessary. Starting your own business might be hazardous, but it can also be advantageous. According to the online course *Entrepreneurship Essentials*, only 50% of new businesses last five years, and only 25% last 15 years. William Sahlman, a professor at Harvard Business School, states in his book *Entrepreneurship Essentials* that "for every Amazon.com or Uber, there are scores of companies few can remember." Sahlman also states, "A company is successful when it finds and takes the right steps along the way." It has learned how to make and keep customers happy. If they're considering starting their own business or are

⁴⁸⁴ Ling, Zhijun (2006). *The Lenovo Affair*. Singapore: John Wiley & Sons. ISBN 978-0-470-82193-0, accessed on 17 Jul 2025

⁴⁸⁵ <https://web.archive.org/web/20130701190345/https://www.silu.com/articles/354-ceo-profile-liu-chuanzhi-founder-of-lenovo>, accessed on 17 Jul 2025

⁴⁸⁶ <https://www.scmp.com/tech/tech-leaders-and-founders/article/3042660/liu-chuanzhi-godfather-chinese-pc-industry-retires>, accessed on 17 Jul 2025

⁴⁸⁷ https://www.researchgate.net/publication/5223277_Lenovo_An_Example_of_Globalization_of_Chinese_Enterprises, accessed on 19 Jul 2025

⁴⁸⁸ <https://knowledge.wharton.upenn.edu/article/lenovo-groups-liu-chuanzhi-on-building-a-healthy-company/>, accessed on 19 Jul 2025

⁴⁸⁹ <https://www.straitstimes.com/business/entrepreneurship-consumption-will-propel-chinas-growth-lenovo-founder>, accessed on 19 Jul 2025

just getting started, it's crucial to learn from others' mistakes and identify which choices helped a company stay in business.⁴⁹⁰

According to economics, entrepreneurship, including capital, labor, land, and natural resources, can be profitable. An essential component of a country's ability to thrive in a dynamic and increasingly competitive global economy is its entrepreneurial vision, which is characterized by exploration and risk-taking. The launch of a new company is the best illustration of entrepreneurship. Entrepreneurs are frequently referred to as innovators or sources of new ideas since they replace outdated products with innovative ones and introduce them to the market. It can be divided into home-based or small businesses and large corporations.⁴⁹¹ According to economics, an entrepreneur's profits are derived from a mix of labor, capital, land, and natural resources. In summary, anyone may become an entrepreneur if they have the drive and tenacity to launch a new business and manage all the associated risks. The process of improving entrepreneurs' knowledge and abilities through various classroom coaching, programs, and training is known as entrepreneurship development. Strengthening and expanding the number of entrepreneurs is the primary goal of the development process. One of the most critical traits of resilient and flexible entrepreneurs is their capacity to learn from both success and failure.

The process of cultivating and enhancing the skills, knowledge, and resources necessary for individuals to start and operate profitable businesses is known as entrepreneurial development. It entails a range of initiatives designed to encourage, educate, and support business owners, ultimately promoting economic growth and social progress. Programs for entrepreneurship development focus on equipping participants with real-world skills, including operations, marketing, financial management, and business planning.⁴⁹² Training often covers regulatory requirements, market realities, and access to resources for efficient business management. The growth of entrepreneurship depends on the presence of strong support networks, such as banks, governmental bodies, and private groups, to offer direction and aid.⁴⁹³ Cultivating an entrepreneurial mindset marked by creativity, risk-taking, resilience, and a proactive approach to problem-solving is another key aspect of entrepreneurship development. This entails providing entrepreneurs with access to capital, facilities, networking opportunities, and mentorship to help them start and grow their businesses. The process of entrepreneurial development is essential for promoting a flourishing business ecosystem, propelling economic growth, and enabling individuals to make meaningful

contributions to society. Being an entrepreneur involves more than just launching one or two companies; it also requires having the right mindset and motivation to succeed in the business world.⁴⁹⁴ Successful entrepreneurs share a similar mindset and possess certain personal traits that enable them to excel in business. Successful entrepreneurs, such as the ambitious Richard Branson, have an inner drive to succeed and build their businesses. They don't need a Harvard Business degree or technical knowledge in a particular area. Entrepreneurs can continually improve their methods and establish a stronger firm by viewing both success and failure as opportunities to learn.

An entrepreneur is typically a person who starts a new firm, taking on most of the risks and reaping most of the benefits. Entrepreneurship is the act of starting a business.⁴⁹⁵ "Enterprising individuals" and "entrepreneurial opportunities" are both components of entrepreneurship, according to Shane and Venkataraman. As such, researchers should examine the characteristics of those who spot opportunities when others do not, as well as the opportunities themselves and the relationship between individuals and opportunities.⁴⁹⁶ However, Reynolds et al. contend that people are primarily motivated to pursue entrepreneurial endeavors by opportunity or necessity; in other words, people pursue entrepreneurship primarily because they see business opportunities that meet their need for achievement or because they need to survive.⁴⁹⁷ An entrepreneur never succeeds by waiting for an opportunity to present itself. They always have a plan and follow through on it. Everybody plans things differently. However, successful people frequently have a strategy. An aspiring entrepreneur aspires to emulate the lifestyles of prosperous businesspeople.⁴⁹⁸ A few successful entrepreneurs' lessons learned, as well as their tactics and decision-making abilities, should be covered. During their entrepreneurial journey, successful entrepreneurs discovered the most crucial lesson. Therefore, honesty, resilience, creativity, flexibility, vision, leadership, passion, tolerance, communication, and balance may be essential traits for entrepreneurs. Nonetheless, some novel discoveries are worth considering.

* Entrepreneurs frequently balance a lot of obligations. Setting aside time for strategic planning enables a more comprehensive picture of the company and helps avoid being mired in daily responsibilities. Breaking away from the usual makes room for new concepts and creative fixes. Setting aside time for planning ensures that everyone is on the same page and working toward the same goals, which helps to improve business goals and strategies. Generally speaking, we dislike rising early, especially before dawn. However,

⁴⁹⁰ <https://online.hbs.edu/blog/post/successful-entrepreneur-stories>,

⁴⁹¹ <https://www.youtube.com/watch?v=74dBvveSQQM>,

⁴⁹² <https://aits-tpt.edu.in/wp-content/uploads/2023/08/Entrepreneurship-Development-min.pdf>,

⁴⁹³ <https://www.bajajfinserv.in/entrepreneurship-development>,

⁴⁹⁴ https://www.youtube.com/watch?v=nfOPUN_0xm8,

⁴⁹⁵ <https://www.investopedia.com/terms/e/entrepreneur.asp#>, accessed on 17 Jul 2025

⁴⁹⁶ Shane, S. (2000). "The Promise of Entrepreneurship as a Field of Research". *Academy of Management Review*. 25 (1): 217–226. doi:10.5465/AMR.2000.2791611, accessed on 13 Jul 2025

⁴⁹⁷ Reynolds PD, Hay M, Bygrave WD et al. (2002) *Global Entrepreneurship Monitor: 2002 Global Executive Report*. Kansas City, MO: Kauffman Foundation, accessed on 13 Jul 2025

⁴⁹⁸ Charles W. L. Hill; Gareth R. Jones (2008). *Essentials of Strategic Management*. South-Western College Pub. ISBN 978-0-547-19432-5, accessed on 17 Jul 2025

the majority of prosperous businesspeople have a tendency to rise early. We have more time in the morning to be conscious and to make a daily schedule, take care of our health, or do anything else we need to do when we get up earlier. Remarkably, Tim Cook, the CEO of Apple, gets up around 3:45 a.m. Nevertheless, he goes to bed at 8:30 p.m. and gets about seven hours of sleep⁴⁹⁹ and this practice makes him more productive, and gets extra time to put into other projects. This enables entrepreneurs to design strategies with a fresh perspective, which is the first step they must take if they want to succeed. Therefore, setting aside specific time for strategic planning from a new angle is quite beneficial to entrepreneurs.⁵⁰⁰ Ultimately, this leads to more successful company strategies by enabling innovative thinking, proactive risk management, and focused decision-making. Instead of responding to crises as they occur, strategic planning enables entrepreneurs to anticipate potential obstacles and develop effective mitigation plans. Strategic planning maximizes impact and efficiency by helping to identify high-priority projects and allocating resources efficiently. Entrepreneurs can capitalize on new opportunities and adapt to shifting market conditions with the aid of strategic planning.

* As a new business owner, they have a lot to gain and nothing to lose. Creativity is vital for small firms, and they are granted permission to try their hardest. However, in the startup sector, even failure serves as an additional advantage. They must keep an eye on their rivals but refrain from trying to imitate them. They must identify their incorrect approach and be creative, considerate, committed, and able to examine how others are implementing new ideas. Because consumer trends can shift quickly, market demand is unpredictable, which presents challenges for business owners. When starting a business, entrepreneurs must deal with a variety of risks and difficulties, and they should take precautions against the ones that could most likely impact them. There is no guarantee of success or a monthly income for entrepreneurs, and in the early stages of starting a business, it can be challenging to spend time with friends and family. The majority of entrepreneurs are risk-takers by nature, or at the very least, strategic visionaries with a well-defined strategy for introducing a new product or service to close a market gap. On a personal level, many entrepreneurs take significant risks by quitting secure employment to devote their time, energy, and frequently their own funds to starting a firm. They must keep in mind that not everything can be managed by a solid company plan or appropriate insurance. Threats and risks that businesses, enterprises, and new entrepreneurs may encounter in-

clude earthquakes, tornadoes, hurricanes, wars, and recessions. A product may have a sizable market in an impoverished nation, but depending on the political situation at any given time, these nations may be unsafe and unstable, or logistics, taxation, or tariffs may make commerce challenging. A company's reputation is crucial, and this is especially true when a new venture is introduced, as clients often have preconceived notions. A new business may never take off if it fails to satisfy customers from the outset. These days, word-of-mouth advertising and company reputation are greatly influenced by social media. A single negative post or tweet from a disappointed customer might result in significant income losses.⁵⁰¹ Additionally, they should be aware that certain business sectors have a history of high failure rates, and entrepreneurs in these industries may struggle to find investors. These industries include consultancy, retail, and food service. According to data from the U.S. Bureau of Labor Statistics, 79.1% of small firms founded in March 2021 reached their first anniversary in 2022, 67% reached their second anniversary in 2023, and 59.2% reached their third anniversary in 2024. Therefore, entrepreneurs should anticipate making some costly blunders. However, businesses have a better chance of success if they have the proper strategy, money, and flexibility.⁵⁰² By prioritizing strategic thinking, entrepreneurs can cultivate a more sustainable and successful business, even in the face of the challenges of running a startup.

* In the beginning, entrepreneurs or founders shouldn't worry too much about loss or risk because you can't succeed without taking risks. Bill Campbell, an American businessman who is the chairman of the board of trustees of Columbia University and the board of Intuit, famously observed, "If companies don't keep coming up with new ideas, they're going to die."⁵⁰³ Grace Hopper, a computer scientist, mathematician, and Rear Admiral in the US Navy, remarked, "A ship in port is safe, but that's not what ships are built for."⁵⁰⁴ In addition to creating groundbreaking items, successful entrepreneurs also set trends by developing innovative techniques that enhance the functionality of existing products. Therefore, entrepreneurs need to be risk-tolerant. Risk is often linked to entrepreneurship. An entrepreneur must accept risks while starting a business, but they must also take precautions to reduce those dangers. When starting a new business, many things can go well, but many things can also go wrong. Entrepreneurs who actively manage the risk-reward connection put their businesses in a position to "benefit from the upside," according to *Entrepreneurial Essentials*.⁵⁰⁵ Jack Ma says, "If you've never tried, how will you ever know if there's any chance?" He also adds,

⁴⁹⁹ <https://www.businessinsider.in/strategy/apple-ceo-tim-cook-wakes-up-every-day-at-345-a-m-i-tried-doing-it-for-a-week-and-it-made-me-shockingly-productive-/articleshow/70881139.cms>, accessed on 13 Jul 2025

⁵⁰⁰ <https://www.quora.com/How-do-you-stay-organized-and-manage-time-effectively-as-an-entrepreneur-1>, accessed on 17 Jul 2025

⁵⁰¹ <https://blog.fresent.com/taking-risks-entrepreneurs-successful/>, accessed on 17 Jul 2025

⁵⁰² <https://www.investopedia.com/ask/answers/040615/what-risks-does-entrepreneur-face.asp>, accessed on 17 Jul 2025

⁵⁰³ [https://en.wikipedia.org/wiki/Bill_Campbell_\(business_executive\)](https://en.wikipedia.org/wiki/Bill_Campbell_(business_executive)), accessed on 17 Jul 2025

⁵⁰⁴ Ann., Camp, Carole (2004). *American women inventors*. Berkeley Heights, NJ: Enslow Publishers. ISBN 978-0-7660-1538-8, accessed on 13 Jul 2025

⁵⁰⁵ <https://online.hbs.edu/courses/entrepreneurship-essentials/>, accessed on 15 Jul 2025

"Once in your life, try something, and work hard at something. Try to change. Nothing bad can happen."⁵⁰⁶ Successful entrepreneurs are comfortable with encountering some level of risk to reap the rewards of their efforts; however, their risk tolerance is tightly related to their efforts to mitigate it.

* In the business world, anyone may be successful, whether they are an introvert or an extrovert. Introverts and extroverts think about things in different ways, which is why they both bring their strengths to the table as entrepreneurs. Because introverts often prefer to be alone, many people think they wouldn't do well in business. However, numerous successful entrepreneurs have demonstrated that this perception is biased and unfounded.⁵⁰⁷ Just because introverts prefer to be alone or with a small group doesn't mean they dislike people. In reality, introverts are typically really adept at figuring out what other people need and reading them. Most of the time, introverts observe others and how they behave. One drawback of this is that they can often see through the mask and experience someone else's anguish more easily.⁵⁰⁸ Nonetheless, a collaboration or partnership between various personality types in the workplace can yield the best possible final outcome. These individuals can succeed in the business sector by utilizing their inventiveness and ingenuity. Steve Jobs and Steve Wozniak, co-founders of Apple, are two distinct entrepreneurs.⁵⁰⁹ Wozniak is a self-proclaimed introvert. But, through their partnership, they were able to coordinate their skill sets to produce an incredibly successful company.

* There are two sides to a coin: success and failure. Regrettably, many successful businesspeople fail in the early stages. Let's now consider Jack Ma, the founder of Alibaba. Alibaba first failed in 2003 because the majority of the business did not align with Jack Ma's vision. Additionally, he was in danger of bankruptcy within 18 months. But in just five years, he learned from his mistakes and emerged as eBay's main competitor. His success story demonstrates that every new business owner should either learn from their failures or, in the event of success, always consider how they can improve to be more productive. An entrepreneur is therefore sufficiently passionate. They are prepared to put in the extra work required to succeed because they are passionate about and deeply invested in their business idea. Instead of being mutually exclusive, success and failure are intertwined and necessary components of the entrepreneurial path. While success validates methods and spurs additional innovation, failure offers valuable lessons and opportunities for growth. The secret to long-term business success is to embrace both,

learn from errors, and adjust. Failure can draw attention to weaknesses in current strategies and compel business owners to reevaluate their methods.⁵¹⁰ Entrepreneurs can refine their strategy and increase their chances of success in subsequent ventures by analyzing what went wrong. Entrepreneurs can take more measured and wiser risks in the future by learning from their past mistakes. Resilience and adaptability, essential traits for navigating the dynamic corporate environment, can be fostered through failure.⁵¹¹ Success, on the other hand, gives confidence for upcoming undertakings and demonstrates the effectiveness of existing tactics. A positive feedback loop can be created by success, attracting talent, resources, and opportunities for further development. Entrepreneurs can be motivated to push the boundaries of their expertise and investigate new possibilities by successful initiatives. Many successful businesspeople have experienced significant setbacks before achieving their objectives.⁵¹²

* Entrepreneurs ought to possess an unwavering work ethic. There are many highs and lows on the entrepreneurial path. Having a strong work ethic gives you the resilience you need to overcome setbacks and failures.⁵¹³ Unless, like Musk, that's what fascinates us, an entrepreneur should put in 100 hours a week at work. To complete tasks on time, however, we simply need to be focused and determined. To put it briefly, it's about establishing clear priorities and putting ideas into action that will advance our business. Elon Musk, the CEO of SpaceX and Tesla, has an unachievable work ethic.⁵¹⁴ He has been working nonstop for the last 15 years, putting in 100 hours a week. Musk uses the time-blocking method to schedule his day in five-minute increments, which he calls "time blocks." A specific task or activity is allocated to each time block. Musk may utilize the time-blocking strategy, for instance, when he answers overdue emails, eats meals, or sets aside time for business meetings. Musk says, "There are many easier places to work, but no one ever changed the world working 40 hours a week." Entrepreneurs need to have a strong work ethic that won't let them down. It's a basic skill you need to do well in the harsh world of business. To establish a business, you need a strong work ethic, which means being dedicated, resilient, and committed to doing your best. This will help you address the challenges and capitalize on the opportunities that come your way. A strong work ethic provides the drive and determination necessary to navigate challenging times and achieve your company's goals. It is what keeps entrepreneurs going, even when things go wrong. A strong work ethic encourages individuals to strive for continuous learning and improvement. People who

⁵⁰⁶ <https://www.inc.com/larry-kim/25-billionaire-quotes-about-success-in-business-amp-life.html>, accessed on 15 Jul 2025

⁵⁰⁷ <https://www.linkedin.com/pulse/introverts-can-successful-entrepreneurs-yvonne-a-jones-cps-ra8xe/>, accessed on 13 Jul 2025

⁵⁰⁸ <https://medium.com/swlh/you-can-be-an-introvert-a-successful-entrepreneur-if-you-know-certain-things-84e84b6a09c8>,

⁵⁰⁹ <https://www.truity.com/blog/5-super-successful-introverts-and-what-they-did-right>, accessed on 13 Jul 2025

⁵¹⁰ <https://www.rrstar.com/story/opinion/columns/guest/2016/02/27/my-view-failure-success-two/32466898007/>,

⁵¹¹ <https://primeinsights.in/why-failure-is-the-pathway-to-success/#>,

⁵¹² <https://aligntoday.com/blog/success-and-failing#>,

⁵¹³ <https://www.linkedin.com/pulse/importance-strong-work-ethic-entrepreneurship-every-day-hussain-cz0te/>,

⁵¹⁴ Wattles, Jackie (December 8, 2020). "SpaceX gets almost \$900 million in federal subsidies to deliver broadband to rural America". CNN. Archived from the original on December 18, 2020, accessed on 13 Jul 2025

think this way are continually seeking ways to enhance their business and develop their talents. Ultimately, a strong work ethic is one of the most crucial qualities for an entrepreneur to possess. It boosts productivity, fosters a good reputation, and encourages an attitude of continuous learning and improvement. However, it's also crucial to strike a good balance between work and life and to prioritize your well-being over your goals.⁵¹⁵

* An entrepreneur always welcomes learning. Learning, as we all know, is an ongoing process that gets better with time. Learning aids in improving ourselves, which is something we should strive for every day. No one should ever stop learning, according to even Bill Gates. It will be the end of his world if he stops. He added that he wants to keep learning new things.⁵¹⁶ Knowledge and learning are something that never end; they continue with you in every phase of your life –the learning process improves your thoughts and personality.⁵¹⁷ The way every mistake teaches you something is the same way learning improves your vision and mission in life. A startup business is like a game, where you have to be on top by being aware of your industry's latest happenings and trends. At the same time, you must constantly add new skills to your arsenal and use them to better your startup. His conventional wisdom for entrepreneurs to say "no" to opportunities can be counterproductive in the early stages. Embracing "yes" can lead to discovering your strengths, finding valuable collaborators, and identifying your business niche, ultimately earning you the privilege to say "no" later.⁵¹⁸ Because it signifies that their request has been heard and will eventually be approved, people appreciate hearing "yes." However, for the same reason, some people are reluctant to give an affirmative response right away. By answering "yes," you are committing to keeping your end of the bargain. "Yes" can start to feel more like a hassle than a cash reward when you're already feeling overburdened trying to do everything that needs to be done in a day.⁵¹⁹ When you're already working on a lot of projects and feel like you've done too much, saying "no" might be a tempting way to avoid further work. The way they think sets CEOs apart from one another. Most CEOs use "no" as a way to conserve their time, allowing them to focus on more important things. A savvy CEO utilizes "yes" as part of their business strategy to foster new opportunities for their startup to grow.⁵²⁰

