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ВІД ЛЬОДУ ДО ПАРИ: ЕНЕРГІЯ ІННОВАЦІЙ У ФАЗОВОМУ ПЕРЕХОДІ ОРГАНІЗАЦІЙНОГО РОЗВИТКУ

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FROM ICE TO STEAM: THE ENERGY OF INNOVATION IN THE PHASE TRANSITION OF ORGANIZATIONAL DEVELOPMENT

Анотація. *Дослідження пропонує новий підхід до аналізу організаційного розвитку через аналогію з фазовими переходами води. Використання цього концепту дає змогу пояснити, як інновації виступають своєрідною енергією, що змінює стан організації, тоді як техніки креативності виконують роль каталізаторів, посилюючи та прискорюючи ці зміни. Аналіз емпіричних даних дає можливість простежити тренд експоненційного розвитку технологічних, економічних та соціальних процесів. Отримані результати засвідчують стрибкоподібний характер фазових переходів, коли поступове накопичення змін приводить до різкого прискорення розвитку. Підтримка цього процесу потребує системного забезпечення «інноваційної енергії», оскільки її відсутність підвищує ризик збереження організації у стабільному, проте менш ефективному стані. Виявлені організаційні стани — «лід», «вода» та «пара» — відображають різні рівні структурної гнучкості й адаптивності системи. Попри наявність загальної тенденції до переходу між фазами, окремі сфери, зокрема оборона, охорона здоров'я та служби реагування на надзвичайні ситуації, характеризуються переважанням жорстких ієрархічних моделей. Запропоновані напрями подальших досліджень спрямовані на забезпечення високої якості вимірювання «паровості» організації, а також на оцінку ефективності креативних технік у посиленні та стимулюванні інноваційних процесів. Додатково рекомендовано дослідити умови, за яких організації можуть безпечно переходити між фазами без втрати керованості та забезпечувати стійкий розвиток у турбулентному середовищі. Особливої уваги потребує визначення порогових значень інноваційного навантаження, після досягнення яких відбувається якісний структурний зсув. Також актуальним є вивчення ролі лідерства та організаційної культури як чинників, що можуть як прискорювати, так і стримувати фазові переходи.*

Ключові слова: *інновації, фазові переходи, організаційний розвиток, інноваційна енергія, структурні трансформації, інноваційна креативність*

Abstract. *The study proposes a new approach to analyzing organizational development through the analogy of water phase transitions. This conceptual framework helps explain how innovation acts as a form of energy that changes the state of an*

organization, while creativity techniques function as catalysts that amplify and accelerate these transformations. The analysis of empirical data reveals an exponential trend in the development of technological, economic, and social processes. The obtained results demonstrate the nonlinear, leap-like nature of phase transitions, where gradual accumulation of changes leads to a sharp acceleration of development. Supporting this process requires a systematic supply of «innovation energy,» as its absence increases the risk of the organization remaining in a stable yet less effective state. The identified organizational states «ice,» «water,» and «steam»—reflect different levels of structural flexibility and adaptability. Despite the general tendency toward transitions between these phases, certain sectors, such as defense, healthcare, and emergency response services, retain predominantly rigid hierarchical models. The proposed directions for further research aim to ensure high-quality measurement of an organization's «steaminess,» as well as to assess the effectiveness of creativity techniques in enhancing and stimulating innovation processes. It is also recommended to investigate the conditions under which organizations can safely transition between phases without losing controllability and while ensuring sustainable development in turbulent environments. Special attention should be given to identifying the threshold levels of innovation intensity that trigger qualitative structural shifts. Moreover, exploring the role of leadership and organizational culture as factors that can either accelerate or hinder phase transitions remains a highly relevant research avenue.

Key words: *Innovation, phase transitions, organizational development, innovation energy, structural transformations, innovative creativity*

JEL codes: O31, O32, M10, M54

The problem. Scientific research often uses visual aids to explain complex concepts. Innovation development of organizations is not an exception. The concept of innovation ecosystem, developed by James Moore in 1993, is one of the examples [25] It may be compared with the biological ecosystem that presupposes the interaction of different organisms with the environment, creating favorable circumstances for growth and evolution. The evolutionary development is another analogy associated with Darwin's theory of evolution. This approach was developed by Charles Darwin in 1859 to indicate that organizations, similar to the nature types, are capable of adapting to the changes in the environment with the endeavor to develop [10].

The term 'organic' reflects the concept of organic development of organizations and reminds one of the properties of living organisms capable of self-regulation and adaptation to outside impacts. These terms are used to describe the processes of organic system development, which follow direct rules and standards and are difficult to predict. Contrary to the development theories of biological systems, the laws of physics are more predictable as they are based on concise dependencies. Therefore, the researcher suggests a more comprehensive and visual analogy. The current study examines organizational development through the analogy with factual water transformation—the most common and essential liquid on Earth [18]. Hence, the study aims to suggest an innovative approach to organizational development analysis through the analogy with water phase transitions.

