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Digital culture as a basis for successful digital transformation of enterprises

Abstract. The concept of digital culture as a foundational element of successful digital transformation is explored through a fractal framework encompassing macro, business, and organizational levels. The article identifies key tasks for promoting digital culture, including the enhancement of digital literacy, the integration of organizational culture within the digital context, and fostering a culture of technological entrepreneurship. The research highlights the critical role of digital culture in creating value through transformational technologies such as artificial intelligence, blockchain, and big data, while emphasizing the challenges organizations face in adapting their cultural frameworks to digital requirements. Insights are provided into the integration of digital culture with leadership, resource development, and knowledge organization, showcasing its impact on digital maturity and competitive advantage. The discussion covers the role of digital congruence in enabling effective collaboration within ecosystems, the necessity of addressing digital divides, and the use of reverse mentoring as a method to enhance digital competencies. A focus is placed on how digital culture reshapes business processes and values to align with the demands of Industry 4.0. The study underscores the significance of fostering digital culture as a strategic imperative for enterprises aiming to thrive in a rapidly evolving digital economy. Recommendations include frameworks for assessing digital maturity, promoting digital literacy, and aligning organizational values with digital transformation goals.

Keywords: *Digital transformation, digital culture, digital literacy, digital maturity, Industry 4.0, leadership in the digital economy, digital congruence, strategic business development.*

JEL Classification: M15, O33, L21, O32.
Formulas: 0; Figures: 0; Tables: 0

Introduction. In the modern world, digital transformation has become the main driving force of Industry 4.0. Digital transformation is one of the main national development goals of Ukraine until 2030 and involves achieving digital maturity in key sectors of the economy and social sphere. Digital transformation is the introduction of digital tools in the processes of construction, planning, design, deployment and operation in traditional industries, accompanied by a significant improvement in their characteristics and results. All processes are undergoing changes due to new methods of collection (IoT, Big Data), transmission and storage (5G, quantum technologies, clouds, blockchain), data analysis and decision-making (artificial intelligence and neurotechnologies).

Every day it becomes more and more obvious that added value is created mainly through the use of transformational digital technologies (artificial intelligence, robotics, big data, distributed ledger systems, quantum technologies, new manufacturing technologies, industrial Internet, wireless communications, virtual and augmented reality). The use of business intelligence (BI) and big data analytics (BDA) in traditional decision-making processes increases the productivity and profitability of companies by 5-6% compared to their competitors [8]. Companies that use analytics-based machine learning algorithms increase their revenues by more than 15% [2].

There is no debate among experts that organizational culture determines the effectiveness of digitalization in a company, and insufficient attention to culture is one of the most frequently cited reasons for the failure of digital transformation. The scientific community is conceptualizing organizational culture in the digital context. However, there is a risk that digital culture may be presented as a consequence of digitizing the culture of a particular company or only as a manifestation of culture in the digital economy. Obviously, digital culture is a higher-level concept that describes not only the processes and results of digitizing the culture of a particular company, but also more broadly the forms and ways of identifying and developing human skills and knowledge not only in the professional sphere but also in all kinds of social processes.

Moreover, the concept of "digital culture" is not limited to digitization, i.e. the process of converting analog data into bit sequences (sequences of 1s and 0s). It is important that these digital objects, with the help of telecommunication networks, computer equipment, programs, and platforms, are transformed into digital resources to transform the practice of creating social and/or economic values. It is no coincidence that experts note that "unlike other methods of innovation, digitalization is based on the simultaneous development of a wide range of technologies" [3]. The term "digital culture" was coined by philosopher Charlie Geer in 2002. However, even today there is a need to generalize the main properties of digital culture.

Literature Review. Recent studies emphasize the transformative impact of digital culture on the digitalization processes of enterprises, underscoring its multifaceted nature and critical role in achieving a competitive advantage. Alpakova [1] and Veretiuk & Pilinskyi [3] highlight the significance of national strategies in fostering a digital economy, particularly in Ukraine's efforts to align with global digitalization trends. Key factors include the development of broadband infrastructure, 5G network adoption, and the promotion of digital literacy as enablers of digital transformation at the macro level.

Digital transformation, as noted by Arbabi [4] and Deloitte [2], extends beyond technological adoption to involve shifts in organizational culture, leadership, and operational models. Arbabi [4] emphasizes how digital transformation reshapes business ecosystems, enabling more efficient resource allocation and fostering innovation. Koliadenko [6] underscores the importance of digital culture in bridging traditional organizational practices with emerging digital paradigms, aligning with Industry 4.0 objectives.

A recurring theme in recent literature is the concept of digital maturity and its alignment across ecosystems. Rasool [8] and reports by the State Statistics Service of Ukraine [9, 10] stress that digital congruence, characterized by similar levels of digital maturity among partners, fosters collaboration and drives innovation. Howard [11] further explores the role of shared values and digital platforms in building cohesive ecosystems.

Challenges in embedding digital culture are also extensively discussed. Koliadenko [6] and the strategic vision for 2030 [12] point to barriers such as resistance to change, skill shortages, and misalignment between traditional organizational structures and digital requirements. Reverse mentoring and continuous skill development are proposed as effective strategies [9, 13], facilitating intergenerational knowledge exchange and enhancing digital literacy across hierarchies.

In summary, the reviewed studies highlight the pivotal role of digital culture in fostering transformation at macro, business, and organizational levels. They stress the need for strategic alignment, capacity building, and cultural adaptation to maximize the benefits of digitalization, integrating insights from both global and Ukrainian contexts.