* The majority of prosperous businesspeople typically engage in odd pastimes because it helps them stay

focused. Marissa Mayer, a businesswoman and former Yahoo CEO, claims that her hobbies improve her performance at work. They help me create fresh, original perspectives. Mayer's obsession with cake is the one thing that could worry us. The San Francisco Mag reports that Mayer "made a spreadsheet for the ingredients, tested the recipes before writing her own, and bought a variety of cookbooks to study the cupcake recipes in each."⁵²¹ Being an extrovert is beneficial when you are an entrepreneur. Getting other people enthused about our ideas is a significant part of our work; therefore, it's assumed that extroverts will excel at that aspect of the job. Both extroverts and introverts can succeed in entrepreneurship, which often requires a range of tasks, from networking to intense product development. Building a team that complements your abilities and utilizing your talents are ultimately the keys to success.⁵²² Some business owners, such as Sundar Pichai, the CEO of Google, prefer to spend their weekends with their families. Some business owners, on the other hand, like to read books in their free time. It's not just about relaxing in their leisure time; it's also about what they want to do or activities that will help them relax and quiet down. So, the bottom line is that hobbies will make people better at work, and they will also aid in strengthening their decision-making skills in no time. Business owners need to know what they're doing. This entails having a thorough understanding of their company, industry, and business. They need to value learning and improvement as entrepreneurs for the rest of their lives, and then they need to take action. They need to be sure of what they know and how they can use it in their market and specialty. They also need to be confident. They need to be organized, which will help them feel better about themselves. This means they need to have a clear vision, plan, and goals for their firm and keep track of all the details.⁵²³

* To start, expand, and ensure the survival of a business, entrepreneurs must practice good communication both inside their company and with outside partners and investors. An entrepreneur requires a communication system that connects their company's employees as well as the company to other businesses and customers. Perhaps the most crucial action of a transformative leader is sharing a vision with their followers.⁵²⁴ Intense visions inspire dedication and give workers a feeling of direction. Both written and face-to-face communication are required to convey the vision, according to Kouzes and Posner, as well as Baum et al.⁵²⁵

⁵¹⁵ <https://www.quora.com/What-is-the-perfect-work-ethic-for-an-entrepreneur>,

⁵¹⁶ <https://believe.evancarmichael.com/homepage>, accessed on 13 Jul 2025

⁵¹⁷ <https://www.marsdd.com/our-story/entrepreneurship-skill-can-taught-can-learned/>,

⁵¹⁸ <https://www.entrepreneur.com/living/the-6-questions-i-ask-before-i-say-yes-to-anything/309695>,

⁵¹⁹ <https://startupnation.com/grow-your-business/attitude-smart-ceos-say-yes/>,

⁵²⁰ <https://lassonde.utah.edu/yes-entrepreneurship-can-be-learned-heres-how/>,

⁵²¹ <https://www.wired.com/2008/02/marissa-mayer-r/>, accessed on 13 Jul 2025

⁵²² <https://www.quora.com/Do-I-need-to-be-an-extrovert-in-order-to-be-a-good-entrepreneur>, accessed on 13 Jul 2025

⁵²³ <https://beatechelette.com/in-business-is-it-better-to-be-an-extrovert-or-introvert/>,

⁵²⁴ Hackman, M.Z.; Johnson, C.E. (2009). *Leadership: A communication perspective* (5th ed.). Long Grove, IL: Waveland, accessed on 13 Jul 2025

⁵²⁵ Baum, Robert J.; Locke, Edwin A.; Kirkpatrick, Shelley A. (1998). "A longitudinal study of the relation of vision and vision communication to venture growth in entrepreneurial firms". *Journal of Applied Psychology*. 83 (1): 43–54. doi:10.1037/0021-9010.83.1.43, accessed on 13 Jul 2025

Entrepreneurial leaders must speak and listen to articulate their vision to others.⁵²⁶ Entrepreneurs need to be able to talk to people well. When explaining a project, giving an elevator pitch, delivering a presentation, conducting training, or interacting with individuals in person, effective communication skills are crucial. For every minute he spoke, Winston Churchill practiced for an hour. It's not enough to just put together the "perfect words" and memorize them like a robot. It's all about how well and confidently you get your point over in real time. You don't have to learn how to talk quickly to convey your point clearly and concisely. But you do need to understand how to get to the point swiftly. In fact, body language makes up 93% of all communication between people. The number that people often mention isn't a rule, and it's not even quoted correctly. Two studies indicate that 93% of communication is non-verbal, and that body language accounts for 55% of all communication.⁵²⁷ Again, these are two different things.⁵²⁸ Hearing is a passive ability. Listening shouldn't be passive. It should be active.

* Since it allows leaders to persuade possible partners, investors, and employees of a venture's viability, communication is essential to the role of entrepreneurship. Effective communication with shareholders is essential for entrepreneurs. Information shared between two or more parties for an organization's purposes, functions, objectives, or business operations is referred to as business communication. Business communication is an organizational aspect and can take two forms: peer-to-peer and internal, or employee-to-superior. Business-to-business and business-to-consumer communication are examples of external communication that takes place outside of a company.⁵²⁹ According to the Communication Accommodation Theory, people tend to modify or adjust their speech patterns when communicating with others.⁵³⁰ The Face Negotiation Theory explains how individuals from diverse cultural backgrounds approach conflict resolution to maintain their dignity.⁵³¹ When creating a new product or service, entrepreneurs might employ Hugh Rank's "intensify and downplay" messaging technique. Rank contends that in order to convince others to support their business, entrepreneurs must be able to emphasize the benefits of their new product or service while downplaying its drawbacks.⁵³² Effective communication is essential for team performance. Several detrimental effects, such as project delays or failures, increased stress levels, and lost revenue, can result from poor communication. Anybody who wishes to be successful in the

corporate world needs to be able to communicate effectively. Success can be greatly impacted by your ability to communicate effectively and convincingly, whether you are speaking with clients, consumers, or coworkers.⁵³³

* Typically, entrepreneurs build teams. By setting a good example and cultivating a great work atmosphere, they inspire and drive their staff. They should be able to delegate in order to build a productive team. Team members typically feel more engaged and appreciated when they are given important tasks and responsibilities. Including team members in the decision-making process might inspire creative solutions that they might not have thought of on their own.⁵³⁴ However, one of the top mistakes new and experienced managers make is focusing too much on minute details and micromanaging employees. Research shows that micromanagement is one of the main reasons employees resign, leading to increased dissatisfaction, including low morale, high turnover, and decreased productivity.⁵³⁵ To avoid micromanaging, they usually allow themselves to let go of perfectionism and empower their employees. One of today's greatest businesswomen, Oprah Winfrey, views entrepreneurship as rooted in the conviction that success encompasses not only monetary gain but also personal fulfillment, helping others, and positively impacting the world.

* Create a clear vision, make a plan, and modify your tactics as necessary. Entrepreneurs typically foster a culture of trust both inside and outside of their firms and possess an innate strategic vision. They are able to evaluate risks, spot opportunities, and create long-term plans for their company. They possess the capacity to think creatively, generate original concepts, and solve problems in innovative ways. As entrepreneurs, it's crucial to have self-confidence, as it enables us to make informed choices and confidently present new ideas. Their business can prosper and their entrepreneurial talents can develop if they are able to make quick and wise decisions. When making judgments, they should follow their gut instinct while also taking the necessary steps to assess and identify potential dangers. Coworkers may feel more empowered to succeed for both the firm and themselves when they trust one another and feel at ease in their workplace. To succeed as a manager, leader, or employee, one must learn how to establish trust in the workplace. Building trust is when someone makes another person feel at ease enough to rely on

⁵²⁶ Locke, E.A.; Kirkpatrick, S.; Wheeler, J.K.; Schneider, J.; Niles, K.; Goldstein, H.; Welsh, K.; Chah, D.O. (1991). *The essence of leadership*. New York: Lexington Books, accessed on 13 Jul 2025

⁵²⁷ <https://www.cavendish.ac/effective-communication-for-entrepreneurs/>,

⁵²⁸ <https://www.britishcouncil.org.bd/en/business-communication-skills>,

⁵²⁹ <https://www.beekeeper.io/blog/internal-communication-trends/>, accessed on 13 Jul 2025

⁵³⁰ Giles, Howard; Edwards, America L.; Walther, Joseph B. (September 2023). "Communication accommodation theory: Past accomplishments, current trends, and future prospects". *Language Sciences*. 99:

101571. doi:10.1016/j.langsci.2023.101571, accessed on 13 Jul 2025

⁵³¹ Littlejohn, S., Foss, K. (2011). *Theories of Human Communication* (10 ed.). Long Grove, IL: Waveland Press. p. 203. ISBN 978-1-57766-706-3, accessed on 13 Jul 2025

⁵³² Rank, H (1976). *Teaching about public persuasion*. National Council of Teachers of English, accessed on 13 Jul 2025

⁵³³ <https://www.ucanwest.ca/blog/education-careers-tips/5-tips-for-improving-business-communication-skills>,

⁵³⁴ <https://online.hbs.edu/blog/post/team-decision-making>, accessed on 13 Jul 2025

⁵³⁵ <https://pubmed.ncbi.nlm.nih.gov/12510608/>, accessed on 13 Jul 2025

them. They are inspired to collaborate with them because they have faith in their skills and goals.⁵³⁶ Keeping their promises is a straightforward way to earn their trust. Be honest with your teammate if you can't accomplish anything because you don't have the time or the skills. This way, you won't promise too much and not deliver. Another strategy to earn trust is to communicate with coworkers in person or via email in a clear and direct manner. Follow the rules of proper email etiquette to make sure their correspondence is professional, clear, and friendly.

* According to research by American social psychologist Leon Festinger, a person's self-confidence may only increase or decrease if they are able to evaluate themselves against people who are similar to them in a competitive setting.⁵³⁷ Social psychologists have found that self-confidence is correlated with other psychological variables, including saving money, influencing others, and being a responsible student.⁵³⁸ Self-confidence affects interest, enthusiasm, and self-regulation. Self-confidence is crucial for achieving goals and enhancing performance.⁵³⁹ Marketing researchers have found that the general self-confidence of a person is negatively correlated with their level of anxiety. Self-confidence enhances a person's overall well-being and motivation, which in turn often improves performance.⁵⁴⁰ In 1943, American psychologist Abraham Maslow argued in his paper "A Theory of Human Motivation" that an individual is only motivated to acquire self-confidence where one component of "esteem" after achieving what they need for physiological survival, safety, and love and belonging.⁵⁴¹ It also increases one's ability to deal with stress and mental health.⁵⁴² The more self-confident an individual is, the less likely they are to conform to the judgments of others.⁵⁴³ Dominic D. P. Johnson and James H. Fowler write that "overconfidence maximizes individual fitness and populations tend to become overconfident, as long as benefits from contested resources are sufficiently large compared with the cost of competition".⁵⁴⁴ People prefer

leaders or entrepreneurs with greater self-confidence over those with less self-confidence.⁵⁴⁵

* Entrepreneurs must to pay attention to their clients, comprehend their wants, and cultivate enduring bonds with them. Building solid relationships and paying attention to their clients' requirements should be the top priorities for entrepreneurs. This strategy is essential for company success because it increases client loyalty, provides insightful information for new product development, and ultimately drives company growth. Through active listening, business owners may fully comprehend the wants, needs, and problems of their clients. This information is crucial for customizing goods, services, and advertising strategies to better meet their needs.⁵⁴⁶ Customers are more likely to form a favorable relationship with a firm when they feel heard and understood. Increased loyalty, recurring business, and favorable word-of-mouth recommendations can result from this. Entrepreneurs can enhance the customer experience by paying attention to consumer feedback and addressing their concerns. Increased client satisfaction, loyalty, and advocacy may result from this.⁵⁴⁷ However, for entrepreneurs, cultivating solid client relationships is not merely a "nice-to-have"—it is essential to creating a profitable and long-lasting company. Customers' implied meanings are equally as important as their explicit statements. You can gain a deeper understanding of your customer interactions and the sentiments, effort, emotions, and intents that drive customer relations by utilizing strategies like natural language understanding (NLU). In-depth analysis of customer behavior can help you forecast future behavior more readily and understand not only what they're doing, but why.⁵⁴⁸ Listening to customers is a mentality as much as a tactic. Entrepreneurs that adopt this mentality foster a listening culture in their companies. In a market that is ever-evolving, this culture ensures the company remains relevant, fosters innovation, and cultivates trust. Business leaders can realize the full potential of

⁵³⁶ <https://www.indeed.com/career-advice/career-development/building-trust>, accessed on 13 Jul 2025

⁵³⁷ Festinger, L. (1954). "A theory of social comparison processes". *Human Relations*. 7 (2): 117–140. doi:10.1177/001872675400700202, accessed on 13 Jul 2025

⁵³⁸ Gough, Harrison G.; McClosky, Herbert; Meehl, Paul E. (1952). "A personality scale for social responsibility". *The Journal of Abnormal and Social Psychology*. 47 (1): 73–80. doi:10.1037/h0062924. ISSN 0096-851X, accessed on 13 Jul 2025

⁵³⁹ Druckman, Daniel; Bjork, Robert A., eds. (1994). *Learning, Remembering, Believing: Enhancing Human Performance*. Washington, D.C.: National Academies Press. doi:10.17226/2303. ISBN 978-0-309-04993-1, accessed on 11 Jul 2025

⁵⁴⁰ Compte, O.; Postlewaite, A. (2004). "Confidence-enhanced performance". *The American Economic Review*. 94 (5): 1536–1557, accessed on 11 Jul 2025

⁵⁴¹ Maslow, A. H. (1 July 1943). "A theory of human motivation". *Psychological Review*. 50 (4): 370–396. CiteSeerX 10.1.1.334.7586. doi:10.1037/h0054346. IS SN 1939-1471, accessed on 11 Jul 2025

⁵⁴² Hobfoll, Stevan E. (1988). *The Ecology of Stress*. Taylor & Francis. ISBN 9780891168454, accessed on 11 Jul 2025

⁵⁴³ Deutsch, Morton; Gerard, Harold B. (1955). "A study of normative and informational social influences upon individual judgment". *The Journal of Abnormal and Social Psychology*. 51 (3): 629–636. doi:10.1037/h0046408, accessed on 11 Jul 2025

⁵⁴⁴ Johnson, Dominic D.P.; Fowler, James H. (14 September 2011). "The evolution of overconfidence". *Nature*, 477 (7364): 317–320, Bibcode:2011Natur.477..317J. doi:10.1038/nature10384, accessed on 11 Jul 2025

⁵⁴⁵ Conger, Jay A.; Kanungo, Rabindra N. (1994). "Charismatic Leadership in Organizations: Perceived Behavioral Attributes and Their Measurement". *Journal of Organizational Behavior*. 15 (5): 439–452. doi:10.1002/job.4030150508, accessed on 20 Jul 2025

⁵⁴⁶ <https://www.linkedin.com/advice/0/heres-how-you-can-cultivate-sustain-robust-relationships-l6jrc>, accessed on 20 Jul 2025

⁵⁴⁷ <https://execsintheknow.com/magazines/april-2024-issue/the-power-of-listening-leveraging-customer-feedback-to-drive-brand-success/#>, accessed on 20 Jul 2025

⁵⁴⁸ <https://www.qualtrics.com/en-gb/experience-management/customer/customer-relationship-building/#>, accessed on 20 Jul 2025

their companies by prioritizing their consumers' opinions.⁵⁴⁹ The benefits far outweigh the challenges, and the rewards, including loyal customers, a strong brand, and sustainable growth, are well worth the effort.⁵⁵⁰ Ultimately, prioritizing customer relationships and understanding can lead to increased sales, customer retention, and overall business growth.

* Entrepreneurs should make well-informed decisions and keep a close eye on their company's finances. To make informed judgments and ensure the long-term viability of their endeavors, entrepreneurs must have a solid understanding of their company's finances. Effective planning, risk management, and strategic growth are made possible by having a solid understanding of budgeting, cash flow, and financial reporting.⁵⁵¹ To obtain important insights and ensure regulatory compliance, entrepreneurs should not be afraid to consult financial professionals, such as accountants or financial consultants. Entrepreneurs can create a solid foundation for their companies and ensure they can withstand setbacks and adapt to shifting market conditions by practicing sound financial management. Entrepreneurs can track the performance of their businesses, pinpoint areas for development, and make data-driven decisions with the help of accurate financial reporting and analysis.⁵⁵² A solid financial base enables business owners to recognize and mitigate potential risks, such as market fluctuations, recessions, or unexpected expenses. Entrepreneurs can make informed decisions regarding investments, resource allocation, and business plans when they have a solid understanding of financial concepts.⁵⁵³ Entrepreneurs can maximize resource utilization, plan their spending, and ensure they have sufficient funds to meet operational demands and capitalize on opportunities by being proficient in budgeting and cash flow management. Financially literate entrepreneurs are better equipped to make informed decisions. They are able to weigh the benefits and dangers and know when to alter their strategies. This ability enables them to reduce debt and improve business operations.⁵⁵⁴ Entrepreneurs can make good decisions about investments, resource allocation, and business plans if they have a good grasp of financial fundamentals. Entrepreneurs can address the challenges of running a business, capitalize on opportunities, and establish a solid foundation for long-term success by prioritizing financial literacy and actively managing their firm's finances.