Water molecules are referred to as individuals that belong to an organization, and their interaction is identified with the help of the molecule grid structure of water, which changes depending on the water state, similar to the interaction of water molecules under different conditions. Therefore, it is suggested that to enhance organizational development, it is necessary to use innovation as energy and creativity techniques as catalysts, which promote process optimization and organizational support in

an optimal state. In the state of ice, an organization has a minimum capability to adapt because ice is solid and fragile. In a liquid state, water has good properties of changing form, which enables an organization to be more flexible and adaptive. Steam molecules can cover long distances, filling large volumes that symbolize the organizational ability to scale and quick adaptation to a new environment. Therefore, thanks to creativity techniques and innovation, these transitions become possible and help organizations to achieve new levels of development.

Analysis of research and publications. The analysis of the physical properties of water and phase transitions forms the foundation for using the metaphor of water states in organizational development. Classical physical works explain the mechanisms of transition between aggregate states, which occur in a jump-like form after the accumulation of a critical amount of energy [22; 25; 38]. The structure of water, its thermodynamics, behavior in various environments and the influence of external factors have been widely studied in modern scientific literature [4; 19; 34; 39]. The properties of ice, its stability and rigidity serve as a useful analogy for describing organizations with a rigid hierarchy and low flexibility [28; 37].

In the field of innovative development of organizations, the theoretical basis formed in classical studies of economic dynamics and innovations is important. The concepts of creative destruction and innovation cycles were laid down by Schumpeter [36], supplemented by modern ideas of open innovation [7], dynamic capabilities of organizations [42] and models of national innovation systems [13]. The spread of innovations and the jumpiness of transformations are also described in detail in the theory of diffusion of innovations [35].

Creative techniques play the role of catalysts of such transitions, contributing to changes in the state of the organization by increasing the intensity of innovation processes. The effectiveness of methods for stimulating creativity has been confirmed by a number of studies [14; 41; 43], and popular practical methods are widely used in business management [1; 6]. Physical studies related to water vapor, thermal processes, energy transfer and phase diagrams allow us to better understand the nature of abrupt changes of states - from «water» to «steam» - in both natural and socio-economic systems [10; 11; 23; 44]. This provides a scientific basis for interpreting innovation as «energy» that expands the adaptability and flexibility of the organization.

Social and economic transformations in history also demonstrate the phase-like nature of transitions, when a long accumulation of changes ends with a sharp leap in development. Examples include the industrial revolution [16; 47], technological breakthroughs [24; 31; 32], institutional reforms [33, 46], as well as social changes in transforming countries [15; 30]. These processes confirm the universality of the phase transition model. Methodologically, the use of secondary data for the analysis of large socio-economic systems is important, allowing researchers to trace long-term trends and patterns of accumulation of changes [12; 17; 48].

In summary, the literature clearly confirms the feasibility of applying the analogy of phase transitions of water to the development of organizations. Innovation can be interpreted as energy that accelerates change, and creative techniques as catalysts that activate processes of transition between states. The jump-like nature of development, found in physical, economic and social systems, indicates that organizations function

as dynamic structures, capable of transitioning from «ice» to «water» and «steam» depending on the level of innovation load.

The purpose of the article. The purpose of the study is to develop a conceptual framework for understanding organizational development through the analogy of phase transitions, identifying how innovation acts as the driving energy that enables shifts between organizational states, and determining the role of creativity techniques as catalysts that accelerate these transformations. The study aims to explain the dynamics of organizational «solid–liquid–gas» transitions and to outline conditions that ensure safe and effective movement between phases while maintaining manageability and fostering sustainable development.

Presentation of the main material. The phase transition in natural sciences is an essential phenomenon that describes the change of a substance's state while changing temperature and pressure. According to classic thermodynamics, the phase transition occurs during the system's energy change, which alters structural substance properties without changing its chemical content. Visual examples of phase transitions include the water transition from ice to liquid and from liquid to steam, where molecules are reorganized following the temperature and pressure changes. However, during every state, substance properties significantly differ [29]. The examination of every state will provide an insight into the occurring changes.

Ice (Solid Phase). Ice is a solid water phase characterized by a crystal grid. Molecules of this structure are arranged regularly, creating crystals with evenly spaced molecules. This ensures structural stability of the material, simultaneously making ice fragile. Ice debris is impossible to combine as the crystal structure loses its stability while cracking, and water molecules are not in a fixed position. This makes it impossible to compile into a single object [4]. Moreover, ice cannot change its form without crystal structure destruction, as water molecules in ice are fixed in certain positions and cannot freely move [28]. Irrespective of its fragility, ice properties make it useful in many areas. Its high heat capacity makes water ideal for food and medical product cooling and storage. The solid state and ease of processing allow ice to be formed into a variety of shapes, which is effectively applied in the construction of temporary industrial structures, as well as ice hotels and sculptures [5]. Additionally, ice has a lower density compared to water, which enables floating on the water surface, protecting living organisms from low temperatures [37]. Hence, the molecules of the solid phase of water are regularly arranged, indicating stability and fragility.

Water (Liquid Phase). Water is a substance characterized by the absence of a crystal grid, and in a liquid state, water molecules are arranged in a less ordered manner compared to ice. Moreover, this state makes hydrogen bonds between them inconstant as they break and form again, ensuring high fluidity and the capability to change shape, considering the vessel shape [34]. Water has a high heat capacity, being able to absorb and release significant amounts without substantial temperature increase or decrease [4]. This makes water an essential temperature regulator in natural and technical systems. Furthermore, polar nature makes water a universal solvent. Water molecules have a dipole moment that enables them to interact with ions and polar molecules of other substances [34]. This breaks their bonds and enhances dissolution. Therefore, water is an essential medium for chemical reactions in living organisms. High water fluidity allows nutrient and metabolic waste transportation within organisms, supporting their life activities [32-34]. High heat capacity of water helps

organisms regulate temperature. High specific heat capacity of water helps regulate the temperature of organisms by cooling them during evaporation and retaining heat [21]. Hence, water is useful for multiple processes essential for life.

Water is commonly applied for cooling, purification, and transportation in technical areas. Moreover, it serves as a working environment in different production processes. This substance is indispensable in the cooling system of industrial equipment, where it absorbs excessive heat, preventing overheating [28]. It is also used for the product or equipment purification and rinsing in production, ensuring their quality and safety. The transition from ice to water (known as the latent heat of fusion) requires a significant energy amount [28]. This energy is applied to the development of hydrogen bonds among ice molecules, which allows them to move freely and become liquid. During this process, ice temperature remains stable until the entire mass turns into water. That energy is used to break the hydrogen bonds between ice molecules, allowing them to move more freely and transition into a liquid state. Thus, unique water qualities are the precondition of its wide implementation in different spheres.

Steam (Gaseous State). Steam is a gaseous water phase that does not have a fixed shape or volume. Water steam molecules are arranged far from each other, which allows them to move freely in different directions. Hydrogen bonds among steam molecules are almost missing, ensuring high molecular mobility and the capability to fill all available volume. This makes steam very highly dispersed and capable of rapid expansion and contraction depending on pressure and temperature conditions. Water steam is characterized by low density explained by the high distance between molecules [12]. It is an essential atmosphere component that plays a major role in condensation and evaporation processes. The transition from liquid water to steam requires a significant energy amount, known as the latent heat of vaporization, which is used to break hydrogen bonds among water molecules, allowing them to move more freely and to become gaseous. Water temperature becomes stable during this process until the entire mass becomes steam [24].

In technical systems, water steam ensures heat transfer, particularly in steam turbines for electricity generation and in heating and cooling systems [11]. Furthermore, it is often applied in the chemical industry for carrying out different reactions such as hydrolysis and synthesis. Water steam is indispensable in evaporation processes, where it is used for solution concentration through water removal, and in distillation processes for mixture component separation. It is used for product pasteurization, sterilization, and purification due to its high-temperature properties [27]. Therefore, unique water steam properties are the primary reason for its wide use in different spheres and industries. Thus, phase transitions from ice to liquid and from liquid or steam are central for understanding the physical properties of water and its wide use in natural and technical systems [27]. These transitions occur under certain temperature and pressure conditions, impacting various processes in nature and technology, which makes water an indispensable constituent of our environment.

The analysis of relevant literature sources has enabled making an analogy between phase transitions and organizational development. The examination of organizational development and its comparison with water states and phase transitions will help clarify the question. Slavery was common, and an individual, like an ice molecule, could not freely move or change fate. He/she was bonded to the owner and had to perform certain duties. In the Middle Ages, when slavery disappeared, affiliation to activity

type was attached to kin or family. Children continued to work with their parents, and it was common for artisans, cattle breeders, and other professionals [2]. A similar structure may be traced these days in certain countries. China has a similar situation, where social structure is based on a hukou system that divides citizens into urban and rural ones, limiting their ability to change the place of living and work [35]. Therefore, it is possible to compare a rigid organizational structure, in which an individual cannot leave it or change the activity type, to water in an ice state. It is limited freedom of choice and action. Several countries have authoritarian management styles and restricted freedoms. Similarly to molecules, which are in the crystal grid, these structures are solid, but they are also fragile and can be broken and crumble like ice into shards.

Revolutions in different countries resulted in the management system changes and usually led to increased adaptability. For example, the French Revolution of 1789 caused important changes in political and social structures [3]. In 1975, after the death of dictator Francisco Franco, Spain engaged in the process of moving from an authoritarian regime to a democratic system [17]. This transition included the acceptance of a new constitution and free elections, which significantly increased public and organizational freedom [3]. Major economic and political reforms followed the fall of the communist regime in Poland in 1989. It resulted in the establishment of the democratic system and market economy. This enhanced greater freedom and social development.

Therefore, it is possible to compare organizations that have a rigid structure with ice. They limit the freedom of choice and action, but can break, and their state can change, as it occurred during the revolutions. Similarly to ice heating that gradually weakens bonds among molecules, changes in the society and economy gradually prepare the basis of radical transformation. Hence, the key event that may be compared to ice heating is the First Industrial Revolution. It is vital to emphasize that it did not occur unexpectedly and resulted from a long-term process of change accumulation in different spheres of life.