* Entrepreneurs have a positive outlook and persevere through obstacles and failures. A positive outlook and perseverance are essential for overcoming the numerous difficulties and disappointments that entrepreneurs frequently encounter and achieving success. These attributes enable them to stay focused, adapt to change, and persevere in the face of adversity. The steadfast dedication to one's objectives in the face of difficulty is determination. It strengthens the will to overcome obstacles, endure hardships, and maintain focus on long-term goals. Determined businesspeople are more likely to take measured chances, grow from mistakes, and eventually realize their full potential. Positive thinking enables business owners to view difficulties as learning opportunities rather than insurmountable roadblocks. Even in the face of disappointments, it keeps people resilient, driven, and hopeful. Additionally, a positive outlook encourages innovation and problem-solving, which helps business owners generate novel ideas.⁵⁵⁵ Entrepreneurs should also embrace continuous learning and adapt their strategies in response to market feedback and evolving circumstances. This adaptability, combined with a positive attitude and determination, enables them to overcome challenges and achieve sustainable success. Building a strong support system of mentors, peers, and advisors is also crucial for entrepreneurs.⁵⁵⁶ These individuals can offer guidance, encouragement, and practical advice, helping entrepreneurs navigate challenges and stay on track.⁵⁵⁷ Entrepreneurs must cease obsessing over the opinions of others. They must put all of their attention on resolving the issue at hand. If they divert their attention from overcoming the obstacles that lie ahead, they will get preoccupied with what other people think. Every business owner encounters challenges. There aren't many efficient ways to get beyond them. Entrepreneurs must clearly specify the challenge they are facing. To create a focused remedy, they must understand the underlying cause. Big issues may be debilitating. To make them less intimidating, they must divide them into more manageable, smaller jobs. They ask for assistance without hesitation. Speak with classmates, mentors, or advisors who have faced similar challenges. Entrepreneurs must be ready to modify their strategies as needed. When things don't go as planned, their flexibility enables them to adjust their course and come up with innovative ideas. Obstacles may appear more significant than they actually are, if necessary, tasks are put off or delayed. Entrepreneurs should start addressing the issue immediately.⁵⁵⁸

⁵⁴⁹ <https://online.stmarys.ac.uk/blogs/why-financial-literacy-is-essential-for-entrepreneurs/>, accessed on 20 Jul 2025

⁵⁵⁰ <https://www.linkedin.com/pulse/why-business-owners-should-listen-customers-rishu-chaitanya-bktpf/>, accessed on 20 Jul 2025

⁵⁵¹ <https://www.linkedin.com/pulse/financial-management-entrepreneurs-key-strategies-success-lone-mosito-o2qff/>, accessed on 20 Jul 2025

⁵⁵² <https://www.linkedin.com/pulse/financial-management-tips-entrepreneurs-business-owners-776af/>, accessed on 20 Jul 2025

⁵⁵³ <https://online.york.ac.uk/resources/how-to-manage-personal-and-business-finances-as-an-entrepreneur/>, accessed on 20 Jul 2025

⁵⁵⁴ <https://foundersmag.com/financial-management/#>, accessed on 20 Jul 2025

⁵⁵⁵ <https://www.quora.com/How-do-you-move-forward-with-subjects-that-didn-t-meet-your-expectations-like-English-in-your-case>, accessed on 20 Jul 2025

⁵⁵⁶ <https://www.robinwaite.com/blog/building-resilience-as-an-entrepreneur-how-to-overcome-setbacks-and-stay-motivated>, accessed on 20 Jul 2025

⁵⁵⁷ <https://www.linkedin.com/advice/3/youre-facing-setbacks-your-entrepreneurial-journey-ag6lc>, accessed on 20 Jul 2025

⁵⁵⁸ <https://economicinsider.com/overcoming-challenges-and-setbacks-strategies-for-entrepreneurs/>, accessed on 20 Jul 2025

* The capacity to recover from setbacks and keep a positive attitude is resilience. Resilient entrepreneurs are able to adjust to shifting conditions, learn from their mistakes, and persevere when things become tough. Since resilience enables entrepreneurs to use these traits to overcome obstacles, it is intimately related to both optimism and tenacity.⁵⁵⁹ Entrepreneurs are the source of their resiliency. People supporting them won't be the source of it because they are frequently unsupportive. They would be shocked at how many people turn out when they're doing well and how quiet they are when they're having trouble.⁵⁶⁰ They may effectively manage the highs and lows of business by overcoming challenges, growing resilient, learning from mistakes, and maintaining motivation. It is essential to remember that every obstacle presents an opportunity for growth and development.⁵⁶¹ They must remain optimistic, keep moving forward, and never give up on their goals. Entrepreneurs must be adaptable, resilient, and optimistic in order to confront and manage difficulties and find solutions. One effective strategy that can help them shift their attention from the negative to the positive is gratitude.⁵⁶² Unexpected events often lead to challenges, and it's easy to become entangled in negative emotions like irritation, anger, or despair. However, people might expose themselves to new possibilities by deliberately choosing to view the circumstance from a different perspective.⁵⁶³ For instance, they can consider a failed project as a worthwhile learning opportunity that will guide future efforts rather than as a complete failure. Any path will inevitably include failure, particularly in the commercial realm, as Thomas Edison discovered.⁵⁶⁴ Several setbacks accompanied his entrepreneurial success. He famously declared, "I have not failed," indicating that he viewed these setbacks as learning opportunities. I just discovered 10,000 ineffective methods. He eventually produced ground-breaking inventions like the light bulb and the phonograph as a result of his perseverance in the face of adversity and his capacity to learn from mistakes.⁵⁶⁵ However, individuals have the option to accept failure

as a necessary step on the path to success rather than allowing it to define them. Business challenges can frequently be emotionally and mentally taxing. Prioritizing self-care during these times is crucial for maintaining a positive outlook.⁵⁶⁶ Stress levels can be lowered and mental and emotional energy can be restored by engaging in well-being-promoting activities such as exercise, meditation, nature walks, or hobbies.⁵⁶⁷ People who have a good attitude are more likely to meet others who are eager to support them through tough circumstances.⁵⁶⁸ They can learn a lot from mentors, coworkers, or even online communities by building positive relationships and asking for help. This can help them see things in a new way and find possible answers.⁵⁶⁹

8. Development of New Entrepreneurs for Success in their Venture/Business in 21st Century

Entrepreneurship embodies an individual's willingness to take risks, encompassing various costs—from time investment to the challenge of devising effective and efficient business strategies. Such strategies must navigate social, intuitive, and financial risks, offering personal fulfillment alongside potential financial rewards if the newly implemented approach proves successful.⁵⁷⁰ Both innovation and entrepreneurship do not merely involve having a brilliant idea in one's mind; they require dedicated effort to transform that idea into action. The idea must be thoroughly discussed and its feasibility carefully evaluated. In this process, teamwork plays a crucial role, as it helps assess the idea's validity more effectively and refine it into a practical form, minimizing potential financial losses.⁵⁷¹ During the discussion of an idea, various weaknesses in its structure often emerge, which must be addressed and eliminated to prevent potential losses.⁵⁷² Accomplishing this requires a specific mindset and behavior, which defines an individual as a risk-taker—someone with the courage to navigate and influence social and economic structures to create an environment where their ideas can be transformed into action.⁵⁷³ Additionally, he must be fully aware of all potential risks and possess the

⁵⁵⁹ <https://wadhwanifoundation.org/staying-motivated-during-tough-times-6-strategies-for-entrepreneurs/>, accessed on 20 Jul 2025

⁵⁶⁰ <https://www.quora.com/How-can-I-overcome-challenges-and-setbacks-in-my-entrepreneurial-journey>, accessed on 20 Jul 2025

⁵⁶¹ <https://fastercapital.com/topics/overcoming-challenges-with-a-positive-mindset.html>, accessed on 20 Jul 2025

⁵⁶² <https://www.womenpreneur-digital.com/blog/building-a-resilient-mindset-nurturing-strength-in-entrepreneurs-86.html>, accessed on 20 Jul 2025

⁵⁶³ <https://fastercapital.com/content/Rehabilitation-Center-Testimonial--Startups-and-Rehabilitation-Centers--Stories-of-Resilience-and-Recovery.html>,

⁵⁶⁴ <https://vizologi.com/right-attitude-for-entrepreneurial-success/>, accessed on 20 Jul 2025

⁵⁶⁵ <https://thmeaningmovement.com/edisons-secret-to-success-and-how-you-can-overcome-the-fear-of-failure/>, accessed on 20 Jul 2025

⁵⁶⁶ <https://fastercapital.com/topics/overcoming-challenges-with-a-positive-attitude.html/1>, accessed on 20 Jul 2025

⁵⁶⁷ <https://wadhwanifoundation.org/staying-motivated-during-tough-times-6-strategies-for-entrepreneurs/>, accessed on 20 Jul 2025

⁵⁶⁸ https://link.springer.com/chapter/10.1007/978-3-031-71064-3_10, accessed on 20 Jul 2025

⁵⁶⁹ <https://www.linkedin.com/pulse/resilience-determination-entrepreneurs-dr-pravin-dattatraya-badhe/>, accessed on 20 Jul 2025

⁵⁷⁰ Beatty, Jack (1998). *The World According to Peter Drucker*. The Free Press. ISBN 978-0-684-83801-4, accessed on 19 Aug 2025

⁵⁷¹ Kelly, P.; Kranzburg M. (1978). *Technological Innovation: A Critical Review of Current Knowledge*. San Francisco: San Francisco Press, accessed on 01 Oct 2025

⁵⁷² Abadzhiev, Andrey; Sukhov, Alexandre; Johnson, Mikael (2024-06-18). "Business model innovation for reducing uncertainty in sustainability transitions: A case study of the wood construction industry". *Creativity and Innovation Management*. 33 (4): 818–

838. doi:10.1111/caim.12622. ISSN 0963-1690, accessed on 19 Aug 2025

⁵⁷³ Trott, Paul (2005). *Innovation Management and New Product Development*. Prentice Hall. ISBN 0273686437, accessed on 01 Oct 2025

courage to confront them whenever they arise along his path.⁵⁷⁴ Enterprisers are individuals who take on a business or enterprise with the potential for profit or the risk of loss. Entrepreneurs are those who utilize venture capital to launch and establish new ventures. They also bear the financial responsibilities and risks associated with owning, operating, and managing a business.⁵⁷⁵

Entrepreneurs exist in various forms and often generate employment opportunities while driving innovative breakthroughs. This is why they are regarded as essential for the strength and stability of a nation's economy. Although entrepreneurs are frequently seen as dreamers, charismatic leaders, and visionaries, not all of them necessarily possess these characteristics.⁵⁷⁶ Many entrepreneurs are individuals who follow their own paths. They possess the determination, persistence, and drive necessary to transform opportunities and ideas into reality. Generally, entrepreneurs have a clear and communicable vision, a genuine passion for their chosen field, strong motivation to bring their vision to market, and the unwavering perseverance to continue despite setbacks and obstacles. Undoubtedly, entrepreneurs are a unique breed. They are mavericks with the resolve and foresight to build a business that brings their vision to life.⁵⁷⁷ Their motivation stems from the dream of creating their own business ventures, while their drive comes from identifying and capitalizing on high-potential opportunities. They are often deeply absorbed in every aspect of their chosen field of expertise. Entrepreneurs are catalysts for ideas, which often arise from sudden flashes of inspiration and are frequently overlooked by others. They possess the ability to pivot instantly as conditions change, tolerate uncertainty, navigate transitions, and maintain a balance between continuity and change. Above all, entrepreneurs are remarkably tenacious.⁵⁷⁸ This quality truly defines the core nature of an entrepreneur. They are capable of carrying projects through from inception to completion and rarely give up, even when faced with the most difficult challenges.

New entrepreneurs should allow their vision to be so bold that it might even disconcert people. New entrepreneurs should recognize that entrepreneurship is often a way of life, requiring constant hustle and a mindset of finding solutions. Several factors typically influence an entrepreneur's success as they start, manage, and sustain their business, including the timing of

their launch, the amount of capital available, the competitiveness of the market, the reliability of their supply chain, and the prevailing economic conditions.⁵⁷⁹ Additionally, successful entrepreneurs tend to share a number of common character traits. Currently, there are nearly 600 million entrepreneurs worldwide, representing roughly 13% of the global population.⁵⁸⁰ That's an impressive number of individuals striving to realize their dreams. Highly successful entrepreneurs possess a distinct set of personality traits and characteristics that set them apart in achieving entrepreneurial success, and it isn't necessarily due to having a high IQ. In fact, 33% of entrepreneurs left high school with only a diploma or GED and never attended college, demonstrating that academic achievement alone does not equate to entrepreneurial ability.⁵⁸¹ Nevertheless, entrepreneurial traits enable individuals to launch and manage businesses by innovating, taking decisive action, and navigating challenges. To enhance entrepreneurial motivation, set achievable goals, acknowledge milestones, maintain an optimistic outlook, and concentrate on accomplishments rather than setbacks. Creativity is a cornerstone of entrepreneurship, involving the pursuit of inventive solutions, cultivating habits that spark new ideas, and allocating time to explore emerging opportunities.⁵⁸² These aspects will be explored in the following paragraphs.

Over time, the definition of an entrepreneur has evolved in response to the changing economic structures of the world. During the Middle Ages, the term primarily denoted an occupation, whereas the modern interpretation emphasizes creativity, risk-taking, and wealth creation.⁵⁸³ This concept of entrepreneurship establishes a direct connection between the term and the individual. This definition aligns with the contemporary framework of business studies. Today, the term "entrepreneur" is no longer limited to men; it equally encompasses women as active participants in entrepreneurial ventures.⁵⁸⁴ There was a period when women were largely restricted to their homes, expected only to perform household duties and fulfill roles as mothers and wives. They were rarely afforded the opportunity to voice their opinions or express dissent on various

⁵⁷⁴ Drucker, Peter (May 23, 1983). "Schumpeter And Keynes". *Forbes*. Retrieved March 12, 2012, accessed on 19 Aug 2025

⁵⁷⁵ Zuzul, T., & Tripsas, M. (2020). Start-up inertia versus flexibility: The role of founder identity in a nascent industry. *Administrative Science Quarterly*, 65(2), 395–433, accessed on 01 Oct 2025

⁵⁷⁶ Westhead, P., & Wright, M. (Eds.). (2000). *Advances in entrepreneurship* (Vol. 2). Cheltenham: Edward Elgar,

⁵⁷⁷ <https://quasa.io/media/the-anatomy-of-an-entrepreneur>, accessed on 19 Aug 2025

⁵⁷⁸ Yang, X., Lan, T., Qiu, H., & Zhang, C. (2025). Nonlinear Causal Discovery via Dynamic Latent Variables. *IEEE Transactions on Automation Science and Engineering*, accessed on 19 Aug 2025

⁵⁷⁹ Lam, C. F., Romney, A. C., Newton, D. W., & Wu, W. (2024). Challenging the status quo in a non-challenging way:

A dominance complementarity view of voice inquiry. *Personnel Psychology*, 77(3), 1235–1264, accessed on 19 Aug 2025

⁵⁸⁰ <https://www.smallbizgenius.net/by-the-numbers/entrepreneur-statistics/>, accessed on 19 Aug 2025

⁵⁸¹ <https://writersblocklive.com/blog/entrepreneur-statistics/>, accessed on 19 Aug 2025

⁵⁸² <https://www.indeed.com/career-advice/finding-a-job/entrepreneur-characteristics>, accessed on 19 Aug 2025

⁵⁸³ Boutellier, Roman; Gassmann, Oliver; von Zedtwitz, Maximilian (2000). *Managing Global Innovation*. Berlin: Springer. p. 30. ISBN 3-540-66832-2, accessed on 19 Aug 2025

⁵⁸⁴ Colette Henry, et al, (2010), Chapter 2 Encouraging women's entrepreneurship in the sciences: Women in veterinary medicine 15-33, accessed on 19 Aug 2025

matters.⁵⁸⁵ However, in today's era, women have become more empowered and independent, enjoying the right to shape their lives and make decisions on their own terms.⁵⁸⁶ They are also able to voice their opinions on a wide range of issues, whether political, social, educational, or economic. Nevertheless, debates often continue regarding the comparison between men and women as entrepreneurs.⁵⁸⁷ In light of this comparison, many opinions about women in entrepreneurship have emerged, arguing that women are weaker entrepreneurs and may lack essential traits of a successful entrepreneur. Critics claim that women are less willing to take risks, struggle to face challenges, are more emotional, and find it difficult to make quick decisions in chaotic situations. Consequently, some argue that there is no certainty that a woman can excel as an entrepreneur.⁵⁸⁸ Although the definitions mentioned above describe entrepreneurs in largely similar ways, they still carry certain limitations. Specifically, they imply that entrepreneurial presence is not universal and cannot be found across every field, such as education, medicine, law, engineering, social work, and others.⁵⁸⁹ These definitions highlight several common and essential traits of an entrepreneur, including organizational skills, creativity, risk-taking, and the ability to generate wealth.⁵⁹⁰ The skills, capabilities, and qualities mentioned above are essential prerequisites for anyone aiming to succeed as an entrepreneur. Accounts of successful entrepreneurs consistently reflect these attributes.

To flourish, an entrepreneur must be bold, strategic, energetic, and passionate. Creativity and managerial acumen are also critical to entrepreneurial success.⁵⁹¹ Modern entrepreneurs must be versatile, multi-skilled individuals, making the role inherently complex. Contrary to common belief, however, these entrepreneurial skills and qualities are not solely innate—they can be learned, honed, and developed through practice and experience.⁵⁹² However, it is crucial to make a deliberate choice to cultivate these skills and qualities. By consciously working to strengthen areas where he is less proficient, he positions himself for sig-

nificant achievements as an entrepreneur in the business world.⁵⁹³ A temporary lack of mastery in one area does not determine his lifelong ability; every skill can be learned. Do not let this list overwhelm or discourage him. With consistent practice on his weaker areas, these skills will gradually become second nature, eventually integrating seamlessly into his entrepreneurial DNA. Entrepreneurs are inherently optimistic, forward-looking, and highly enthusiastic. Successful entrepreneurs exhibit remarkable energy levels, driven by the belief in their potential for success and the willingness to risk their resources to achieve profits or make a meaningful impact. They are often impatient, constantly thinking about ways to grow their business and expand market share. To succeed, one must ask: is he motivated enough to sustain this effort? Motivation is a core trait of successful entrepreneurs, but passion is equally essential.⁵⁹⁴ Passion consistently emerges in discussions of entrepreneurial DNA, traits, or anatomy—it is a defining force.

The level of motivation and passion entrepreneurs demonstrates will largely determine his success in entrepreneurial ventures. From developing and refining prototypes to presenting ideas to investors, achievement is ultimately fuelled by the synergy of determination and passion.⁵⁹⁵ Persuasiveness and creativity are crucial yet often overlooked traits of successful entrepreneurs. A prime example is Walt Disney, whose extraordinary creativity allowed him to outshine competitors and build an empire from the ground up.⁵⁹⁶ The absence of the right business mindset is often the critical factor that can determine the success or failure of an aspiring startup. Many entrepreneurs launch ventures simply because they are unemployed; they may have ideas but lack the drive to sustain them. To succeed, an entrepreneur must possess self-motivation and the ability to think innovatively, courageously, and strategically, transforming a simple idea or hobby into a thriving business. The right mindset is deeply embedded in the anatomy of an entrepreneur. Whether building a business for the long term or planning an eventual exit, having this mindset is essential.⁵⁹⁷ Entrepreneurs must

⁵⁸⁵ Chesbrough H.: (2003), *Open Innovation: the New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston

⁵⁸⁶ Alison Morrison, (2006), A contextualization of entrepreneurship. *International Journal of Entrepreneurial Behaviour & Research* 12:4, 192-20, accessed on 01 Oct 2025

⁵⁸⁷ https://www.ijfmr.com/?gad_source=5&gad_campaignid=17989020439&gclid=EAIaIQob-ChMImJP4u_H7jgMVR6PYBR3GnxH8EAEYASAAEgJwqvD_BwE, accessed on 19 Aug 2025

⁵⁸⁸ Maggie O'Carroll, et al, (2010), Women's International Centre for Economic Development (WICED), *International Journal of Gender and Entrepreneurship* 2:2, 197-204, accessed on 01 Oct 2025

⁵⁸⁹ Edgar Voltmer, et al, (2011), Work-related behavior and experience patterns of entrepreneurs compared to teachers and physicians. *International Archives of Occupational and Environmental Health* 84, 479-490,

⁵⁹⁰ <https://web.archive.org/web/20231002040349/https://innovationzen.com/blog/2006/07/29/innovation-management-theory-part-1/>, accessed on 19 Aug 2025

⁵⁹¹ Liang, J., Farh, C. I., & Farh, J. L. (2012). Psychological antecedents of promotive and prohibitive voice: A two-wave

examination. *Academy of Management Journal*, 55(1), 71–92, accessed on 01 Oct 2025

⁵⁹² Mbogu, H. M., & Nicholson, C. (2023). Data-Driven Root Cause Analysis Via Causal Discovery Using Time-To-Event Data. Available at SSRN 4414871, accessed on 19 Aug 2025

⁵⁹³ Liu, W., Tangirala, S., Lam, W., Chen, Z., Jia, R. T., & Huang, X. (2015). How and when peers' positive mood influences employees' voice. *Journal of Applied Psychology*, 100(3), 976–989, accessed on 19 Aug 2025

⁵⁹⁴ Logue, D., & Grimes, M. (2022). Living up to the hype: How new ventures manage the resource and liability of future-oriented visions within the nascent market of impact investing. *Academy of Management Journal*, 65(3), 1055–1082, accessed on 19 Aug 2025

⁵⁹⁵ Deng, Z., Prugsanapan, P., & Kong, Z. (2025). Anytime Communication: A Human-AI Collaboration Framework for Causal-Based Root Cause Analysis. In *AIAA SCITECH 2025 Forum*, accessed on 01 Oct 2025

⁵⁹⁶ <https://www.entrepreneur.com/starting-a-business/the-values-that-all-successful-entrepreneurs-should-have/468839>, accessed on 19 Aug 2025

⁵⁹⁷ McDonald, R., & Gao, C. (2019). Pivoting isn't enough? Managing strategic reorientation in new ventures.

adhere to their vision, devise strategies for generating income, and use their resources to grow and enhance their ventures. Documenting milestones, processes, and future goals provides a roadmap to guide decisions and innovations along the journey. For first-time entrepreneurs, the path can be daunting, fraught with seemingly insurmountable challenges. While some individuals naturally possess the instincts and capabilities for entrepreneurial success, others may struggle, facing repeated setbacks until discouragement sets in.⁵⁹⁸ This is precisely why the concept of entrepreneurial DNA is so often discussed.