Various factors may impact the organizational transition from ice to water, including the new knowledge in physics, chemistry, and mechanics created the basis for the development of modern machines and technology. Hence, new fields in physics, chemistry, and mechanics created a favorable background for the development of new machinery and technology. Therefore, the invention of a steam vehicle was a breakthrough that significantly changed production [48]. Changes in agriculture, particularly new crop introduction, improved equipment, and growth techniques, which resulted in increased work effectiveness in agriculture. It enabled many people previously engaged in agriculture to work in industry.

Moreover, the expansion of trade routes, the appearance of new trade centers, and the increase in demand stimulated production development. Finally, the increasing number of cities, social structure change, and the establishment of a new entrepreneurial class resulted in favorable conditions for industrialization. These changes, similar to how heat weakens ice molecule bonds, gradually ruined the structure of traditional society. Rigid feudal relations, manufacturing, and agriculture, as the primary activities, gradually gave way to new forms of production organization and social life. The First Industrial Revolution was not a mere change of technology but a complex process of social transformation. It resulted in the appearance of new social

classes, changed the work character, and changed people's lives. Moreover, it impacted the geopolitical situation in the world [48]. Thus, transitions are associated with multiple processes that are complex and influential.

Hence, the analogy of phase transitions to organizational development is historically reflected through the First Industrial Revolution, which is one of the key events in human history. This stage of social development is similar to the transition from ice to water, where a gradual decrease in the rigidity of traditional social structures and the improvement of industrial approaches provided new opportunities for individual and collective development. In parallel with the elimination of feudal restrictions and industrial technology development, changes occurred in society, gaining new forms and organizational structures. The appearance of new technologies and changes in the economic and social structures provided extended opportunities for individual and professional growth. Innovation in the form of new manufacturing and transportation technologies has opened up new avenues for personal and organizational success. Similar to water molecules getting energy and becoming free, people, under the impact of industrialization and technology development, gained the capability to change their professional trajectories, place of living, and level of life.

Water heating occurs similarly to changes in organizational development. Cold water at 4°C is quite viscous, and its movement is not very quick. Similarly, individuals in organizations were slowly moving and not very effective at the beginning of the Industrial Revolution. However, constant heating or the implementation of innovations in the form of new technologies, acceleration of molecule (individual) movement, and water (organizations) became more mobile and adaptive. The invention of the telegraph in 1837 revolutionized communication, allowing for message transmission over long distances. The telephone, invented in 1876, significantly improved communication capabilities [35].

Moreover, an electric lamp that saw the world in 1897 made street lighting accessible for wide use [42]. The car, invented in 1886, opened a transport era [6]. Aviation, with the first successful flight made by Wright brothers in 1903, provided new opportunities for transportation and individual displacement. Furthermore, computers, presented to humanity in the 1940s, revolutionized information processing and automation [9]. These inventions, which turned into innovations, gradually heated the «water» (organizations), increasing mobility and adaptability. Each innovation makes organizations more flexible and improves their ability to respond to market changes. Similar to water flows, individuals and organizations began to move more freely in the search for new niches and rapidly fill them.

Therefore, continuous technological changes pertinent to the modern world can be compared to constant water heating. Temperature increase (similar to the speed of technological changes) enables water molecules to get more energy and move more quickly, improving mobility. The Internet enabled organizations to enter a new state — the state of digital organization. Globalization, the transition to a network structure, flexibility, and the use of data as the main asset are the key characteristics of this state. The organizational transition to a digital state can be compared to the phase transition of water to steam. This process is accompanied by increased freedom, flexibility, and extended development opportunities. However, like any phase transition, it requires significant effort and can cause difficulties. Successful digital transformation means that organizations should invest in technology, develop employee

competence, and create a favorable culture. Thus, organizational development occurs similarly to water phase transition, with certain growth stages. When the quantity increases and periodically jumps into another quality.

Innovation as Phase Transition Energy. Similar to the way heat energy changes water's state and causes quality phase transitions, innovation alters organizational logics, quality of life, and freedom level. Innovation plays a critical role in the development of not only organizations but also humanity, acting as energy that accelerates its transition among development phases. The evolution of innovation theories also reflects a dynamic development of society and organizations. The dominance of static views, focused on individual inventions, was traced at the initial stage. However, over time, these views became more flexible. Joseph Schumpeter played a central role in the reconsideration of this idea, and his works help better understand modern innovation [23].

In his book «The Theory of Economic Development,» Joseph Schumpeter presented the concept of 'creative destruction,' according to which innovation is a destructive force of economic development. Schumpeter identified innovations as 'new combinations' which include the introduction of new products, production approaches, markets, raw material sources, and organizational structures. He highlighted that entrepreneurs, who are the holders of these 'new combinations,' perform 'creative destruction' and ruin old markets, creating new ones [36]. Hence, innovation performs multiple functions (improve efficiency, drive economic growth, encourage competitiveness, support sustainability, inspire creativity) and provides organizations with many benefits.