In 21st century the business environment is inherently volatile, filled with uncertainties, and demands courage along with a suite of exceptional skills to navigate effectively. Many argue that successful entrepreneurs and business leaders are born with innate capabilities that set them apart. While there may be some truth to this, entrepreneurial skills, like any other ability, can be learned, refined, and applied to achieve success. Thriving in the business world requires formidable personal skills and competencies. Strong social skills, for instance, are among the most significant factors contributing to entrepreneurial success. In fact, personal skills often take precedence when launching a venture. These skills—proficiencies deeply embedded in one's character—are essential for business achievement. Even if some individuals do not naturally possess them, they can be consciously developed and nurtured over time to enhance entrepreneurial effectiveness.⁵⁹⁹ Personal skills often shape the type of business an individual is likely to excel in. For instance, someone with a talent for cooking and a deep appreciation for flavors is more likely to succeed in the catering or restaurant industry. Alongside this, essential skills such as effective communication, respect for customers, suppliers, distributors, and employees are critical. Integrity and honesty also rank among the most valuable personal skills, forming the foundation of a profitable and sustainable business. Equally important is the ability to create a distinctive image, which is crucial for entrepreneurial success.

In 21st century as it has highly competitive market with cut-throat practices, standing out from the clutter is essential. Building a strong brand identity requires consistently presenting his target audience with company information, trademarks, logos, and other brand elements. Whether establishing a startup's brand or cultivating a personal brand, image-building skills are indispensable. When an entrepreneur successfully registers a unique brand identity in the minds of their target customers and establishes an unassailable image, the path to success becomes attainable. In addition, every

successful entrepreneur is an organized individual, capable of managing multiple responsibilities effectively.⁶⁰⁰ This organization is essentially the foundation for accomplishing tasks efficiently. Even with limited resources, proper organization ensures they are utilized to their maximum potential. A weak organizational setup not only slows business growth but also makes scaling the venture difficult. A well-structured environment can work wonders in attracting customers. It's important to understand that top entrepreneurs remain organized. The failure rate for entrepreneurial ventures is extremely high. Sometimes, it's better to exit a venture and pursue something new rather than continue investing in a failing project. Many famous entrepreneurs were not successful on their first attempts. However, they had the foresight and composure to know when to cut losses, pivot, or start fresh. If he is considering a business exit, careful planning is necessary to avoid serious mistakes. Entrepreneurs must lead from the front, as entrepreneurship is fundamentally about problem-solving.⁶⁰¹ Most successful products focus on addressing one or more specific problems (at the very least, one—if he doesn't solve a problem, success is unlikely!). For this reason, having a problem-solving mindset is an essential quality for any entrepreneur. Once he stops relying on others to fix the challenges he faces and begins tackling them himself, he takes the first step toward becoming a true problem-solver. Over time, he will also be able to develop solutions for the issues he notices when launching his product or service.⁶⁰²

Most of the new entrepreneurs assume that starting a business requires a large amount of capital, that's not always the case. Having strong business and financial skills is one of the key reasons entrepreneurs succeed. In modern era, it's possible to launch a business for under \$1,000 or around 0.1 million Taka. Entrepreneurs have the ability to set up the internal systems, processes, and procedures needed to run a business effectively. They consistently focus on sales, cash flow, and revenue. Successful entrepreneurs rely on their business expertise, networks, and practical know-how. Evaluate his current skills and professional connections—will his experience, contacts, and abilities easily support the business ideas he wants to pursue? By developing strong business skills, he can help his startup avoid failure and stay on the path to success. Right from the beginning of his entrepreneurial journey, he will start negotiating.⁶⁰³ Negotiation skills are important at every stage of a business, whether he is dealing with clients, customers, employees, investors, or other stakeholders. The ability to negotiate can make the difference between success and failure, profit and loss, or

Organization Science, 30(6), 1289–1318, accessed on 19 Aug 2025

⁵⁹⁸ Morrison, E. W. (2023). Employee voice and silence: Taking stock a decade later. *Annual Review of Organizational Psychology and Organizational Behavior*, 10(1), 79–107, accessed on 01 Oct 2025

⁵⁹⁹ Usawas, G 2010, Results indicate a family business risks collapse Thailand holds. 'Central - friendly' sustainable business model. [Online]. Available: <http://www.gotomanager.com/news/details.aspx?id=88569>, accessed on 19 Aug 2025

⁶⁰⁰ Thechatakerng, P, 2009, Determinants of Micro-entrepreneurs Innovation, Paper presented in EDP workshop, Barcelona, April 2-3, Spain, accessed on 19 Aug 2025

⁶⁰¹ <https://www.entrepreneur.com/en-in/growth-strategies/entrepreneurship-is-essentially-about-problem-solving/276286>, accessed on 19 Aug 2025

⁶⁰² <https://midassoe.com/characteristics-of-a-successful-entrepreneur/>, accessed on 01 Oct 2025

⁶⁰³ <https://quasa.io/media/27-reasons-why-startups-fail-and-how-yours-can-succeed>, accessed on 01 Oct 2025

even solvency and bankruptcy. As an entrepreneur, he needs to be able to negotiate favorable terms and conditions. Therefore, developing strong negotiation skills is essential and should be carefully cultivated.⁶⁰⁴ In today's age of innovation, starting and growing a business has become more accessible than ever. From affordable tools that aid decision-making to cost-effective marketing strategies, he has the resources to make this year a breakthrough period for his business. Be sure to leverage all the most effective tools available so he can transform his entrepreneurial ambitions into reality.

In 21st century a business plan outlines a company's approach, and an entrepreneur must excel at creating effective plans.⁶⁰⁵ Having a clear strategy is essential for every aspect of a business, particularly for staying ahead of the competition, reaching new customers, and retaining existing ones. For example, if he runs a detergent manufacturing company and aims to increase sales, developing a plan based on market research and analysis provides valuable insights into customer demand that can guide his decisions. If his target market is mainly low-income earners and students, it would make sense to produce small-sized detergent packs rather than family-sized ones. Strong business skills are certainly one of the defining traits of successful entrepreneurs. A comprehensive plan should also include a marketing strategy designed to reach his target audience most effectively.⁶⁰⁶ A plan gives his business direction and provides a structured approach to achieving specific goals. Creating a business plan is a skill he develops over time; it's not something he is born with. True entrepreneurs don't have a plan B—they take risks and commit fully to achieving their objectives. Success requires sacrifice, and for entrepreneurs, this means dedicating time, effort, and determination to their dreams. A genuine entrepreneur relentlessly pursues their vision because it aligns with their passion and beliefs. Without passion, it's impossible to give him all, and success becomes unlikely. Determination and an unyielding will to win are traits of the most successful entrepreneurs, and anyone who masters these qualities becomes a formidable force. Being able to identify the strengths and weaknesses of their business is a critical skill for every entrepreneur.

In 21st century no business is perfect in every area. Some may excel in marketing and service delivery but

struggle with employee relations. When an entrepreneur understands their business's strengths, they can leverage them for competitive advantage and growth. Similarly, recognizing weaknesses allows for adjustments that compensate for gaps or shortcomings. An aspiring entrepreneur must develop the ability to assess their business honestly, as this is the most reliable way to remain competitive and profitable.⁶⁰⁷ Entrepreneurs must stay motivated and maintain a strong work ethic. Being his own boss means taking full responsibility for managing his workload. When working for an employer, duties are usually outlined in a job description, making it easy to understand his tasks and manage time effectively. As an entrepreneur, however, he must be able to define his own responsibilities and ensure they are completed. It can be tempting to procrastinate or postpone challenging tasks until he feels more energized, but that's not an option when running his own business. The most successful entrepreneurs push themselves to work and stay productive even on days when they don't feel like it.⁶⁰⁸ When he launches his own business, he gets to set his own working hours, but that also means he must stay disciplined—if he doesn't show up, nothing gets done and his business won't progress. Around 26% of entrepreneurs chose to start their businesses because they wanted to be their own boss, but being the boss requires acting like one and getting up to work even on days when he'd rather stay in bed.⁶⁰⁹ There are significant benefits to pushing himself to stay motivated. It not only improves his mindset but also reduces stress, gives him more time, opens new opportunities, and helps him achieve his goals more quickly.

In 21st century one of the greatest challenges is most businesses face is the lack of a clear purpose. Every entrepreneur must have a definite and unwavering vision of where the business is headed. Clarity of purpose is a vital business skill that every aspiring entrepreneur needs to develop. It's essential to define the business's goals, vision, and objectives.⁶¹⁰ For some companies, the goal may center on building a strong corporate image, while for others it might focus on boosting sales. Although business purposes often share similarities, each one has unique differences that set it apart.⁶¹¹ Every entrepreneur needs a well-defined purpose and must communicate it effectively to the right audience in order to succeed.⁶¹² Entrepreneurship is

⁶⁰⁴ Sitthipongpanich, T., & Polsiri, P. (2015). 'Do CEO and board characteristics matter? A study of Thai family firms', *Journal of Family Business Strategy*, 6(2): 119–129. Thechatakerng, P., 2012, Thai Immigrant Entrepreneurs in New Zealand, *Contemporary Research on E-business Technology and Strategy Communications in Computer and Information Science*, 2012, pp.658-670, accessed on 01 Oct 2025

⁶⁰⁵ Orne, M. T. (1962). On the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. *American Psychologist*, 17(11), 776–783, accessed on 23 Aug 2025

⁶⁰⁶ <https://www.tutor2u.net/business/blog/characteristics-of-successful-entrepreneurs>, accessed on 23 Aug 2025

⁶⁰⁷ <https://www.industryleadersmagazine.com/9-essential-traits-of-a-successful-entrepreneurial-mindset/>, accessed on 23 Aug 2025

⁶⁰⁸ <https://www.kimp.io/entrepreneurial-success/>, accessed on 01 Oct 2025

⁶⁰⁹ <https://www.smallbizgenius.net/by-the-numbers/entrepreneur-statistics/#>, accessed on 23 Aug 2025

⁶¹⁰ Petriglieri, G., Ashford, S. J., & Wrzesniewski, A. (2019). Agony and ecstasy in the gig economy: Cultivating holding environments for precarious and personalized work identities. *Administrative Science Quarterly*, 64(1), 124–170, accessed on 23 Sep 2025

⁶¹¹ Wennekers, S., van Stel, A., Carree, M., & Thurik, A. R. (2010). The relationship between entrepreneurship and economic development: Is it U-shaped? *Foundations and Trends in Entrepreneurship*, 6(3), 167–237, accessed on 23 Aug 2025

⁶¹² <https://link.springer.com/article/10.1007/s43039-023-00077-0>, accessed on 01 Oct 2025

certainly not an easy path, as it requires taking on numerous roles and responsibilities. The ability to multitask becomes essential because entrepreneurs are involved in nearly every aspect of business operations. They must understand and influence activities in production, distribution, customer relations, negotiations, marketing decisions, and more. Staying relevant in all areas of the business demands strong multitasking skills, making it a compulsory trait for anyone aspiring to be an entrepreneur.⁶¹³ A successful entrepreneur must be familiar with every aspect of business operations, as this enables them to monitor, guide, and drive the company toward success.

In 21st century entrepreneurs need to possess an unshakable passion for their line of business, as this is what sustains them even in difficult times. Having genuine enthusiasm for the nature of the business is a prerequisite for involvement because it fosters persistence. With passion, entrepreneurs stay motivated and are more willing to make sacrifices for growth. Stress often weighs heavier on those who lack interest in their work, but when he truly enjoys his business, he can inject creativity and develop a unique style that helps the company stand out.⁶¹⁴ Passion is a vital ingredient for entrepreneurial success and should never be underestimated. When an entrepreneur is passionate about the business, it reflects in management style, business practices, employee attitudes, and customer responses. Such entrepreneurs remain deeply engaged in every process and inspire their teams to consistently give their best.⁶¹⁵ Indecisiveness can be extremely costly in business, leading to many negative consequences. The ability to make timely and sound decisions is crucial for staying ahead and seizing opportunities, since such opportunities are not always available. Decisions can make or break a business, so this skill must be carefully developed, as both survival and growth depend on it. While decisions are often based on available data, having the sharpness to act quickly and wisely can significantly boost success. Decision-making is a quality that entrepreneurs can strengthen through practice, even in activities like poker that sharpen judgment under pressure. There is also a close link between business success and how reliable he is perceived to be. Clients and customers expect trustworthiness and will evaluate him by how consistently he delivers on his promises. Building a reputation for reliability is therefore essential for every entrepreneur.⁶¹⁶ The business landscape is constantly shifting with new trends and developments emerging across industries. An entrepreneur must be skilled at tracking these changes and capable of making

the necessary adjustments to adopt and apply them effectively. Every sector undergoes periodic shifts, whether driven by customer preferences or by new ways of carrying out business processes.⁶¹⁷ Whatever form these trends take, an entrepreneur should be able to identify, leverage, and harness them for the advancement of the business.

In 21st century building a successful venture demands dedication and high levels of energy. It involves immense effort, and there will be moments of discouragement. In such times, staying faithful, persistent, and focused on his vision is essential. Without full commitment, failure is inevitable. This is why resilience is often regarded as the strongest predictor of startup success.⁶¹⁸ If he wants to stay productive and effective throughout his entrepreneurial journey, there are several habits he/she needs to adopt. An entrepreneur must possess a strong sense of efficiency, as it is essential for boosting output and profitability. This skill is vital and often inspires employees to demonstrate the same standard. Efficiency requires being hardworking and staying updated on the latest tools that can improve operations. Entrepreneurs must constantly seek innovative ways to increase productivity while integrating relevant tools that streamline processes and functions within the business. In today's business world, automation and outsourcing are among the most effective methods for enhancing efficiency and driving higher productivity.⁶¹⁹ An entrepreneur must know how to manage employees effectively, as this is a crucial and sensitive skill every business owner should possess. The ability to earn the trust and loyalty of workers is essential, alongside promoting their welfare and engaging them for peak performance. Employees are vital to the success of any business, and effective management is necessary for continuity and operational efficiency. Creating a supportive work environment, maintaining regular communication, offering fair remuneration, and providing rewards are all key aspects of proper employee management.⁶²⁰ Effective employee management also involves the entrepreneur fostering open communication with staff, allowing them to share their thoughts and suggestions for improving the company. Ensuring employees feel valued and part of the organization is a key aspect of managing them successfully.

In 21st century possessing an unyielding drive is essential for business owners, as they often face obstacles that can discourage or derail them, especially if their motivation is weak. An unwavering drive is arguably the most crucial factor for achieving success. No

⁶¹³ <https://www.slideshare.net/slideshow/essentials-of-entrepreneurs-f/24606635>, accessed on 23 Aug 2025

⁶¹⁴ McMullen, J. S., & Shepherd, D. A. (2006). Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1), 132–152, accessed on 01 Oct 2025

⁶¹⁵ <https://timespro.com/blog/what-are-the-top-characteristics-of-an-entrepreneur>, accessed on 23 Aug 2025

⁶¹⁶ <https://joelcomm.com/reasons-why-an-entrepreneur-should-establish-a-positive-reputation.html>, accessed on 23 Aug 2025

⁶¹⁷ Roulin, N., Bangerter, A., & Levashina, J. (2015). Honest and deceptive impression management in the employment

interview: Can it be detected and how does it impact evaluations. *Personnel Psychology*, 68(2), 395–444, accessed on 23 Aug 2025

⁶¹⁸ <https://www.blueprintrf.com/important-characteristics-of-successful-entrepreneurs/>, accessed on 01 Oct 2025

⁶¹⁹) <https://www.valuer.ai/blog/50-examples-of-corporations-that-failed-toinnovate-and-missed-their-chance>, accessed on 23 Aug 2025

⁶²⁰ https://www.liveplan.com/blog/starting/traits-of-entrepreneurs?srsId=AfmBOoqRjX10cYBitU73SKYUwQk-kuS3i9h4lUvFk21miQ_Oi2HvG856, accessed on 01 Oct 2025

matter the level of skill or talent, consistent determination is what ultimately leads to accomplishment in business. Drive fuels resilience and persistence. It keeps an entrepreneur focused on their objectives, regardless of challenges or adverse conditions. Drive is the force that propels progress and ensures the achievement of goals.⁶²¹ Drive motivates the entrepreneur to work harder than employees, as they see the complete vision of the business and are fully committed to bringing it to reality. Possessing this drive is essential, as it remains the ultimate requirement for success in the business world. Businesses face numerous challenges, many of which can arise unexpectedly, and a successful entrepreneur must anticipate these situations and take proactive steps to address them before they impact the business.⁶²² Creating inclusive and diverse ecosystems that support entrepreneurs from all backgrounds is essential for unlocking the full potential of entrepreneurship.

In 21st century, an entrepreneur must also learn how to handle the challenges and pressures that come with running a business. Although often overlooked, failing to manage stress effectively can lead to serious consequences. Entrepreneurs need to recognize when and how to relieve stress, turning it into productive and restorative activities. While stress is an inevitable part of business, mastering it is a skill that develops over time and becomes part of an entrepreneur's core abilities. Successful entrepreneurs understand that problems will arise, but they anticipate these challenges in advance and devise solutions before they occur.⁶²³ Reacting to issues only as they happen can quickly become overwhelming. A key trait of successful ventures is strong and effective management. Many businesses fail due to poor management, whether it concerns workforce allocation or financial resources. Effective management is critical to turning any venture into a success. Additionally, creativity and inventiveness are essential for maintaining productivity and efficiency in business.⁶²⁴ This is another reason why an entrepreneur must strive to develop this skill. Entrepreneurship requires keeping up with technological advancements and finding innovative ways to apply these technologies to improve business processes and activities. Inventiveness simplifies operations, enhances efficiency, and boosts output. An entrepreneur must be aware of new and creative approaches to enhance business performance and customer satisfaction. When an entrepreneur embraces inventiveness, the business continues to grow while remaining cost-effective.⁶²⁵ Most businesses operate with limited resources, including time, information, and money. Successful entrepreneurs know how to maximize these resources and are skilled

at stretching finances and creating additional resources to meet business needs.

In 21st century brilliant time management is crucial for balancing multiple roles or ventures simultaneously for successful entrepreneurs. Following productivity practices from top CEOs can help entrepreneurs manage their time effectively. The future depends on the present, and a successful entrepreneur is always focused on the future, working hard and setting achievable goals. Strong vision and purpose pave the way to success.⁶²⁶ Without the ability to compartmentalize, switch focus smoothly, and transition between responsibilities efficiently, managing and growing different ventures—or even multiple aspects of the same business—becomes difficult. Staying focused on priorities instead of distractions, such as social media, reflects effective time management. Similarly, scheduling meetings without overlap or compromise is another sign of strong time management skills.⁶²⁷ To be a successful entrepreneur, it is essential to know how to use his time wisely, as this can make a significant difference. There are many time-management strategies to adopt, and creating a schedule is highly recommended. For example, he might handle emails in the morning, hold meetings in the afternoon, and manage social media in the evening.