After Schumpeter, innovation theories began to consider a wider set of factors. The Theory of Diffusion Innovation by Everett Rogers (1962) highlighted the value of communication and social networks in distributing new ideas. It is essential to emphasize that in 1962, 'social networks' indicated traditional forms of social interaction such as families, societies, local organizations, clubs, work entities, and informal bonds among people. Rogers (1962) examined how new ideas spread over the existing social structures. Over time, innovation theories became more dynamic. The concepts of national innovation system (Freeman & Lundvall, 1980) and dynamic capabilities (Teece, 1990) focused on the interaction between different actors, for instance, the state, science, business, and organizational ability to quickly adapt to changes, developing ideas presented by Schumpeter about the dynamic change.

Innovation theories of the 2000s focus on open and disruptive innovations that endeavor to transform existing markets or ways of doing things. They offer affordable and simple solutions to replace established services of production. The concept of disruptive innovation by Clayton Christensen (2000) explains how new technologies can significantly change markets, continuing to develop the concept of Schumpeter's 'creative destruction.' Modern technologies, such as open innovation of Henry Chesbrough (2003), highlight the value of collaboration and the use of internal sources of knowledge. This approach represents the trend of decentralization of the innovation process. The modern innovation landscape is characterized by an increase in user participation in the development and establishment of new decisions. This phenomenon, known as innovation, is user-driven and becomes more popular in different spheres. Research shows that in extreme sports, where the users often experience unique challenges and needs, the innovation level, suggested by users, can reach

over 50% [30]. For instance, in the alpine skiing field, where sportsmen often modify equipment to improve their results, a significant part of innovation comes from users. One more sphere with a high innovation level, ruled by users, is software with open code. In such projects as Linux or Mozilla Firefox, users not only use the product but also actively participate in its development, suggesting new functions and correcting mistakes [45, 46]. Therefore, we observe an exponential increase in innovation amount, its authors, and distribution channels.

The evolution of innovation theories directly relates to organizational development, as they mutually enrich one another, enhancing human progress and development. Joseph Schumpeter's ideas continue to inspire and form modern approaches to innovation, highlighting their key role in the dynamic development of the economy and society [23]. Similarly to this, heat energy causes phase transformations of water, making steam from ice. Innovations are the driving force of transformational changes in organizations and societies. This causes their transition to a new and higher development level.

Therefore, innovation is not only enhancing economic growth but also promoting social changes, ensuring stable development, and an increase in people's quality of life. Similar to the water heating speed that depends on multiple factors, such as energy supply, pressure level, heating area, and catalyzer use, innovation effectiveness depends on the quality of innovation management. Organizational structure, corporate culture, human resource management, leadership, organizational communication, the presence of resources, and the level of knowledge and expertise impact the organization's outcomes [38]. It is easy to notice that a critical majority of these factors are based on work with individuals. Continuous focus shift to knowledge, which contributes to an individual's experience, has caused the appearance of the term 'knowledge economy' [31]. Because innovation development includes two main stages—ideation and realization—the generation of new and valuable ideas becomes an innovation cornerstone. Creativity is competence that has acquired a new sense [4]. Exclusivity of the arts as the customer of creativity was destroyed one century ago.

Similarly to water and steam, creativity actively fills empty space. State and private organizations take an initiative, focusing on the search for initiative and creative employees, creating favorable conditions, and ensuring necessary education [1]. These days, the generation of ideas does not depend on participants' inspiration, as this is an organized process built on the use of knowledge and creativity techniques [38]. However, the use of one creativity technique is not enough. It is necessary to use those techniques and their elements that are most relevant to the task. Hence, creativity techniques can be compared to catalysts, which allow the use of innovative energy more effectively. Their systematic use leads innovation to a new quality level. This analogy with water heating and catalyzation is not limited to mere organizational processes but also reflects fundamental patterns of human development. Similar to how heat energy leads to phase transitions and the scientific approach accelerates these processes [49]. Innovations that are based on modern theories and knowledge are direct causes of the exponential increase of different human activity aspects, leading to a new quality level.

Table 1

ANALOG BETWEEN WATER PHASE STATES AND ORGANIZATION STRUCTURES

Water Phase States			
Characteristics	Ice (Solid State)	Water (Liquid State)	Steam (Gaseous State)
Molecular structure	Rigid crystal grid	Less structured and mobile molecules	Free and high-energy molecules
Peculiarities	Stability, low mobility, and fragility	Adaptability, average mobility, and flexibility	Dynamism, high mobility, and scalability
Energy needed for state support	Necessary negative energy	Necessary positive energy	Necessary and very significant positive energy
Molecule mobility	Minimum	Average	High
Organizations			
Organizational structure	Rigid, hierarchical	Adaptive and flexible	Network and decentralized
Management methods	Authoritarian, hierarchical	Democratic, adaptive	Horizontal, network
Individual dynamism	Minimal, fixed roles	Average, flexible roles	High, free mobility
Idea generation	Individual, limited, traditional	Group, idea exchange, innovation	Open, collaborative, digital
Innovation theories	Isolated inventions, traditional practices	Innovation diffusion, national innovation systems, and the Industrial Revolution	Open innovations, disruptive innovations, and digital transformation
Necessary effort level to support the state	High negative (for support stability)	Average	Significant for a certain level of achievement. Later, only to ensure support.
Examples	Slavery, the caste system, authoritative states, the military, emergency, and religious organizations	The First Industrial Revolution, democratic states, large corporations with a division structure, and educational establishments with an academic hierarchy.	Digital organizations, global networks, crowdfunding platforms, open research societies, platform organizations with decentralization elements, and decentralized autonomous organizations (DAO).

Table 1 indicates how different water phases can be used to model organizational changes. Similar to physical systems, which transit from one state to another un-

der energy impact, organizations change their structure under the impact of innovation processes. 'Ice' structures have rigid hierarchies that are effective in the spheres that require quick response and strict responsibility distribution (for instance, military structures, medical help in emergencies, crisis management). 'Liquid' structures combine stability and adaptivity, which are optimal for companies operating in a competitive environment that requires concise organizational processes. 'Steam' structures are characterized by high flexibility and the possibility to scale rapidly, which makes them ideal for innovative startups, technological companies, and open innovation systems. Therefore, the suggested model enables explaining organizational processes through the analysis with phase transitions, highlighting the key role of innovations as the driving force of transformations. The suggested analogy and relationship between innovations and well-being level can be represented with the help of a picture that represents how heat impacts water states and phase change. Hence, heat changes solids to liquids, causing significant alterations. Molecule bonds differ depending on the state, and their ability to be mobile is represented in Figure 1.

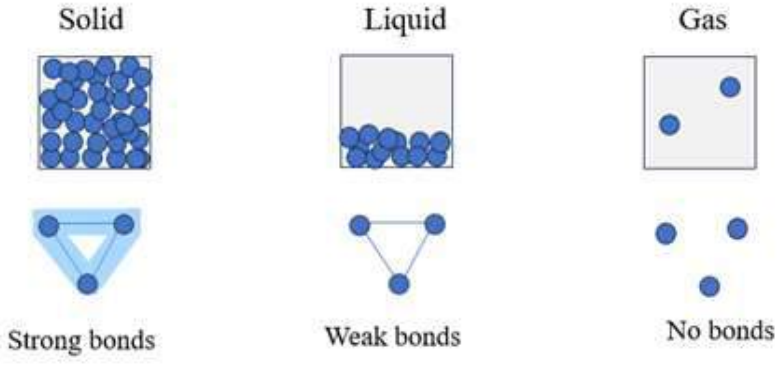

Figure 1. Molecule Bonds

Source: https://archive.ourworldindata.org/20250903-083611/grapher/daily-median-income.html?time= latest&overlay=download-data

Figure 2 shows how water molecules move under different temperatures and change phases. Hence, water becomes ice under 0 °C. Molecules lose their bonds when they are heated to over 100 °C. Weak molecule bonds (1—99 °C) make it liquid.

The figure of the human movement evolution speed from the 19th century till modern times indicates how innovations in transport technologies, from horse-drawn carriages to modern aviation and space systems, significantly increased the speed of human movement, impacting mobility and globalization (see Figure 3).

Information dissemination has also evolved due to the development of communication technologies. The invention of writing till the modern Internet has caused immediate global information distribution. This change enhanced rapid data, knowledge, and idea exchange.

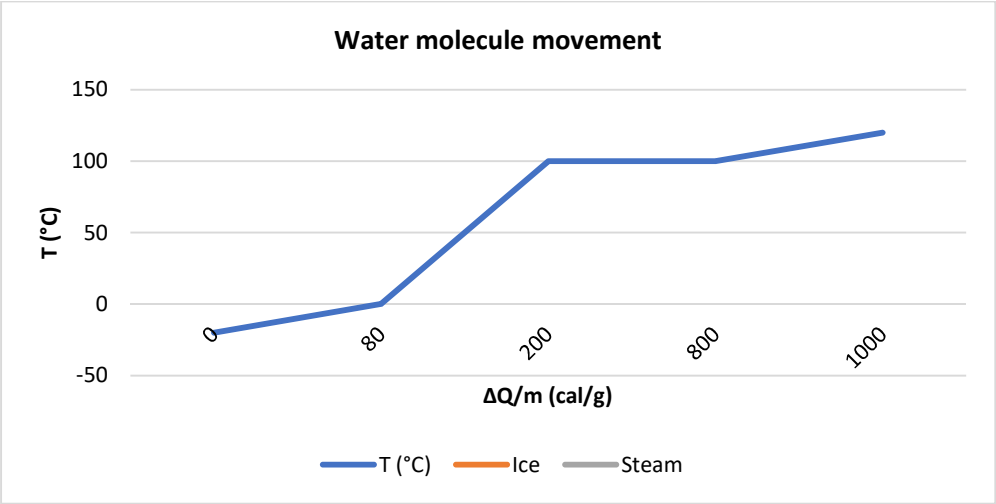

Figure 2. Water Molecule Movement

Source: https://archive.ourworldindata.org/20250903-083611/grapher/daily-median-income.html?time= latest&overlay=download-data