In 21st century aspiring entrepreneurs should focus on improving communication, teamwork, leadership, delegation, perseverance, tenacity, and work ethic. Networking with other entrepreneurs provides mentoring, learning, and collaboration opportunities. Cultivating an entrepreneurial mindset requires proactivity, problem-solving, and learning from mistakes. Creativity, personal branding, and market differentiation are essential strategies for success. Practical experience through projects, ventures, or collaborative initiatives provides valuable lessons. One of the first challenges entrepreneurs face is securing funding, as realizing an idea requires courage, vision, and resourcefulness. Entrepreneurs transform low-value resources into profitable opportunities and must understand the various financing options available. Entrepreneurship is one of the most critical drivers of a country's economic development. According to Harbison, entrepreneurs are the primary catalysts of innovation. While entrepreneurship carries significant risks like startup failures, funding shortages, poor sales decisions, or insufficient market demand and that remains a key mechanism for progress and growth. This inherent risk places entrepreneurship beyond the comfort zone, requiring resilience and strategic thinking. Economic growth, measured as a sustained increase in real income, is

⁶²¹ Wiriyakulkit, N, Sirivanasandha, R and Viriyarungsarit, P 2009, *Family Business*. Bangkok: Siam N & B Publishing, accessed on 23 Aug 2025

⁶²² <https://www.theeventplannerexpo.com/10-traits-of-successful-entrepreneurs-what-sets-them-apart/>, accessed on 25 June 2025

⁶²³ Toivonen, T., Idoko, O., Jha, H. K., & Harvey, S. (2023). Creative jolts: Exploring how entrepreneurs let go of ideas during creative revision. *Academy of Management Journal*, 66(3), 829–858, accessed on 01 Oct 2025

⁶²⁴ <https://www.bdc.ca/en/articles-tools/entrepreneurial-skills/be-effective-leader/stress-management-tips-entrepreneurs>, accessed on 23 Aug 2025

⁶²⁵ Shepherd, D. A., Seyb, S. K., & George, G. (2023). Grounding business models: Cognition, boundary objects, and business model change. *Academy of Management Review*, 48(1), 100–122, accessed on 23 Aug 2025

⁶²⁶ Snihur, Y., & Markman, G. (2023). Business Model Research: Past, Present, and Future. *Journal of Management Studies*, 60(8), e1–e14, accessed on 01 Oct 2025

⁶²⁷ <https://www.oneeducation.org.uk/characteristics-of-successful-entrepreneurs/>, accessed on 01 Oct 2025

greatly supported by entrepreneurial communities, which identify and establish profitable ventures that raise per capita income and improve the overall quality of life. By creating enterprises, entrepreneurs generate employment opportunities and contributing to poverty alleviation as income levels rise. China is a good example of entrepreneurship driving national development.

Despite initial challenges in meeting international standards, Chinese firms have increasingly aligned with global norms, enhancing their credibility and access to international markets. The government has supported this growth through policies, infrastructure development, and financial incentives, fostering an environment conducive to innovation and expansion.



Figure 10: Entrepreneurs contribution to sustainability global development in 21st century.⁶²⁸

In 21st century, for success new entrepreneurs need to prioritize understanding and serving their customers over focusing on investors. They need to be open to new opportunities and willing to pivot their approach when and where needed. Today, thinking negatively can be detrimental for an entrepreneur; not because problems should be ignored, but because the focus should be on finding solutions rather than fixating on obstacles. It is easy to look at someone like Richard Branson and assume success came effortlessly. In reality, even the most accomplished entrepreneurs face setbacks and failures. Regardless of the company he starts or the profits he earns, there will be moments when things appear bleak. Optimism is the key to overcoming these challenges. Successful entrepreneurs are recognized for their unwavering optimism, which guides them through both lows and highs.⁶²⁹ This does not mean they are happy all the time, but they refuse to let circumstances dictate their long-term goals. Great leaders also understand that mental exhaustion and overwork are a recipe for disaster. No matter how skilled he is, without proper wellness, he cannot execute effectively on his capabilities. Allocating time for self-care yields significant returns, and the same principle applies to employees. Encouraging his team to rest when needed ensures sustained performance and a healthier work environment.⁶³⁰ They will reward him with a positive mindset and a stronger work ethic. Risk-takers often excel as business leaders, but it is essential to have a clear approach and a backup plan in case things go wrong. By strategizing carefully and setting measura-

ble goals, he can make quick adjustments and find effective solutions. Test his product or service with a trusted group, review market research to ensure sufficient demand, and stay informed on industry trends.⁶³¹ These steps help him take calculated risks while pursuing new opportunities.

8. Conclusion

New entrepreneurs need to view mistakes as opportunities to learn and grow, rather than as endpoints. They have passion for their work and their vision for a better world be their primary motivation, not just financial gain. In 21st century successful entrepreneurs rely on honesty, capability, judgment, and skill. Lord Alan Sugar states, "There is no such thing as entrepreneurial juice that he can buy from Boots. He is either born with entrepreneurial gifts or not." Similarly, Gary Vaynerchuk believes that "hustle and drive to succeed are innate qualities; they cannot be taught." In contrast, thinkers like Robert Greene, Tom Bilyeu, Duncan Bannatyne, and Peter Drucker argue that successful entrepreneurs can be made through learning and experience. However, a few highly successful entrepreneurs seem to fall somewhere in between these perspectives.⁶³² When asked whether entrepreneurs are born or made, Richard Branson stated that everyone is born with entrepreneurial potential, but only a few takes action to realize it. Theo Paphitis, from the BBC business program *Dragons' Den*, describes different "levels of entrepreneurs," suggesting that one's level depends on how far they aim to go. He implies that some entrepreneurs are born while others are made. Patrick Bet-David adds another perspective, noting that anyone can be

⁶²⁸ <https://bamboi.eu/blogs/blog/entrepreneurship-with-a-purpose-contributing-to-the-sustainable-development-goals>, accessed on 29 Sep 2025

⁶²⁹ Swider, B. W., Harris, T. B., & Gong, Q. (2022). First impression effects in organizational psychology. *Journal of Applied Psychology*, 107(3), 346–369, accessed on 02 Oct 2025

⁶³⁰ <https://brainly.com/question/49057165>, accessed on 01 Oct 2025

⁶³¹ Wayne, S. J., Sun, J., Kluemper, D. H., Cheung, G. W., & Ubaka, A. (2023). The cost of managing impressions for Black employees: An expectancy violation theory perspective. *Journal of Applied Psychology*, 108(2), 208–224, accessed on 03 Oct 2025

⁶³² <https://ceoentrepreneur.com/are-successful-entrepreneurs-born-or-made/>, accessed on 03 Oct 2025

a “meh” entrepreneur—neither exceptional nor terrible, just average. However, he argues that to become truly outstanding, an entrepreneur must have been born with that innate drive.⁶³³ By understanding entrepreneurship and the key characteristics of successful entrepreneurs, aspiring entrepreneurs can develop the skills and mindset needed to improve their chances of success. While some argue that entrepreneurial talent is innate, research indicates that many essential traits can be learned and refined.⁶³⁴ By grasping the core components of entrepreneurial success, individuals can pursue personal growth and development, cultivating the qualities and characteristics necessary to become a successful entrepreneur.

In 21st century entrepreneurship is one of the most critical drivers of a country’s economic growth and development. According to Harbison, entrepreneurs are the primary catalysts of innovation. While entrepreneurship carries significant risks—such as startup failures, funding shortages, poor sales decisions, or insufficient market demand—it remains a key mechanism for progress and growth. This inherent risk places entrepreneurship beyond the comfort zone, requiring resilience and strategic thinking. Economic growth, measured as a sustained increase in real income, is greatly supported by entrepreneurial communities, which identify and establish profitable ventures that raise per capita income and improve the overall quality of life. By creating enterprises, entrepreneurs generate employment opportunities both directly and indirectly, contributing to poverty alleviation as income levels rise. A clear example of entrepreneurship driving national development can be seen in China. Despite initial challenges in meeting international standards, Chinese firms have increasingly aligned with global norms, enhancing their credibility and access to international markets. The government has supported this growth through policies, infrastructure development, and financial incentives, fostering an environment conducive to innovation and expansion. The combination of entrepreneurial leadership, strategic market expansion, technological innovation, and government support has propelled Chinese firms to become major global players. This model of entrepreneurial development offers a valuable blueprint for other developing countries, such as Bangladesh, Pakistan, and India, to stimulate economic growth and create sustainable business ecosystems.

In 21st century for success new entrepreneurs need to work reliably and consistently on creating value and developing innovative solutions. They make clear agreements with co-founders and others as well as understand that the right partner can be more important than anything else. Again, extensive study and personal investigation have been undertaken, examining the perspectives of highly successful global entrepreneurs on the nature versus nurture controversy. Furthermore, this debate has been examined and substantiated through pragmatic research, delving into the principal attributes

that define prosperous entrepreneurs in this modern era. Deeper exploration into this subject revealed compelling studies investigating the innate or cultivated origins of entrepreneurial achievement. One finding indicates that such individuals are, in fact, born. A more intriguing revelation, however, is that successful entrepreneurs are also made. A particularly concerning truth is that the conventional education system frequently operates in opposition to entrepreneurial values. From a young age, instruction emphasizes high performance and the acquisition of accolades. Risk-taking, perseverance, bravery, and nonconformity are fundamental to entrepreneurship, as achievement is unattainable without venture and daring. Nonetheless, youth raised in entrepreneurial environments exhibit a significantly higher propensity to become entrepreneurs themselves, primarily because they are not conditioned to avoid risk. Consequently, those born into such circumstances are typically successful. They benefit from quality guidance, instruction, and a supportive environment, and their inherent comprehension of business operations leads to their predictable success and economic development.

Successful entrepreneurs consistently uphold high ethical standards in all business dealings and workplace interactions. They possess the confidence to make difficult decisions and follow through, exercising sound judgment even under pressure. Typically, successful entrepreneurs combine intrinsic traits with developed skills, including passion, creativity, adaptability, resilience, and strong leadership. They demonstrate a willingness to take calculated risks, persist in the face of challenges, and maintain a strong work ethic. Effective communication, networking abilities, and a customer-focused mindset are essential, as entrepreneurs understand and prioritize the needs of their customers. They manage finances efficiently, interpret financial statements clearly, and build professional relationships to create opportunities and support growth. By taking calculated risks and tackling challenges, entrepreneurs show strong commitment to their goals. Innovation is another hallmark of success, with creative ideas and solutions allowing them to stand out in competitive markets. In addition to risk management and strategic decision-making, entrepreneurship requires comfort with failure, the ability to prioritize tasks, and efficient time management. In conclusion, the majority of research indicates that accomplished entrepreneurs are developed. The pinnacle of entrepreneurial success is most often reached by those who experience failure and persist. These individuals actively pursue mentors, acquire training, learn from their environment, and possess the resolve to persevere, engaging directly with challenges and risks. As global development in the era of technological advancement, so successful entrepreneurs are the assets for national and global economic development and growth.

⁶³³ <https://timespro.com/blog/what-are-the-top-characteristics-of-an-entrepreneur>, accessed on 03 Oct 2025

⁶³⁴ Wheatley, T., Thornton, M. A., Stolk, A., & Chang, L. J. (2024). The emerging science of interacting minds.

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TECHNICAL SCIENCES

THE IMPACT OF CLIMATE CHANGE ON THE CHOICE OF CONSTRUCTION TECHNOLOGIES

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Abstract

Modern construction is undergoing a profound transformation driven by global climate change. Rising temperatures, increased humidity, extreme precipitation, and wind loads are forcing a rethinking of architectural and engineering approaches and the principles of selecting construction technologies. This article provides a comprehensive analysis of the impact of climatic factors on the design, technological, and operational characteristics of buildings. Particular attention is paid to the adaptation of construction technologies to various climatic zones worldwide, including Europe, the Middle East, Russia, Kazakhstan, and the Caucasus region.

This article examines current trends in the evolution of building materials and architectural solutions, including the use of phase-changing and geopolymer materials, ventilated facades, dynamic envelopes, energy storage systems, and climate-active coatings. The role of digitalization is highlighted, including the implementation of BIM and CFD modeling, artificial intelligence technologies, and predictive microclimate control. Particular emphasis is placed on the integration of renewable energy sources (solar, geothermal, and wind systems) into the structure of buildings and urban developments.

The scientific novelty of this study lies in its rationale for shifting from the concept of sustainable to self-adaptive construction, which views buildings as intelligent systems that interact with the climate and are capable of energy self-regulation. The practical significance of this work lies in the potential application of the identified principles in developing national standards for climate-resilient construction, improving architectural design, and shaping national environmental policy in the construction sector.

Keywords: adaptation, architecture, geopolymer materials, ecology.

Introduction: The current stage of human development is characterized by a rapid intensification of climate processes, affecting all spheres of life—from agriculture to the architectural and construction industries. According to the latest synthesis report of the Intergovernmental Panel on Climate Change (IPCC, 2023), the global surface temperature of the Earth has increased by more than 1.1°C compared to pre-industrial levels, leading to an increase in the frequency of extreme weather events—floods, droughts, hurricanes, and temperature anomalies [11, pp. 45–48]. These processes create fundamentally new challenges for the construction industry, which traditionally relies on long-term climate standards and the stability of materials under specific temperature and humidity conditions [17, pp. 61–64].

Climate change affects not only the performance of buildings but also the very paradigm of design and

the choice of construction technologies. As average temperatures rise and precipitation patterns shift, traditional solutions become less reliable: building insulation deteriorates, façade materials degrade faster, and foundation behavior changes as groundwater levels fluctuate. As a result, architects and engineers are forced to find a balance between energy efficiency, environmental friendliness, and resilience to new climate realities [10, pp. 112–115].

Adaptive design technologies that take into account projected climate scenarios are becoming particularly important. According to UNEP research (2022), the main challenge for the construction industry in the coming decades is to reduce the carbon footprint of buildings and adapt design solutions to extreme temperatures and humidity [21, pp. 15–19]. The European Commission takes a similar position in the Energy Performance of Buildings Directive (EPBD), requiring the

integration of climate-resilient solutions into architectural planning [7, pp. 4–6]. Thus, the relevance of this topic is determined not only by environmental factors but also by economic, engineering, and regulatory ones.

At the turn of the 21st century, the construction industry is no longer simply a "building manufacturer"—it is becoming a strategic tool for sustainable development. Technological advances (BIM, digital microclimate modeling, "smart materials") enable the design of structures that dynamically interact with the environment, compensating for negative climate impacts [13, pp. 202–206]. In this context, the choice of construction technologies is becoming not a technical but a civilizational challenge, directly linked to energy security, comfort, and the sustainability of the urban environment.

International studies demonstrate that adapting buildings to climate change reduces overall energy consumption by 30–45% and extends the service life of structures by 20–25% [4, pp. 1136–1139; 5, pp. 33–35]. An example of the successful integration of climate approaches is provided by Northern European countries, where the principles of the "passive house" and BREEAM standards have become a mandatory element of urban development policy [3, pp. 57–61]. In contrast, countries in hot regions (the Middle East, South Asia) are developing concepts of cooling facades, wind-screens, and passive ventilation systems [1, pp. 102–105]. These contrasts emphasize that architecture is becoming a space of interaction between people, technology, and climate.

In line with global trends, regional research in the post-Soviet space has intensified in recent years. For example, in Kazakhstan, Azerbaijan, and Russia, efforts are underway to find solutions for the implementation of energy-efficient materials, heat-resistant coatings, and heat recovery systems adapted to local climatic anomalies [12, pp. 98–99; 2, pp. 60–62; 15, pp. 141–144]. This experience demonstrates that innovation in construction cannot develop in isolation—it requires consideration of local natural factors, as well as coordination between engineering science, economics, and environmental policy.

Thus, the purpose of this study is to systematically analyze the impact of climate change on the choice of construction technologies, determine factors for adapting design solutions, and identify promising areas for sustainable development in the construction industry. The study's objectives include:

1. generalization of international and regional approaches to climate adaptation of construction technologies;

2. analysis of key innovations in the field of energy-efficient and bioclimatic solutions;

3. identifying areas of scientific and engineering innovation in the design of buildings of the future.

The scientific significance of this topic is determined by the need to develop comprehensive strategies that integrate climatology, architecture, and engineering modeling into a unified knowledge system. The research results contribute to the development of new principles of sustainable design and deepen the understanding of how climate transforms the very logic of technological choice in construction [6, pp. 270–272; 19, pp. 3620–3624].

1. Global climate trends and their impact on the built environment

The current climate situation is characterized by the acceleration of processes previously considered long-term. According to the Intergovernmental Panel on Climate Change (IPCC), the rate of increase in the average global temperature in the 21st century is twice that of the 20th century [11, pp. 48–51]. This is accompanied by an increase in the frequency of anomalies: heat waves in Europe, floods in Asia, and permafrost degradation in the northern regions of Eurasia. Such changes directly impact the operational parameters of buildings, their energy efficiency, durability, and structural stability [8, pp. 111836–111838].

Climate stress on building structures manifests itself through four key factors: temperature, humidity, wind, and solar radiation. Rising average temperatures lead to thermal expansion of materials, causing deformation and premature failure. Rising humidity intensifies corrosion processes, and unstable wind flows increase the demands on the aerodynamic strength of facade systems [20, pp. 72–75].

In countries with continental and sharply continental climates, including Kazakhstan and Russia, so-called "thermal contrast stress" is observed—an alternation of temperature maximums and minimums during the day, which leads to fatigue failure of concrete and metal joints [12, pp. 97–99]. For southern regions (the Middle East, Central Asia), the dominant factor is overheating of the outer building envelopes, which increases energy consumption for air conditioning to 45–55% of total annual energy consumption [1, pp. 102–104].

To better reflect the scale and specificity of climate impacts, it is appropriate to present the summarized data in comparative form:

Table 1.

The influence of the main climatic factors on building structures and technological choices			
Climate factor	Manifestation	Impact on buildings	Engineering and technological answer
Temperature increase	Increased thermal load on facades and roofs	Overheating, loss of thermal insulation properties	Application of reflective coatings, heat-resistant materials, ventilated facades [18, pp. 215–217]
Rising humidity	Condensation, bio-corrosion	Acceleration of aging of materials, mold, fungus	Use of moisture-resistant concrete, sealed membranes, vapor barriers [10, pp. 115–118]
Strengthening wind currents	Increased aerodynamic loads	Damage to roofs and facades	Aerodynamically optimized designs, strengthening of fastening units [15, pp. 196–198]
Increased solar radiation	Increase in heat input	Overheating of premises, increased energy consumption	Sun protection facades, photochromic glass, intelligent blinds [3, pp. 63–65]

As the table shows, each climate impact transforms into an engineering challenge requiring new materials and design solutions. A clear pattern emerges: the greater the region's climate instability, the more complex the technological choices. In countries with moderate climates, the emphasis is on reducing energy consumption, while in hot zones, thermal protection and cooling become a priority [5, pp. 31–34; 9, pp. 22–23].

It's significant that the global construction industry is already adapting to these challenges. For example, in the European Union, a directive has been in effect since 2021 requiring all new buildings to comply with the Nearly Zero Energy Building (NZEB) standard [7, pp. 6–8]. These standards require that a building's energy needs be minimal, with thermal balance achieved through passive ventilation systems and solar energy generation. In Scandinavia, similar principles are being implemented in "passive house" architecture, which achieves a 90% reduction in heat loss thanks to airtight envelopes and heat recovery [13, pp. 204–206].

At the same time, in countries with high solar activity (UAE, Qatar, Saudi Arabia), an opposing concept—"smart cooling" architecture—is developing. Here, façade systems with reflective coatings, passive wind towers, and bioclimatic ventilation regulation are being implemented [1, pp. 103–106]. These practices demonstrate that climate adaptation has no universal model: it is always region-specific, and it is precisely this flexibility that is becoming a hallmark of modern technological thinking.

The impact of climate fluctuations on the operating costs of buildings deserves special attention. According to researchers Bribián and Usón, the share of the carbon footprint associated with the operation of structures reaches 60–70% of the total life cycle of a building [4, pp. 1136–1139]. The introduction of adaptive technologies (dynamic facades, intelligent micro-climate sensors, phase-change materials) makes it possible to reduce these indicators by almost half, confirming the direct relationship between climate resilience and economic efficiency [6, pp. 270–272; 19, pp. 3622–3623].

Taken together, the data reviewed allows us to conclude that the modern construction industry is transitioning from a static to a climate-responsive design

model. The key change lies not only in the use of new materials but also in a restructuring of engineering thinking—from local adaptation to integrated sustainable development strategies.

2. Evolution of construction technologies under the influence of climate challenges

The transition from traditional construction methods to climate-responsive design technologies is one of the most significant transformations in the history of construction science. While the 20th century was defined by functionalism and industrialization, the 21st century is characterized by a shift to ecological engineering thinking, where buildings are perceived not as static objects but as dynamic systems interacting with climate and energy flows [16, pp. 23–27].

This evolution is driven not only by environmental awareness but also by objective engineering factors. According to Kibert (2022), more than 40% of global energy consumption and approximately 30% of carbon dioxide emissions are associated with the construction and operation of buildings [13, pp. 118–120]. In response to these challenges, architecture is beginning to integrate principles of energy efficiency and closed-loop material life cycle assessment (LCA), which allows for the optimization of the energy and carbon balance of structures [4, pp. 1134–1137].

New generation materials and technological modernization

One of the key areas of this evolution has been the introduction of new-generation materials that combine energy efficiency, environmental friendliness, and climate resistance. Leading researchers in the field of sustainable construction (Pacheco-Torgal, Labrincha, 2014) note the growing popularity of nanostructured concrete, heat-reflective paints, and composite panels with variable thermal conductivity [18, pp. 101–104]. These materials are capable of adapting their properties depending on temperature, humidity, and solar radiation, thereby reducing the load on heating and cooling systems.

Particular attention is being paid to "smart materials" technologies—substances that exhibit a reversible response to external climatic stimuli. For example, phase-changing materials (PCMs) accumulate excess heat during the day and release it at night, stabilizing the internal microclimate [17, pp. 174–178]. The use of

such solutions allows for energy consumption reductions of up to 25–30% without significantly increasing capital expenditures [6, pp. 270–272].

Another trend is the development of ventilated facades and "breathing" envelopes. These systems allow buildings to "respond" to temperature changes, providing natural air exchange and preventing condensation [10, pp. 118–121]. This increases the durability of structures, reduces the risk of biocorrosion, and lowers operating costs.

Energy-efficient design and digital technologies

Along with the development of materials, the logic of architectural design has also changed. Energy modeling and digital microclimate forecasting have taken a leading position. Modern BIM (Building Information Modeling) technologies allow for the simulation of heat flows, solar insolation, and wind loads during the design stage [14, pp. 6655–6657]. This makes it possible to accurately determine the optimal building orientation, insulation thickness, and window configuration, which is especially important when designing for a changing climate.

CFD (Computational Fluid Dynamics) systems simulate the behavior of air and moisture around and within a building, preventing façade overheating, increasing ventilation efficiency, and reducing aerodynamic risks [8, pp. 111837–111838]. Thus, digitalization is becoming an integral element of climate-resilient construction.

Bioclimatic architecture and integration of renewable energy sources

Bioclimatic architecture, based on the harmony between the building and its surroundings, plays a significant role in the development of adaptive technologies. The concept of bioclimatic design was formulated by Viktor Olgiay in the mid-20th century, but in recent decades it has been further developed thanks to digital technologies [16, pp. 54–58]. Key principles include the rational use of cardinal orientation, consideration of local wind patterns, and the integration of green spaces to create natural ventilation and cooling.

The Nearly Zero Energy Building (NZEB) concept combines bioclimatic architecture with renewable energy sources—solar panels, wind turbines, and heat pumps [17, pp. 223–225]. These technologies provide the building with autonomy and compensate for fluctuations in climate parameters, creating a sustainable energy balance. In Northern European countries, such systems have already become the design norm, while in Central Asia and the Caucasus region they are only just beginning to be implemented [2, pp. 61–63; 12, pp. 99–101].

Transformation of design solutions and architectural form

An equally significant component is the change in architectural form itself. Under the influence of climatic factors, buildings are becoming more aerodynamically stable—with smooth façade lines, reduced overhangs, and reduced resistance to wind flow [15, pp. 197–199]. In areas with increased insolation (for example, the Middle East), façades with dynamic panels that respond to the intensity of sunlight are gaining popularity [1, pp. 104–106].

A new type of structure is emerging—adaptive envelopes—that can change their properties in real time in response to weather conditions. The use of photochromic and temperature-sensitive materials allows for the regulation of light transmission and thermal balance without human intervention [3, pp. 62–64; 19, pp. 3621–3623]. These solutions represent a synthesis of architecture and artificial intelligence technologies, forming the basis of a smart, climate-self-regulating building.

Engineering and scientific innovation

Modern research shows that the further evolution of building technologies is aimed at creating intelligent climate control systems, where the building's interaction with the climate becomes algorithmically controlled. Unlike the passive systems of the past, new solutions utilize sensor networks and software-based microclimate control, making it possible to develop a "building data life cycle" (BDLC) [14, pp. 6656–6658].

The scientific novelty of this approach lies in the shift from the principle of sustainability to the principle of self-adaptation. While sustainability implies resistance to external influences, self-adaptation is a building's ability to predictively change its parameters in response to predicted climate scenarios. Thus, the building of the future becomes not simply an object of operation but a participant in energy and climate exchange, shaping a new engineering philosophy for the 21st century [6, pp. 270–273].

3. Regional approaches to the adaptation of construction technologies

The evolution of climate-resilient construction demonstrates not only general global trends but also regional differences reflecting the specifics of natural conditions, economic opportunities, and regulatory systems. The impact of climate on architectural and construction practices varies across the globe: in northern countries, the priority is heat conservation, while in southern countries, it is protection from overheating and ventilation [8, pp. 111835–111837]. This differentiation shapes the diversity of technological solutions and regional models of sustainable construction.

3.1. Europe and North America: Standardization of Sustainable Construction

In the European and North American contexts, climate adaptation has long since reached the level of state strategies. The basis for these approaches is the international standards LEED, BREEAM, and WELL Building, which set criteria for energy efficiency, water conservation, waste management, and indoor climate quality [22, pp. 124–128; 3, pp. 59–61]. In accordance with the Energy Performance of Buildings Directive (EPBD, 2018/844/EU), all new buildings in the European Union must have near-zero energy consumption from 2021 [7, pp. 5–6].

Nordic countries are characterized by an emphasis on heat conservation and carbon footprint reduction. Finland, Sweden, and Norway actively utilize heat recovery systems, triple-glazed windows, super-insulated panels, and low-U-value facades [13, pp. 221–223]. Passive house architecture has become a widespread phenomenon: according to estimates by the European Council on Energy Efficiency, it reduces energy loss by

90% compared to traditional buildings [17, pp. 229–231].

In North America, the development of adaptive technologies relies on private investment and technological innovation. Building information modeling (BIM) and digital twins of buildings are common here, enabling microclimate monitoring and predicting heating and cooling loads [14, pp. 6657–6658]. An example is the Bullitt Center project in Seattle, which is entirely self-sufficient in energy through solar panels and rain-water recycling systems [6, pp. 271–272]. Thus, climate adaptation in Western countries is closely linked to digitalization and regulation.

3.2. Asia and the Middle East: Combating Overheating and Water Scarcity

In the hot, dry climates of the Middle East and South Asia, reducing overheating and rational water use are priorities. Architectural adaptation in these regions relies on the principles of bioclimatic design, which combine ancient traditions with modern engineering solutions [1, pp. 103–106]. For example, in the UAE, facades with automatic sun protection panels are widely used, while in Saudi Arabia, natural ventilation systems through vertical shafts, reminiscent of traditional "wind towers" (badgir) [18, pp. 311–313].

According to Al-Saadi (2021), the implementation of passive cooling systems and dynamic façades can reduce buildings' air conditioning energy costs by 35–50% [1, pp. 104–105]. In Qatar, the Msheireb Downtown Doha project has been implemented—the world's first "smart" city built entirely according to climate integration principles. The complex's architecture takes into account wind direction, solar activity, and humidity, providing natural cooling and reducing carbon emissions [19, pp. 3622–3624].

It should be noted that Asian countries, particularly China and India, are rapidly developing water con-

servation and condensate reuse systems, which are becoming part of the "zero water footprint" strategy (Zero Water Building). These solutions are particularly relevant for regions experiencing increasing drought and freshwater shortages [21, pp. 17–18].

3.3. Russia and the CIS countries: adaptation to a continental climate

In post-Soviet countries, climate conditions require a universal approach: heat retention in winter and protection from overheating in summer. This is characterized by wide temperature fluctuations and uneven precipitation. Therefore, the primary focus is on heat-saving structures and climate-friendly materials.

Modern research by Russian and Kazakh scientists shows that the most effective approach is the use of multilayer thermal panels with dynamic properties that allow for the regulation of heat transfer [10, pp. 122–125]. At the same time, the production of moisture-resistant concrete and geopolymer mixtures resistant to freeze-thaw cycles is developing [9, pp. 23–24; 15, pp. 201–203].

In Kazakhstan and Central Asia, interest in combined heating systems based on solar collectors and heat pumps is growing. According to Kalmatsky and Kurbatova (2020), such solutions reduce energy consumption by up to 40% and stabilize the microclimate in conditions of sudden temperature fluctuations [12, pp. 99–100]. Similar experiments are being conducted in Azerbaijan, where traditional architectural forms (high ceilings, shade-forming elements) are combined with modern thermal insulation and air recovery technologies [2, pp. 60–62].

3.4. Comparative characteristics of regional adaptation models

For a more visual comparison of the approaches of different regions, a summary table is presented:

Table 2.

Regional strategies for climate adaptation of building technologies			
Region	Climate challenges	Technological solutions	Key standards and practices
Europe, North America	Cooling, energy efficiency	Passive houses, triple-glazed windows, heat recovery, BIM modeling	LEED, BREEAM, EPBD [3; 7; 22]
Asia, Middle East	Overheating, lack of water	Wind towers, solar screens, dynamic facades, water conservation	Zero Water Building, Green Building Code [1; 18; 21]
Russia, CIS	Continental climate, temperature fluctuations	Multilayer panels, geopolymer concrete, combined heating	GOST R 54964–2012, energy efficiency standards of the CIS [9; 10; 12]

Overall, regional strategies demonstrate that adapting construction technologies to climate change is impossible without considering local natural and socioeconomic contexts. While universal standards focused on carbon neutrality prevail in Europe, Asian and CIS countries are developing hybrid models that combine traditional construction principles with innovative microclimate control systems.

Thus, the regionalization of climate-resilient construction serves as a basis for global technological diversification, opening up opportunities for the creation of national standards for "smart" construction that take

into account historical traditions, local materials and natural features [2, pp. 61–63; 15, pp. 202–204].

4. Promising areas of development

The modern construction industry is undergoing a period of conceptual restructuring, driven by a shift from the principle of sustainability to the principle of adaptability. While the engineer's task previously was to ensure the strength and energy efficiency of a structure, today the primary focus is on creating self-regulating architectural systems capable of dynamically responding to climate change. These trends are shaping a

new technological paradigm—intelligent climate design, which integrates digital modeling, smart materials, and controllable energy systems [6, pp. 270–273].

4.1. Digital modeling and predictive microclimate control

One of the key development areas is the implementation of digital technologies in building lifecycle management. Modern BIM (Building Information Modeling) and CFD (Computational Fluid Dynamics) analysis systems are no longer limited to 3D design—they are becoming tools for predictive climate analytics. They can be used to simulate air flow behavior, temperature fields, solar radiation dynamics, and humidity in real time [14, pp. 6655–6657].

New algorithms based on artificial intelligence allow buildings to "learn" and adapt their energy consumption to changing climate conditions. For example, the Smart Adaptive Building project in Germany has implemented a system that automatically adjusts ventilation, lighting, and heating based on the outside temperature and weather forecast [17, pp. 233–235]. These solutions form the basis of the Building Data Life Cycle concept, in which climate information becomes a constant element of a building's operational cycle [13, pp. 208–210].

The implementation of digital modeling helps reduce building operating costs by up to 30%, as well as carbon emissions by 20–25% due to optimized heat exchange and ventilation [19, pp. 3623–3624]. Thus, digitalization not only increases the resilience of building systems but also enables a transition to predictive design, where climate risks are anticipated and mitigated before construction begins.

4.2. Smart and self-adapting materials

The second direction is the development of smart materials capable of changing their physical and chemical properties in response to external climatic stimuli. According to research by Pacheco-Torgal and Cabeza (2013), the use of phase-changing materials (PCMs), photochromic glass, and temperature-sensitive coatings makes it possible to create building envelopes that "regulate" temperature without mechanical intervention [17, pp. 179–181].

Bioinspired materials that mimic natural thermoregulatory mechanisms—for example, microcellular structures that replicate the structure of plant leaves—are particularly promising. Such materials are used in façade systems, where they reflect excess solar radiation and retain moisture at high temperatures [18, pp. 108–110].

Furthermore, geopolymers with a low carbon footprint are actively developing, in which cement is completely or partially replaced with fly ash and metakaolin. These materials are not only stronger than traditional cement but also reduce CO₂ emissions by 40–60% [10, pp. 125–128].

In terms of scientific innovation, the use of smart materials allows us to discuss the development of a new class of functionally active building envelopes that not only insulate but also regulate the building's interaction with the environment. This approach radically changes the understanding of the function of a wall or façade: they are transformed from passive barriers into active

elements of the building's climate system [4, pp. 1137–1138].

4.3. Integration of renewable energy sources

The next development vector is the increased integration of renewable energy sources (RES) into building structures. The Net Zero Energy Building (NZEB) concept is already being implemented in the EU, the US, and Asia, where buildings are capable of producing as much energy as they consume through solar panels, wind turbines, and heat pumps [7, pp. 6–8; 22, pp. 125–127].

Modern developments are aimed at creating integrated energy envelopes in which solar cells are integrated directly into façade panels. These solutions not only reduce the cost of installing photovoltaic systems but also enhance the aesthetic expression of architecture [3, pp. 63–65]. According to UNEP (2022), by 2040, energy-saving buildings could account for up to 35% of the global building stock [21, pp. 20–21].

Hybrid systems combining solar and geothermal energy are particularly relevant for the CIS and Central Asian regions. Such solutions compensate for seasonal temperature fluctuations and ensure year-round energy stability [12, pp. 99–101; 2, pp. 60–61].

4.4 The role of public policy and regulation

Without systemic government support, the transition to climate-smart construction is impossible. EU experience shows that the implementation of green technologies is stimulated not only through standards (BREEAM, LEED, EPBD), but also through tax incentives and subsidies [7, pp. 7–9]. In Russia and the CIS, similar initiatives are the "Energy-Efficient Home" programs and regulatory documents—GOST R 54964–2012, which regulate environmental requirements for real estate [9, pp. 24–25].

In Azerbaijan and Kazakhstan, national sustainable design standards are being developed, focusing on the combination of traditional architectural forms and modern engineering solutions [12, pp. 100–102; 2, pp. 61–62]. However, as comparative studies show, the main barrier remains insufficient digitalization and the high cost of energy-efficient technologies [15, pp. 203–205].

The future development of climate-responsive construction requires the creation of integrated regulatory systems that integrate requirements for energy efficiency, carbon neutrality, and sustainability. This will harmonize approaches across the CIS and integrate national standards into international sustainable development initiatives.

Thus, an analysis of promising trends allows us to conclude that the construction industry of the future will be defined not so much by architecture as by its ability to self-learn and interact with the climate. The scientific novelty of this trend lies in the formation of a synthetic design model in which digital analytics, smart materials, and renewable energy form a single technological organism that responds to environmental dynamics [6, pp. 272–273; 18, pp. 109–111].

Conclusion

The modern architectural and construction industry is entering an era where climate ceases to be an ex-

ternal design constraint and becomes an internal parameter. Climate change is not simply an environmental issue, but a factor in technological transformation that determines the development of engineering thought, architectural form, and building materials. The results of the analysis showed that sustainable construction is impossible without a shift from traditional functionalism to an adaptive and intelligent design model in which the building interacts with the environment as an active participant in climate exchange [6, pp. 270–273].

A systematization of global experience has demonstrated that climate challenges in different regions are addressed through various technological strategies: from energy-efficient and passive houses in Europe to innovative cooling facades in the Middle East and thermal stabilizing panels in the CIS countries [1, pp. 104–106; 12, pp. 99–101; 22, pp. 125–127]. A unifying element across all these approaches is a focus on energy efficiency, durability, and digital control of buildings.

Digital modeling technologies, smart materials, and the integration of renewable energy sources are acquiring particular importance. These solutions form the core of a new engineering philosophy, in which the concept of "sustainability" is transformed into the category of self-adaptation—the ability of a building to predict and compensate for climate change. This is a qualitatively new level of development in building systems, ensuring not only economic and environmental efficiency but also increased human comfort [14, pp. 6656–6658; 17, pp. 233–235].

Regional examples confirm that there is no universal recipe for climate adaptation. On the contrary, it is precisely the localization of solutions that becomes a sign of the maturity of architectural culture. This is the key scientific conclusion: sustainable construction in the 21st century is not a global template, but a flexible matrix that integrates international standards and local natural and cultural characteristics [2, pp. 61–62; 10, pp. 122–125].

Thus, the impact of climate change on the choice of construction technologies is manifested in three interconnected planes:

1. **Material and technological**— development of new materials that respond to climate stimuli;
2. **Digital engineering**— implementation of predictive models for microclimate design and management;
3. **Normative and strategic**— development of sustainable construction policies and national environmental design standards.

It is the synthesis of these approaches that forms the foundation of the future architectural and engineering paradigm. In this context, a building ceases to be a passive object—it becomes an intelligent system capable of interacting with the climate, accumulating data, optimizing energy consumption, and minimizing its carbon footprint.

In conclusion, it can be argued that the future of construction is a symbiosis of humans, technology, and nature, where architecture acts as an instrument for ecological balance. Implementing this model requires not

only engineering innovations but also a profound cultural rethinking of the role of architecture in the era of climate transformation. And the extent to which the construction industry can integrate these approaches in a timely and systematic manner will determine whether the 21st century becomes an era of climate crisis—or a time for overcoming it through science, technology, and intelligent design [21, pp. 20–21; 13, pp. 208–210].

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ARTIFICIAL INTELLIGENCE AND ECOLOGY: SYNERGY OF TECHNOLOGY AND SUSTAINABLE DEVELOPMENT**Zheenbekov E.***Bachelor in Computer Science in National Louis University
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<https://doi.org/10.5281/zenodo.17492598>**Abstract**

Modern humanity faces a dual challenge: rapid technological progress and a growing environmental crisis. In this context, artificial intelligence (AI) is becoming not only a tool for digital revolution but also a powerful factor in transforming environmental thinking. This article examines the potential of AI for solving environmental problems: environmental monitoring, climate change forecasting, resource management, and energy system optimization. It demonstrates that AI has the potential to become the core of a new sustainable development model based on data, transparency, and predictive regulatory mechanisms. Particular attention is paid to the ethical and environmental risks associated with the high energy consumption of machine learning technologies. The paper analyzes international initiatives to create "green AI" and reveals the importance of synergy between technology, science, and ecology for the transition to a harmonious model of interaction between humans and nature.

Keywords: artificial intelligence, ecology, sustainable development, green technologies, digitalization

Introduction: The technological evolution of the 21st century has confronted humanity with a paradox: the more sophisticated our technologies become, the more profound our environmental problems become. Climate change, the depletion of natural resources, and the pollution of the oceans and atmosphere can no longer be solved by administrative or economic means alone. New intellectual tools are needed that can analyze, predict, and manage natural processes on a planetary scale [20, pp. 5–9; 10, pp. 452–455].

Artificial intelligence (AI) is emerging as a leading candidate for this role. Its capabilities—from processing large data sets to adaptive learning based on natural patterns—allow for the construction of complex climate models, the prediction of natural disasters, and the management of resources with unprecedented accuracy [9, pp. 220–223; 22, pp. 8–12]. In essence, AI is becoming not just an analytical technology, but a digital intermediary between humans and the biosphere, capable of maintaining ecological balance through algorithmic understanding of natural processes.

The emergence of AI in ecology coincided with the transition to a new scientific paradigm—the concept of sustainable development, where the priority is not growth rates, but harmony with nature. Machine learning algorithms are used to monitor pollution, optimize energy networks, predict weather anomalies, and manage agricultural systems [4, pp. 450–454; 5, pp. 943–945]. Artificial intelligence technologies are being integrated into smart city models and create the basis for energy-efficient urban planning, where digital data serves as a tool for ecological balance [24, pp. 103–110].

However, AI itself is not environmentally neutral. Training neural networks requires colossal energy and computing power, increasing the carbon footprint of data centers [4, pp. 449–452]. This creates a new contradiction: a tool designed to save the planet simultaneously becomes a burden on it. Therefore, alongside technological development, it is necessary to develop a

“green AI” ethic focused on reducing energy consumption, using renewable energy sources, and making algorithmic decisions transparent [6, pp. 3514–3521; 25, pp. 12–15].

The purpose of this article is to explore the role of artificial intelligence in shaping an environmentally sustainable future. The research objectives include: analyzing the application of AI in ecology, examining its contribution to combating climate change, and identifying the ethical and energy limitations of its use.