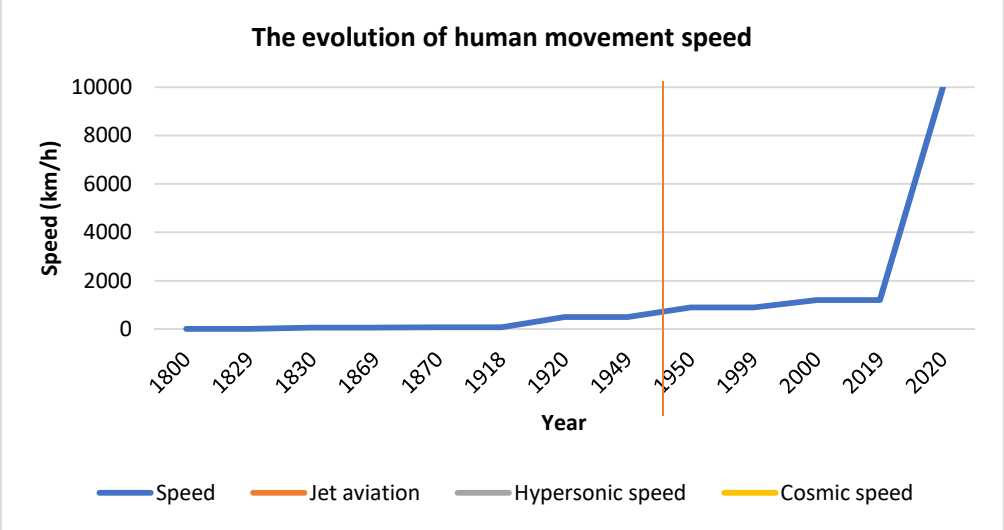

Figure 3. The evolution of human movement speed

Source: https://archive.ourworldindata.org/20250903-083611/grapher/daily-median-income.html?time= latest&overlay=download-data

Figure 4 shows the speed of information dissemination since 1850, highlighting that innovation and technology significantly enhanced data distribution time. Similarly, innovation has impacted people's income. Susskind (2024) examined the growth of people's income in the 19th century and found that in 1880, people got less than $1. In five years, this number increased to $1, while in 1930 it reached $1.6 (Sussking, 2024). Flynn (2023) analyzed the average global income to examine the

global statistics. Hence, the research found that the average global income per individual is $9,733 per year. Figure 4 shows changes in the daily income of people globally. In 1992, the average daily income per individual was $2.95 but it reached $7.56 in 2019 and continued to grow to over $8 in the 2020s.

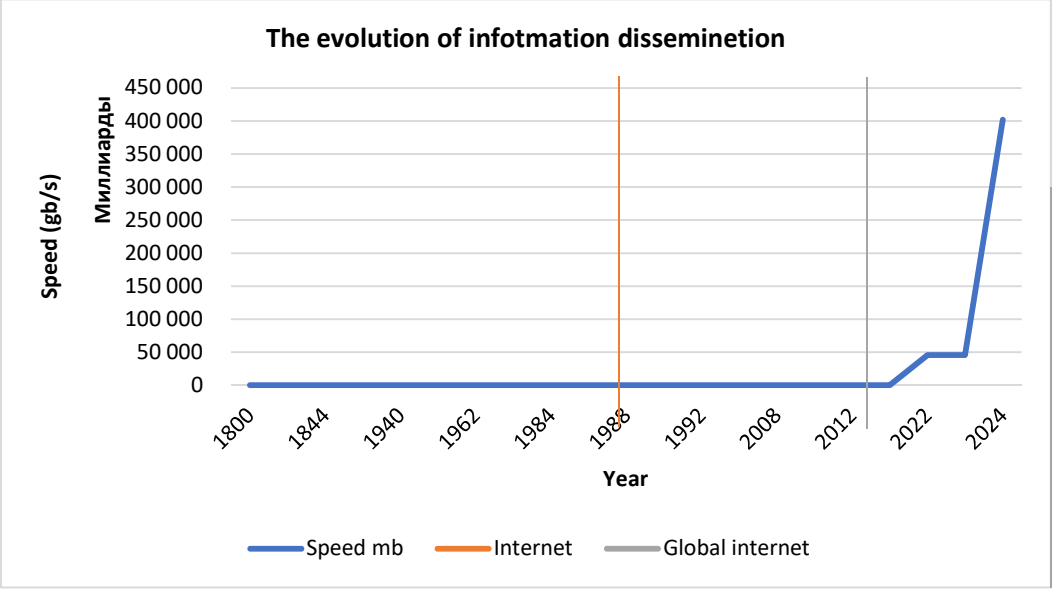

Figure 4. The evolution of information dissemination

Source: https://archive.ourworldindata.org/20250903-083611/grapher/daily-median-income.html?time= latest&overlay=download-data