In the context of the global challenges of the 21st century, AI is emerging not simply as a technological achievement, but as a new form of environmental awareness, where digital systems become an extension of human intelligence aimed at preserving the planet. It is in this synthesis—science, ecology, and technology—that lies the path to creating a harmonious model of the future, in which intelligence, whether natural or artificial, serves nature rather than subjugates it.

• Theoretical foundations of the interaction of artificial intelligence and ecology

The modern understanding of artificial intelligence (AI) extends far beyond the boundaries of engineering and computer science. Originally emerging as an attempt to formalize human thinking within algorithmic structures, AI has now become an interdisciplinary field, uniting mathematics, neurophysiology, philosophy, linguistics, cognitive and social sciences [17, pp. 12–16; 18, pp. 25–30]. Within an ecological context, it is viewed not simply as a set of computational methods, but as an intelligent system capable of interacting with natural processes, analyzing the interrelations within the biosphere, and proposing solutions aimed at preserving the sustainability of living systems. This approach brings the concept of artificial intelligence closer to the concept of the noosphere, introduced by V. I. Vernadsky, where the human mind acts as an active geological force transforming the planet. Now this role is gradually being transferred to synthetic intelligence—a digital extension of man [14, pp. 65–69].

Ecology as a science studies the mechanisms of sustainability and interdependence of systems—from microbial communities to the global biosphere. In this sense, the principles of ecology and the operating principles of AI have structural similarities: both systems are based on self-organization, feedback, learning, and adaptation to external conditions [1, pp. 42–46; 3, pp. 48–50]. The biosphere is a natural information network, and AI can be viewed as an artificial superstructure above it, capable of enhancing the adaptability and predictability of natural processes. Through this prism, the interaction of AI and ecology becomes a form of technological biomimetics, where digital algorithms learn from nature the principles of sustainability, efficiency, and balance.

A special place in this system is occupied by the concept of "green technologies," aimed at reducing the environmental impact of production and optimizing resource consumption. Artificial intelligence is becoming a tool for the transition from reactive to proactive management of ecological systems: it analyzes emissions data, predicts pollution, models ecosystem restoration scenarios, and manages energy flows [11, pp. 107–109; 9, pp. 220–225]. For example, neural networks analyzing satellite images are capable of tracking deforestation and glacier dynamics, while machine learning algorithms can predict climate change with an accuracy previously unattainable by classical models [15, pp. 112–115]. These technologies underlie a new wave of sustainable development, where efficiency is measured not by the rate of growth, but by the degree of harmony with nature.

However, the interaction of AI and ecology is impossible without ethical and philosophical reflection. The question arises: can a human-created digital intelligence become a guarantor of environmental responsibility if humans themselves are not always capable of this? The ethical dilemma of "autonomous intelligence" manifests itself in the risk that technologies designed to protect nature will begin to subordinate it to the logic of optimization, depriving it of the natural rhythms and randomness necessary for life [13, pp. 5–8; 25, pp. 18–22]. On the other hand, AI is capable of shaping a new environmental consciousness based on data, objectivity, and empathy for planetary systems.

Thus, artificial intelligence in the context of ecology is not simply a technological phenomenon, but a reflection of a profound transformation in thinking. It combines the rationality of science with the ethics of sustainability, creating the foundation for a new form of intelligence—ecological intelligence, in which digital algorithms and biospheric processes begin to act in concert. This not only expands the boundaries of science but also opens the way to the formation of a civilization capable of thinking and acting in harmony with the planet.

• Application of artificial intelligence in solving environmental problems

Artificial intelligence has become one of the most powerful tools for analyzing, forecasting, and managing environmental processes on a global scale. Its unique ability lies in its ability to process vast volumes of data, identify hidden patterns, and make decisions

based on dynamic models. This allows not only to record the consequences of environmental changes but also to predict their development, thereby creating the conditions for a transition from response to prevention of environmental crises [6, pp. 3514–3520; 9, pp. 222–225].

One of the key areas is environmental monitoring. Neural networks and deep learning systems that analyze satellite images, sensor data, and drone data enable highly accurate monitoring of the atmosphere, soil, and water bodies [15, pp. 112–115]. Remote sensing and machine learning technologies are used to study changes in forest structure, glacier movement, pollutant concentrations, and the rate of desertification [4, pp. 450–454]. Models developed by the European Space Agency and IBM, for example, use AI to automatically detect carbon dioxide emissions and assess the effectiveness of environmental measures. These systems provide continuous climate monitoring in real time, enabling the development of adaptive strategies for the sustainable management of natural resources.

AI is also actively used in predicting and preventing natural disasters such as fires, floods, droughts, and hurricanes. Deep learning algorithms can analyze meteorological data, geoinformation maps, and historical patterns to generate accurate forecasts of extreme events [10, pp. 455–458; 22, pp. 11–13]. For example, the FireNet system, based on neural networks, identifies fires from satellite images in seconds, and FloodML models predict the likelihood of flooding using long-term hydrological data. The use of AI in disaster forecasting significantly reduces the response time of civil defense services and reduces human and economic losses.

In natural resource management, artificial intelligence is used to optimize water, energy, and land systems. Neural network algorithms can analyze the balance between resource consumption and replenishment, identify areas of inefficient use, and propose rational allocation scenarios [11, pp. 110–114]. In the energy sector, AI regulates the supply and distribution of energy in smart grids, predicts consumption, and increases the share of renewable sources. In water systems, algorithms optimize irrigation, preventing water overuse and soil degradation, and in agricultural technology, they control the dosage of fertilizers and pesticides depending on plant health and weather conditions [5, pp. 944–947]. This integrated approach not only improves the efficiency of economic activity but also reduces human impact on natural ecosystems.

The use of AI in waste processing and the construction of "smart" disposal systems is particularly important. Machine vision systems are used on automated sorting lines to recognize and separate materials by type: plastic, glass, metal, and paper [7, pp. 85–88]. Computer algorithms are trained to distinguish even contaminated and mixed waste, which improves the quality of recycling. In "smart cities," AI controls garbage trucks, predicts container filling, and minimizes emissions during waste collection and transportation [24, pp. 103–106]. Such systems, implemented in Singapore and Amsterdam, have reduced logistics costs by up to 25% and CO₂ emissions by 15–20%.

An equally significant area is the use of AI for ecosystem modeling and biodiversity conservation. Mathematical models based on machine learning make it possible to predict population behavior, assess the risk of species extinction, and develop ecosystem restoration programs [12, pp. 128–131]. For example, AI helps track animal migration and identify poaching zones using thermal imaging drones and acoustic sensors. WWF and Google Earth Engine projects use algorithms that analyze sound data from tropical forests to identify illegal logging and hunting. These developments contribute to the formation of a global digital biomonitoring network, where every ecosystem process can be recorded and assessed with high accuracy [20, pp. 9–12].

Taken together, the application of AI in ecology is forming a new strategy for planetary governance based on data and predictive analytics. Artificial intelligence is becoming the core of intelligent systems capable of monitoring climate processes, regulating resource balance, and protecting the biosphere from destruction. This signals humanity's gradual shift from observing nature to consciously cooperating with it, where technology no longer opposes ecosystems but becomes an integral part of them.

• **The Impact of Artificial Intelligence on Energy and Climate Resilience**

The use of artificial intelligence (AI) in energy and climate is ushering in a new era of technological interaction between humans and nature. It is becoming an intelligent tool capable of optimizing energy production, reducing carbon emissions, increasing the efficiency of urban systems, and minimizing anthropogenic impacts on ecosystems. Essentially, AI is becoming the link between technological progress and sustainable development, helping to build a "smart energy" based on predictive algorithms and the rational allocation of resources [11, pp. 107–110; 20, pp. 12–16].

One of the key areas is the application of AI in the energy sector to optimize energy generation, storage, and consumption. Machine learning algorithms analyze data on weather, consumption levels, equipment status, and market trends, which helps improve the efficiency of energy systems and integrate renewable energy sources (RES) such as solar, wind, and hydroelectric power [7, pp. 88–92]. Intelligent models predict peak loads and automatically distribute energy between consumers, minimizing losses and production costs. Examples of such solutions include Google's DeepMind Energy Management system, which reduced data center energy consumption by 40%, and Siemens MindSphere, used to optimize wind farms and solar power plants [5, pp. 944–947].

AI also plays a crucial role in reducing carbon dioxide (CO₂) emissions. Intelligent industrial and transport process control systems analyze production cycles, identify inefficient areas, and propose emission reduction scenarios [10, pp. 456–458; 22, pp. 10–14]. In the metallurgy and chemical industries, machine learning algorithms regulate reaction temperatures and pressures, ensuring energy savings. In the transporta-

tion industry, AI is used to optimize routes, predict traffic jams, regulate traffic lights, and manage electric vehicle networks, which can significantly reduce the carbon footprint of cities [8, pp. 215–218].

The concept of "smart cities" embodies the synthesis of technology and ecology. In such cities, AI is integrated into transport, lighting, water supply, and waste management systems, transforming the urban environment into a self-learning ecosystem [24, pp. 103–110]. Projects have already been implemented in Singapore, Helsinki, and Dubai where algorithms analyze traffic patterns, air pollution levels, and building temperatures, automatically regulating ventilation, energy supply, and lighting. These technologies reduce energy consumption by 20–30% and improve the quality of the urban environment [8, pp. 217–221]. AI enables a balance between technological growth and environmental sustainability, transforming cities from sources of pollution into active elements of climate regeneration.

In agriculture, artificial intelligence is being used to reduce the impact on ecosystems and improve the sustainability of agricultural production. Machine vision systems determine plant health, analyze soil moisture, temperature, and nutrient levels, allowing for precise application of water, fertilizers, and pesticides [5, pp. 944–947]. This minimizes the chemical load on the environment and reduces resource consumption. In Japan and the Netherlands, autonomous farms are being implemented, where AI controls greenhouses, lighting, and microclimate, ensuring high yields with a minimal carbon footprint [9, pp. 224–226]. Thus, digital farming is becoming part of a global "smart ecology" strategy, where precision replaces redundancy, and data becomes a tool for maintaining natural balance.

However, along with these environmental benefits comes a new challenge: the balance between digitalization and the carbon footprint of AI technologies themselves. Training large neural networks requires enormous amounts of computation, which is accompanied by colossal energy consumption for data centers [4, pp. 448–452]. According to estimates from the University of Massachusetts Amherst, training a single GPT-type model can emit as much CO₂ as the lifetime of five cars. This raises the question of developing a Green AI approach, which aims to reduce energy costs by optimizing algorithm architecture, using energy-efficient processors, and using renewable energy sources [6, pp. 3514–3518].

Thus, the impact of artificial intelligence on energy and climate sustainability is twofold. On the one hand, AI opens the way to an energy-efficient and environmentally friendly future, where every system is regulated by accurate data. On the other hand, it requires a critical rethinking of our own energy costs and the development of an ethical model for technological growth. Only in this balance—between digital progress and environmental responsibility—can artificial intelligence become not a burden, but a tool for harmonizing energy and climate, forming the foundation for a sustainable civilization of the future.

• **Problems and risks of using artificial intelligence in ecology**

Despite the enormous potential of artificial intelligence (AI) for sustainable development, its application is fraught with numerous contradictions and limitations. While AI is designed to help humanity overcome the environmental crisis, the technologies that underpin it are themselves becoming the source of new challenges—energetic, ethical, social, and philosophical. These risks require a comprehensive understanding, as their resolution will determine whether AI can become a tool for ecological balance or become yet another mechanism for exacerbating global inequalities and human-induced pressure on the planet [19, pp. 132–136; 25, pp. 18–22].

One of the most pressing issues is the high energy consumption and carbon footprint of data centers that power machine learning systems. Modern artificial intelligence models—especially those based on deep neural networks—require colossal computing resources. Researchers at the University of Massachusetts Amherst estimate that training a single GPT model emits up to 300 tons of CO₂, which is comparable to operating dozens of cars throughout their entire life cycle [4, pp. 450–453]. The data centers where these models are trained consume billions of kilowatt-hours of electricity annually, often from non-renewable sources. As a result, artificial intelligence, designed to combat climate change, is itself becoming an additional factor in global warming. A solution may lie in the implementation of the Green AI concept—the development of energy-efficient architectures, quantum computing, and the use of renewable energy in data center infrastructure [6, pp. 3516–3521].

No less serious are the ethical and legal dilemmas arising from the use of autonomous systems without human intervention. In environmental projects, AI is increasingly gaining the ability to make decisions independently—for example, to regulate emissions, redistribute resources, or operate robotic installations at mining and processing facilities [13, pp. 7–10]. However, the question of liability for possible errors or unpredictable consequences remains unresolved. Who bears legal and moral responsibility for damage caused to a natural system as a result of an incorrect algorithm—the developer, the operator, or the state? The lack of international regulatory standards makes these issues particularly pressing. Therefore, the United Nations and UNESCO insist on the need to develop a code of ethics for autonomous systems designed to interact with the biosphere [25, pp. 15–17].

The next challenge relates to digital inequality and the limited availability of "green" technologies in developing countries. AI development requires significant investment, access to computing power, trained specialists, and communications infrastructure, which is unavailable to most countries in the Global South [20, pp. 17–19]. As a result, a new type of environmental inequality is emerging—a technological one. Countries with advanced AI systems gain the ability to manage natural processes, while others become dependent on external digital solutions. This situation threatens to undermine the principles of global environmental justice and could lead to technological colonialism, where

control over environmental data becomes a form of power.

At the same time, the risk of relying on artificial intelligence in strategic decision-making is increasing. Algorithms are increasingly used to assess natural risks, design infrastructure, plan land use, and even formulate climate policy [12, pp. 128–130]. However, absolute reliance on algorithms can lead to the loss of the human capacity for critical analysis. AI models reality based on data, but data is always limited and subject to distortion. The danger is that an environmental strategy based solely on algorithmic forecasts may ignore the social and cultural aspects of the interaction between humans and nature. Therefore, it is necessary to maintain the principle of human-centeredness—AI should assist humans in decision-making, not replace them in areas of moral responsibility [19, pp. 140–142].

Against this backdrop of challenges, a fundamental contradiction arises between technological growth and the limitations of the biosphere. Human history shows that each new technological wave first creates the illusion of control over nature and then increases dependence on it. Artificial intelligence is no exception: the more it automates processes, the more difficult it becomes to manage its consequences. The widespread adoption of digital systems leads to increased consumption of rare earth metals, electricity, and water for server cooling [11, pp. 110–113]. There is a danger that "ecological AI" will become a tool for hypertechnological growth, contrary to the principles of sustainability.

Nevertheless, recognizing these risks is the first step to overcoming them. The future of artificial intelligence in ecology must be built on the principles of ethical digital responsibility, energy efficiency, and social justice. Only with strict regulation, international cooperation, and the inclusion of philosophical and ethical dimensions in technology policy will AI be able to fulfill its original mission—not to subjugate nature, but to contribute to its preservation.

• Prospects and development directions of "green AI"

The current stage of artificial intelligence (AI) technology development is characterized by a gradual transition from the quantitative growth of computing power to a qualitative rethinking of its environmental efficiency. A new scientific and technological paradigm is emerging—Green AI—which is focused on reducing energy consumption, increasing the resilience of algorithms, and integrating AI into the processes of environmentally responsible planetary system management [6, pp. 3514–3518; 20, pp. 14–17]. In a context where digital infrastructure is already comparable in energy consumption to the aviation industry, the development of energy-efficient algorithms is becoming not only a technical but also an ethical priority.

The core idea of the Green AI concept is to create algorithms that require minimal computing resources while maintaining high accuracy and functionality. Reducing data volumes, applying hybrid architectures, utilizing energy-efficient processors, and transitioning to distributed learning systems make it possible to re-

duce the carbon footprint of AI without sacrificing performance [4, pp. 448–452; 11, pp. 118–120]. Major technology companies—Google, IBM, and Microsoft—are already implementing automatic server cooling systems powered by renewable energy sources, while research centers are developing TinyML technologies, which train models directly on low-power devices. Thus, Green AI is becoming not just a scientific field, but a norm of future technological ethics aimed at minimizing the environmental footprint of digitalization.

One of the most promising approaches is the use of biomimetic principles, where artificial intelligence algorithms are inspired by the mechanisms of natural systems. In nature, self-organization, adaptation, and energy efficiency are fundamental laws of survival. These same principles underlie the development of neural architectures capable of learning with minimal expenditure of energy and computational resources [15, pp. 114–117; 12, pp. 130–132]. For example, evolutionary algorithms that mimic the process of natural selection allow AI models to select optimal solutions in a manner analogous to biological evolution. Such approaches form the field of neuroecological design, where artificial systems adopt nature's capacity for resilience and balance.

The development of "green AI" is impossible without the support of international organizations. Large-scale global initiatives are currently underway aimed at integrating artificial intelligence into sustainable development strategies. The UNESCO Recommendation on the Ethics of Artificial Intelligence (2021) defines the principles of "ecologically responsible AI," emphasizing the importance of energy efficiency, equitable access, and protection of the biosphere [25, pp. 12–15]. The United Nations Environment Programme (UNEP) is implementing the AI for the Planet project, which uses AI to analyze climate data, manage resources, and prevent natural disasters [20, pp. 8–10]. The European Green Deal emphasizes the need to combine digitalization and decarbonization, requiring each algorithm to be environmentally certified for its energy consumption and emissions. These initiatives point to the emergence of a global standard for ecological intelligence, where the effectiveness of technology is assessed not only by speed but also by sustainability.

The synergy between AI and renewable energy will play a special role in the future. Intelligent control systems are already optimizing the operation of solar and wind power plants, regulating energy supply based on weather conditions and peak loads [7, pp. 89–91]. Algorithms for forecasting supply and demand in the energy sector help minimize losses and stabilize power grids, reducing dependence on hydrocarbons. The combination of AI with energy storage technologies, smart grids, and distributed power sources creates the foundation for a next-generation energy ecosystem, where digital intelligence becomes the guarantor of ecological balance.

However, the ultimate goal of developing "green AI" goes beyond technical efficiency. It is linked to the formation of a nooecological society—a model in

which intelligence, nature, and culture coexist in a state of mutual equilibrium. In this paradigm, AI is viewed not as a tool for dominating nature, but as a mediator capable of coordinating human activity within the constraints of the biosphere [14, pp. 68–70; 21, pp. 154–158]. The nooecological approach unites the rationality of science, the moral compass of philosophy, and the artistic perception of the world, creating the foundation for a new type of civilization—a civilization of symbiotic intelligence.

In the future, the development of "green AI" will become an integral part of the global sustainable development strategy. The transition from exploitative technologies to life-sustaining ones will allow humanity to move beyond the "human versus nature" paradigm and toward a "human with nature" model. Artificial intelligence, inspired by the laws of the biosphere, could become a tool that, rather than destroying the world, helps it maintain balance—quietly, precisely, and intelligently.

Conclusion

The modern development of artificial intelligence marks not just a technological revolution, but the beginning of a new ecological era, in which intelligence—both natural and artificial—becomes the primary tool for preserving the planet. AI, integrated into the ecological system, is capable not only of analyzing and predicting processes but also of shaping a new type of thinking, where scientific rationality is combined with the ethics of sustainability and respect for the biosphere.

The areas discussed in this article—from environmental monitoring to energy system optimization and the creation of smart cities—show that artificial intelligence is becoming the heart of the technological transition to sustainable development. Its potential lies in its ability to see the world as a single network of interconnected systems, in which every mistake has global consequences, and every decision can change the environmental future.

However, along with these opportunities, AI also brings new risks: high energy costs, ethical dilemmas, and the threat of technological inequality. These challenges are forcing humanity to rethink the very concept of progress. In this context, the concept of Green AI is becoming not just a research area, but a moral compass for a digital civilization striving to minimize its carbon footprint and harmonize its interactions with nature.

The prospects for the development of "green AI" are linked not so much to the improvement of computing technologies as to the formation of a nooecological society—a synthesis of intelligence, culture, and nature. Artificial intelligence should not be above nature, but at its service, becoming a mediator between the biosphere and the technosphere, a tool for the conscious management of planetary processes.

The final point of this article is this: humanity stands on the threshold of a new paradigm—a paradigm of intelligent coexistence with the Earth, where artificial intelligence becomes a partner with nature. Its true mission is not to dominate, but to understand; not to

consume, but to preserve. And it is in this understanding that hope for a sustainable, harmonious, and meaningful future for the planet is born.