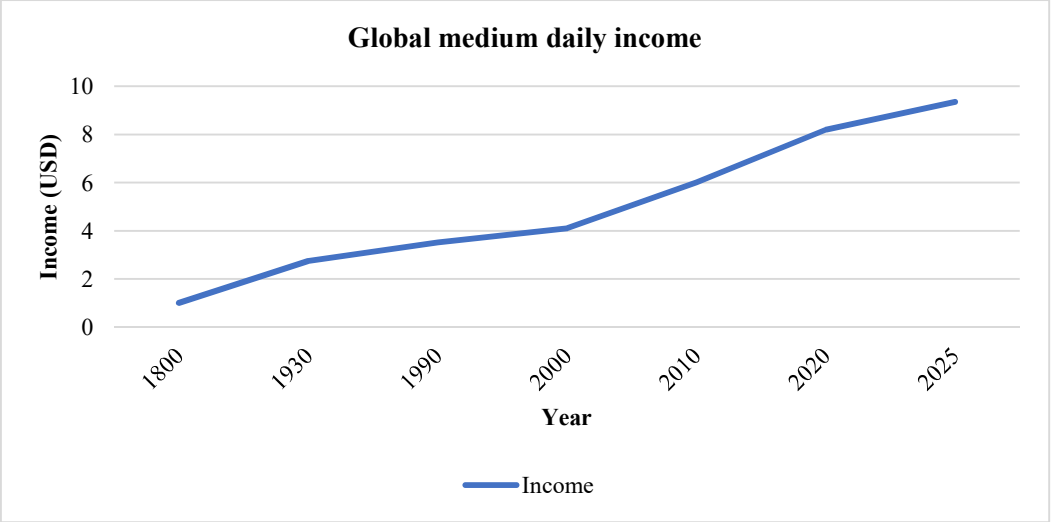

Figure 5. Global medium daily income (Flynn, 2023; Susskind, 2024)

Source: https://archive.ourworldindata.org/20250903-083611/grapher/daily-median-income.html?time= latest&overlay=download-data

The analysis of the above-mentioned figures enables to visually trace a general tendency of development. At first, changes occur gradually. However, after the achievement of the critical stage, there is a rapid acceleration. This is explained by water molecule movement while heating, which results in a phase transition. Similarly, innovation serves the role of energy that accelerates technological development, particularly in the spheres of movement, information dissemination, and other key processes. This enhances further productivity and effectiveness, which assists in developing a favorable environment for positive changes. Hence, there is an interrelation between innovation and technological breakthrough, followed by rapid growth.

Discussion. It would be beneficial to examine the development of quality models to assess the level of 'steamy' organizations on the basis of integrated indicators of innovation activity and adaptability to outside impacts. This presupposes the use of econometric modeling methods and statistical analysis to identify the correlation between structural characteristics of organizations and their capability to transform in changing environmental conditions. Moreover, the examination of the effectiveness assessment of creativity technique application as catalytic agents of innovation processes would help get a deeper insight into the question. It would include the analysis of experimental data and case studies with the aim of providing quantitative impact measurement of multiple creative thinking approaches in relation to the speed and quality of developing and implementing innovative solutions. Finally, further research should focus on the impact of management factors on phase transition speed in organizations. Increased attention should be paid to such aspects and the reduction of administrative pressure (the expansion of individual autonomy) and the increase of 'heat space' (total penetration of innovative culture) and their interrelation with the adaptability of organizational structures in different economic sectors.

Conclusion. The conducted research confirms that the analogy of water phase transition is an effective conceptual tool for analyzing the evolution of technology, economic, and organizational structures. Similar to natural systems, changes in society and business do not occur linearly but due to gradual innovation and energy accumulation, which at a certain moment result in a rapid jump — a phase transition. The analysis proves that irrespective of the examined sphere, whether the movement speed, information transmission, or economic growth, processes begin from slow development, and after reaching a critical point, they accelerate. Innovation performs the role of energy that makes the system move, while creative techniques are catalysts that enhance the more effective use of this energy. They ensure the transition from one technological paradigm to the other one, enhancing the appearance of new solutions and development models.

However, like in physical processes, this transition is not universal for all spheres. As in any law of nature, there are exceptions; the suggested concept admits that in certain spheres 'ice' structure is more appropriate. Hence, in military organizations, emergency systems, and crisis management, there is a rigid hierarchy and strict division of responsibilities, which are critical for rapid solutions and effective decision-making in uncertain conditions. Similar to how certain substances remain solid in physics even under changing environments, some organizational system requires stability to function with maximum effectiveness. At the same time, in dynamic spheres such as innovative business, startups, and creative industries, 'vaporous' structure is the most effective, as it ensures high adaptability and quick reaction to changes. However, there are spheres, for instance, healthcare, military, defense, banking, legal and judicial systems, in which 'ice' structure is the most suitable.

The success of an organization or system depends not only on its ability to transform, but also correct identification of an optimal management form according to its functional assignment.

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