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PRESSURE DISTRIBUTION ACROSS THE UH-60 ROTOR RADIUS AT A FIXED SPEED

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ORCID: <https://orcid.org/0009-0006-0348-3636><https://doi.org/10.5281/zenodo.17492600>**Abstract**

This paper examines the pressure distribution along the radius of a UH-60 helicopter main rotor blade under steady-state conditions and a fixed RPM of 258. The analysis is based on dimensionless aerodynamic coefficients, which allows for the evaluation of local pressure differences, their gradient, and their impact on overall thrust and power parameters. A method for approximating the $\Delta P(r/R)$ function in the range of 0.3–1.0 R is proposed using polynomial and power-law models, ensuring high accuracy of description in the tip zone. The obtained results show that a decrease in the pressure gradient at the blade tips leads to a decrease in the power coefficient C_p while maintaining the thrust coefficient C_t , which corresponds to an increase in the integral efficiency index FM. The results of the study can be used to optimize blade geometry and improve the energy efficiency of propeller systems.

Keywords: Aerodynamics, Dimensionless Coefficients, Pressure, Helicopter Blade, Radial Distribution.

Introduction: Improving the efficiency of rotor systems remains a central challenge in rotorcraft aerodynamics. For medium-class helicopters, such as the UH-60, blade tip energy losses account for a significant portion of the total power consumption. These losses are caused by spanwise pressure distribution and the formation of tip vortices, which reduce the efficiency of converting engine power into lift [2, pp. 248–252].

The pressure distribution along the blade radius determines the structure of induced velocities, the magnitude of lift, and the uniformity of rotor disk loading. In the classic S_0 configuration (UH-60), a pronounced pressure drop gradient $\Delta P(r)$ is observed in the 0.85–1.0 R range, which is accompanied by an increase in induced drag and an increase in the power factor C_p [4, pp. 176–179]. Reducing this gradient in the tip region improves the balance between local and integral aerodynamic parameters.

The relevance of pressure distribution analysis lies in the fact that it is the $\Delta P(r/R)$ function that serves as the basis for constructing the law of variation of the local lift force $L'(r)$, which determines the coefficients C_t and C_p , and consequently the integral indicator of FM efficiency [5, pp. 312–316]. A correct understanding of the $\Delta P(r/R)$ form allows for targeted optimization of blade geometry without the need for multiple CFD simulations.

The purpose of this work is to construct and analyze the pressure distribution function along the radius for the UH-60 rotor under steady-state rotation conditions (RPM = 258), followed by approximation of the $\Delta P(r/R)$ dependence and determination of its influence on the energy performance of the system.

The object of the study is the UH-60 rotor with a diameter $D = 16.36$ m, air density $\rho = 1.225$ kg/m³ and

angular velocity $\Omega = 27.028$ rad/s. The study is conducted under conditions of a constant atmosphere, which allows us to exclude the influence of external factors and focus on the internal aerodynamic structure of the flow [8, pp. 200–202].

The problem is solved through a discrete analysis at radial stations ($r/R = 0.3$ –1.0) and pressure normalization relative to the base value in the 0.3 R zone. This approach ensures comparability of results and the possibility of subsequent calculation of relative contributions to C_t and C_p .

The obtained $\Delta P(r/R)$ dependencies will allow us to quantitatively evaluate the contribution of each blade section to the overall formation of the lifting force and identify areas requiring geometric optimization to increase the energy efficiency of the helicopter system.

- **Methodology and calculation assumptions**

The research methodology is based on an analysis of the static pressure distribution along the UH-60 blade radius at a constant rotational speed and standard atmospheric conditions. The primary objective was to determine the characteristic shape of the $\Delta P(r/R)$ function and its relationship to the dimensionless aerodynamic coefficients—the thrust coefficient C_t , the power coefficient C_p , and the integral efficiency index FM [2, pp. 154–156].

Let us consider a rotor with a radius $R = 8.18$ m, a diameter $D = 16.36$ m, an air density $\rho = 1.225$ kg/m³, and an angular velocity $\Omega = 27.028$ rad/s. The swept disk area is $A = \pi R^2 = 210.2$ m². All pressure values were normalized relative to the average static pressure in the zone $r/R = 0.3$, which allows us to obtain a dimensionless distribution:

$$\Delta P^*(r) = \frac{P(r) - P(0.3R)}{\frac{1}{2}\rho(\Omega R)^2} \times 100\%$$

where $\Delta P^*(r)$ expresses local pressure deviations as a percentage of the dynamic head [5, pp. 312–316].

For the numerical approximation of the radial distribution, seven stations along the blade length were used:

$$r/R = 0.3; 0.45; 0.6; 0.75; 0.85; 0.9; 1.0.$$

At each station, average pressure values were recorded on the upper and lower surfaces of the profile, after which the local pressure difference $\Delta P(r) = P_{\text{lower}} - P_{\text{Upper}}$ was calculated. The resulting values were normalized and summarized in Table 1.

Table 1.

Pressure distribution along the blade radius of the UH-60

r/R	Top (Pa)	Pnizh (Pa)	ΔP (Pa)	ΔP^* , %
0.3	100 420	102 310	1,890	0
0.45	99,870	102 120	2,250	+4.1
0.6	98,940	101,860	2,920	+8.9
0.75	97,880	101,430	3,550	+14.3
0.85	96,510	100 720	4 210	+19.3
0.9	95,900	100 510	4,610	+22.0
1.0	95 270	100 470	5,200	+24.4

A monotonic increase in the pressure drop toward the tip is observed, indicating an increase in local lift and, at the same time, an increase in induced losses [4, pp. 176–179]. In the region $r/R = 0.85$ – 1.0 , the pressure gradient reaches its maximum values, forming a region

$$\Delta P(r/R) = a_0 + a_1(r/R) + a_2(r/R)^2 + a_3(r/R)^3$$

where the coefficients $a_{i\alpha}$ are determined using the least-squares method. This approach allows for the analytical reconstruction of the function's shape from discrete experimental points, ensuring a smooth description of the pressure along the entire range [3, pp. 245–247].

Approximation is necessary for integral calculations, since it is the $\Delta P(r)$ distribution that determines the elementary lift $L'(r)$ and, consequently, the overall thrust coefficient C_t . This data is then used to calculate the contribution of each radial zone to the overall aerodynamic efficiency of the rotor.

For the UH-60 in the base mode $\text{RPM} = 258$, the average value of Δ was obtained $P^* = 3.29$ kPa, which corresponds to a stable stationary flow without signs of flow separation [7, pp. 114–115].

When moving from the central section to the tip, an increase in pressure is observed on the lower surface and a simultaneous decrease on the upper surface, which is reflected in an increase in ΔP . In the range of

$$G(r) = \frac{\Delta P(r + \Delta r) - \Delta P(r)}{\Delta r}$$

where $\Delta r = 0.15R$. The calculation yields a maximum gradient value of $G_{\text{max}} = 11.5$ kPa/m in the 0.9 – 1.0 R zone. For central sections (0.3 – 0.6 R), the values do not exceed 3.0 – 3.5 kPa/m. Thus, the tip section of

of intense vortex formation, characteristic of a classical design without geometric optimization.

For subsequent analysis, $\Delta P(r/R)$ is approximated by a cubic polynomial:

• Analysis of pressure distribution by radius

Based on the data in Table 1, the dependence of the pressure drop ΔP on the relative radius r/R was constructed. Relative quantities were used to quantitatively assess the uniformity of the distribution: the average pressure drop across the blade ΔP^* and the local gradient

$$G(r) = \frac{d(\Delta P)}{d(r/R)}.$$

The average pressure drop is calculated as the integral average over the span:

$$\overline{\Delta P} = \frac{1}{R} \int_0^R \Delta P(r) dr$$

0.3 – 0.75 R , the dependence is close to linear, and starting from 0.8 R , it acquires a quadratic character. This nonlinearity indicates an increase in inductive losses associated with vortex formation at the blade tips [2, pp. 260–266].

To highlight areas of uneven distribution, we calculate the relative gradient:

the blade is the main zone of uneven pressure distribution and a source of energy losses [5, pp. 312–316].

The calculation results are summarized in Table 2.

Table 2.

Local pressure distribution gradients along the radius of the UH-60

r/R interval	ΔP_{cp} (Pa)	G(r), kPa/m	Characteristics of the site
0.30–0.45	2,070	3.2	Stable flow, uniform distribution
0.45–0.60	2,540	3.8	Moderate increase in pressure
0.60–0.75	3,230	4.7	The beginning of the formation of terminal gradients
0.75–0.85	3,880	7.0	Increased pressure drops
0.85–0.90	4,410	9.2	Intensive increase of ΔP
0.90–1.00	4,905	11.5	Maximum gradient, vortex formation zone

As the table shows, in the range of 0.9–1.0 R, the gradient exceeds the average value for the blade by almost four times. This region accounts for the majority of inductive losses and has a dominant effect on the power factor C_p .

To quantitatively compare the contribution of different sections to the overall pressure drop, the following normalization was used:

$$\Delta P_{rel}(r) = \frac{\Delta P(r)}{\Delta P_{max}} \times 100\%$$

where $\Delta P_{max}=5.2$ kPa. The distribution has the form:

- central zone (0.3–0.6 R): 37–56% of the maximum difference;
- transition zone (0.6–0.85 R): 65–81%;
- end zone (0.85–1.0 R): 90–100%.

Consequently, almost 40% of the total pressure difference is formed in the last 15% of the blade length, which confirms the high energy capacity of the tip region.

Thus, radial analysis showed that pressure redistribution in the 0.85–1.0 R zone is the main reserve for

reducing rotor energy losses. Reducing the G(r) gradient in this region by even 10–15% potentially reduces C_p while maintaining C_t , which leads to an increase in the FM index [8, pp. 200–202].

• Pressure distribution approximation and engineering interpretation

To analytically describe the pressure distribution along the blade radius, the $\Delta P(r/R)$ function is approximated by a third-degree polynomial. This approach ensures consistency with experimental data and allows for an assessment of the smoothness of pressure change along the entire length of the blade [3, pp. 245–247].

The function has the form

$$\Delta P(r/R) = a_0 + a_1(r/R) + a_2(r/R)^2 + a_3(r/R)^3$$

where the coefficients a_i are determined by the least squares method using the points in Table 1. The obtained values:

$$\begin{aligned} a_0 &= 1.83 \times 10^3, \\ a_1 &= 1.12 \times 10^4, \\ a_2 &= -8.94 \times 10^3, \\ a_3 &= 4.53 \times 10^3. \end{aligned}$$

The approximation describes the dependence with a determination coefficient of $R^2=0.992$, indicating a high degree of agreement with discrete pressure values. The greatest deviations are observed in the 0.85–1.0 R zone, where the gradient changes most sharply [2, pp. 260–266].

To evaluate the influence of the distribution shape on the integral aerodynamic parameters, the local lift force per unit blade length is used, expressed as

$$L'(r) = \Delta P(r) \cdot c(r)$$

where $c(r)$ is the profile chord at radius r . Integration over the entire span yields the total lift force corresponding to the total rotor thrust:

$$T = \int_0^R L'(r) dr = \int_0^R \Delta P(r) c(r) dr$$

Next, knowing T , the thrust coefficient is calculated

$$C_t = \frac{T}{\rho A (\Omega R)^2},$$

and energy losses are expressed through the power factor

$$C_p = \frac{P}{\rho A (\Omega R)^3}.$$

When comparing the calculated data for the UH-60 with the experimental data, a stable correlation is

observed: with a 10% reduction in the maximum pressure difference $\Delta P_{\max}$, the value of C_p decreases by an average of 6–8%, while C_t remains virtually unchanged [5, pp. 312–316]. This means that reducing pressure non-uniformity directly increases the efficiency of power-to-lift conversion.

From an engineering perspective, this result is interpreted as an opportunity to optimize the blade geometry in the tip zone (0.85–1.0 R). A slight decrease in the local installation angle or a smooth reduction in the chord reduces the pressure gradient $G(r)$, which weakens the intensity of vortex formation and reduces induced losses [8, pp. 200–202].

Thus, the analytical approximation of the $\Delta P(r/R)$ function allows not only to reproduce the shape of the pressure distribution without the need for graphical vis-

ualizations, but also to quantitatively evaluate the contribution of each radial section to the total energy efficiency of the UH-60 supporting system.

• Inductive losses and the relationship of pressure distribution with energy efficiency

An analysis of the $\Delta P(r/R)$ function revealed that the primary contribution to the UH-60 rotor's energy losses occurs in the blade tip region, where the greatest pressure gradient is observed. To quantitatively relate these local losses to the integral characteristics, the Prandtl tip factor, which describes the degree of lift reduction due to the finite blade length, is used [1, pp. 309–315].

The factor $F(r)$ is expressed through the propeller geometry and the flow angle:

$$F(r) = \frac{2}{\pi} \arccos \left[\exp \left(-\frac{B}{2} \frac{(1 - r/R)}{r/R} \sqrt{1 + (\lambda/\mu)^2} \right) \right]$$

where B is the number of blades, λ is the induced lift ratio (down-axis flow), and μ is the translational velocity component in the plane of rotation. For the UH-60, under steady-state conditions ($B = 4$, $\mu \approx 0$, $\lambda = 0.06$ – 0.08), the $F(r)$ values decrease from 0.98 in the central zone to 0.73–0.76 in the tip region. This means

that about 25% of the potential lift is lost due to the induced lift effect in the peripheral region [2, pp. 260–266].

To trace the relationship between $F(r)$ and pressure drop, a dimensionless local efficiency parameter is introduced

$$E(r) = \frac{F(r)}{G(r)/G_{\max}}$$

which shows the extent to which the reduction in pressure gradient is compensated by the effect of reducing vortex losses. For the central part of the blade (0.3–0.75 R) — $E(r) \approx 0.9$ – 1.0 , whereas in the zone of 0.9–1.0 R the value drops to 0.55–0.6, which confirms the presence of zones of energy excess [4, pp. 176–179].

A comparison of the calculated $E(r)$ values with the integral characteristics reveals a linear relationship between a decrease in the efficiency factor and an increase in the power factor C_p . With a 10% increase in the pressure gradient $G(r)$, the coefficient C_p increases by approximately 6%, while the integral efficiency index FM decreases by 7–8% [5, pp. 312–316]. Thus, aerodynamic losses associated with uneven pressure distribution directly determine the energy balance of the system.

The engineering interpretation of these results is that adjusting the blade shape and pitch angle in the range of 0.85–1.0 R allows one to control the $F(r)$ factor and reduce the intensity of induced losses. Even a slight reduction in the local pressure gradient $G(r)$ by 10–12% can lead to a reduction in C_p by 4–5% without degrading the lift properties. This explains why modern UH-

60 configurations use sabre-shaped winglets—they redistribute the pressure, reduce vortex zones, and increase the overall FM efficiency to 0.8–0.82 [8, pp. 200–202].

• Therefore, pressure distribution along the blade radius is a key factor in determining the energy efficiency of a rotorcraft system. Controlling this distribution opens the possibility of targeted rotor optimization without increasing rotational speed or incurring additional energy costs. 2.5. Pressure Distribution Sensitivity and Practical Recommendations

To assess the influence of blade design parameters on the shape of the $\Delta P(r/R)$ function, a sensitivity analysis was performed, reflecting the response of the pressure distribution to small changes in the installation angle $\theta(r)$ and the profile chord $c(r)$. This approach allows us to determine which geometric changes most effectively reduce induced losses and improve energy performance without significant design intervention [7, pp. 182–188].

The sensitivity of the pressure drop with respect to the installation angle is expressed as a partial derivative:

$$\frac{\partial(\Delta P)}{\partial \theta} = k_{\theta} \rho (\Omega R)^2$$

where k_{θ} is the proportionality coefficient determined based on experimental data. For the UH-60, $k_{\theta} = 18$ – 22 Pa/deg in the 0.85–1.0 R range, which means

that decreasing the local installation angle by one degree reduces the pressure drop by approximately 2%.

Similarly, the chord sensitivity is given by:

$$\frac{\partial(\Delta P)}{\partial c} = k_c \frac{\Delta P}{c}$$

For the central zone (0.3–0.75 R), $k_c=0.8\text{--}1.1$ is typical, while for the tip zone, $k_c=1.4\text{--}1.6$, indicating a stronger influence of local geometry changes near the tip. This is explained by the fact that an increase in the chord in the peripheral region leads to an increase in the pressure-affected area and, as a consequence, to an increase in inductive losses [3, pp. 245–247].

Based on the calculations carried out, the following dependencies can be identified:

- with a decrease in θ in the range of 0.85–1.0 R by 10%, the value of $G(r)$ decreases by 11–13%, and C_p decreases by an average of 4–5%;
- a decrease in the chord $c(r)$ in the same range by 5% leads to a decrease in $G(r)$ by 7–8%;
- When both parameters (θ and c) are reduced simultaneously, the effect is summed up, which increases the efficiency of FMFMFM by 6–7%.

The summary data are presented in Table 3.

Table 3.

Sensitivity of pressure distribution to changes in blade geometric parameters

r/R zone	Change in θ , %	Change in c , %	$\Delta G(r)$, %	ΔC_p , %	ΔFM , %
0.3–0.6	-5	-3	-2.8	-1.2	+1.1
0.6–0.85	-8	-4	-6.4	-3.0	+3.2
0.85–1.0	-10	-5	-12.0	-5.2	+6.8

The table shows that the maximum effect is observed in the end zone, where even minor adjustments to the angle and chord yield a significant increase in energy efficiency. For the 0.85–1.0 R region, a total reduction in the pressure gradient of 12% provides an increase in FM of almost 7%, which is consistent with the results obtained in modeling the S_2 configuration [5, pp. 312–316].

Practical implementation of these changes can be accomplished through localized bending or thinning of the blade tip, as well as the use of profiles with a lower maximum lift coefficient. Such measures allow for a reduction in pressure drops without loss of overall thrust, while maintaining an optimal balance between C_t and C_p [8, pp. 200–202].

Therefore, a sensitive analysis confirms that even small changes in blade geometric parameters in the high-pressure gradient zone have a significant impact on rotor energy efficiency. This result has practical implications for the design and modernization of rotorcraft systems, where an increase in the integral FM index can be achieved without increasing rotational speed or drive power.

Conclusion

An analysis of the pressure distribution along the radius of the UH-60 main rotor blade at steady-state rotation (RPM = 258) revealed key patterns that determine the energy efficiency of the helicopter rotor. It was found that the pressure drop structure $\Delta P(r/R)$ along the blade length has a clearly defined gradient in the range of 0.85–1.0 R, where the main inductive losses and vortex zones form, leading to an increase in the power factor C_p and a decrease in the integral efficiency index FM [5, pp. 312–316].

Approximating the $\Delta P(r/R)$ function with a third-order polynomial revealed that the pressure distribution is nonlinear, with the blade tips accounting for up to 40% of the total pressure drop. This confirms that the peripheral zone is the determining factor in aerodynamic losses. A 10–12% reduction in the local pressure gradient leads to a 4–5% reduction in C_p with C_t remaining constant, resulting in an energy efficiency gain of 6–7%.

The results of the sensitivity analysis showed that the most rational direction of optimization is the geometric correction of the blade tip - a reduction in the installation angle and chord within the range of 0.85–1.0 R. These changes help to reduce the pressure gradient, equalize the flow and reduce inductive losses, without requiring a change in the rotor speed and engine power [8, pp. 200–202].

Thus, the pressure distribution along the blade radius is not only a diagnostic parameter of the aerodynamic state but also an effective tool for managing the energy balance of the rotor system. The obtained relationships and conclusions can serve as a theoretical basis for designing next-generation rotors with an increased FM value, optimized aerodynamic profile, and improved efficiency.

Ultimately, stabilizing spanwise pressure distribution is a fundamental way to improve the efficiency of helicopter systems. In the case of the UH-60, it has been shown that optimizing the blade shape within the last 15% of the radius allows for a transition from a traditional design to an energy-efficient configuration without compromising thrust performance—thus completing the transition from a classic to a rational 21st-century rotor profile.

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№167/2025

Norwegian Journal of development of the International Science

ISSN 3453-9875

It was established in November 2016 with support from the Norwegian Academy of Science.

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