Purpose, Objectives, and Research Methods. This study aims to investigate the role of digital culture in facilitating successful digital transformation of enterprises by examining its fractal configuration at macro, business, and organizational levels. The study employs a qualitative research approach, analyzing existing academic literature, industry reports, and case studies of enterprises undergoing digital transformation. Key objectives include defining the core characteristics of digital culture, identifying its impact at different levels, evaluating challenges and barriers to its integration, and proposing strategies for fostering digital culture to achieve digital maturity and competitive advantage.

Research Results. Digital culture, along with managerial leadership, staff engagement, digital resources and processes, forms the necessary environment for successful digital transformation of an organization. The isomorphism of these conditions at different levels - at the macro level, in the business environment, and within the organization itself - creates a pre-fractal dimension of the digital transformation environment. For example, at the macro level, leadership is manifested through the implementation of national programs for the digitalization of the economy, the development of digital technologies and information infrastructure, attention to information security and the spread of artificial intelligence, as well as training for the digital economy. Leadership in the business environment is demonstrated through leading research centers, cooperation with industrial partners and leading companies in the development and implementation of digital technologies.

Leadership in the organization, as an important factor in the digital transformation environment, means the active involvement of top management in all aspects of the process. This includes planning, distribution of responsibilities and powers, continuous improvement and optimization of procedures for developing, making, deploying and supporting decisions. It also involves systematic measurement and analysis of results and effectiveness of digital transformation projects, direct communication with stakeholders, and staff engagement. At the macro level, digital transformation resources are determined by factors such as household broadband coverage, average IPv4 connection speeds and data transfer, availability of 4G networks throughout the territory, the amount of radio frequency spectrum available for use by 5G/IMT-2020 electronic means, and the availability of a unified telecommunications network with fiber optic connection lines.

For the business environment, it is important to connect to data transmission networks that ensure sufficient information security, including quantum networks, as well as the dissemination of technologies for creating and executing decentralized applications and smart contracts, technologies for ensuring data integrity and consistency (consensus), and seamless interaction. A key resource for digital transformation at the organization level is a set of technologies and digital products based on them that provide computing, telecommunications and networking capabilities and operate on a digital basis. The study of digital culture should follow the same logic, i.e., it should be considered at the macro level as an attribute of the business environment and as a characteristic of the organization itself.

When it comes to the "macro-level" of digital culture, the state's task is to overcome the stereotype that "new generations have a new approach to devices and have developed quasi-inborn skills that offer companies great potential when entering the labor market" [9]. Indeed, the new

generation demonstrates considerable experience in using electronic services and products (streaming services, chatbots, video games, cryptocurrencies, online banking, cashback services), as well as relatively greater awareness of digital technologies (artificial intelligence, digital twins, blockchain, etc.) [4].

However, if we accept the rather widespread position that the embedding of search engines, algorithms and databases in various social and cultural practices shapes not only specific communication actions but also ways of understanding the social world around us, forcing us to think, assimilate information and act in the logic of archiving, organizing, filtering and searching, we can agree with the conclusion that digital culture is nothing more than the organization of knowledge. Thus, we should not talk about some quasi-inborn abilities, but about the need to supplement the minimum level of literacy, such as reading, writing, and arithmetic, with a fourth set of cognitive digital skills, and then to develop them consistently in the system of higher and secondary vocational education, which allows us to develop ways of critical thinking, noting what information is missing, searching for it, actually finding it, and, finally, processing the information found using digital resources.

It should be noted that in the field of education, skills in working with digital library environments and virtual platforms, cross-reviewing, digital visualization, using team editing tools, etc. are already being developed. However, not in all cases do the requirements for knowledge, skills and abilities, both general cultural, universal, general professional and professional, include mastery of digital technologies in the field of design, administration and testing, taking into account the development of coding skills, including teamwork using digital tools, working with version control and cross-review systems, working with unstructured data and virtual reality, as well as machine learning. At the same time, the state should focus on addressing the digital divide, such as ensuring equal access to information technology, ensuring the reliability of ICT and the quality of communication in the frontline areas, and the usefulness of the results of using the Internet and ICT in various economic systems.

This stereotype has a negative impact on the decisions made by the management of organizations. According to a survey conducted in 2020 by the KCSA among 700 representatives of Ukrainian companies from 27 industries, 30% of managers intend to replace "insufficiently competent employees with new ones from the market" as a way to address the lack of digital staff and competencies, and 34% plan to engage external consultants. While the receptivity of the new generation to digital resources is an important phenomenon, recognizing it should lead to another approach - reverse mentoring. This approach involves a partnership between managers and young employees, where the latter share their knowledge and skills on digital transformation. The goal of reverse mentoring is to increase digital literacy by sharing valuable information and skills across generations, stimulating interaction between leadership and young talent.

Experts point out that the values of the new generation determine their requirements for business processes, personal space, communication and lifestyle. Representatives of this generation believe that freedom, honesty, and realism in the environment are necessary for existence, and interaction with the younger generation requires elements of play and a fast pace. They strive for practicality and efficiency, are ready to cooperate and seek mutual benefit. The development of the younger generation is characterized by changing interests, diversity, and the fear of missing out on opportunities. These values are formed on the basis of understanding the mechanics of video games, such as the on-demand format, the gameplay loop principle, the ability to control dynamics, interaction through the environment (mediated cooperation), the inclusion of the marginalized, the formation of a digital footprint, and more.

Instead, the company's management should identify the components of the current organizational culture and take measures to reduce or remove those aspects of the culture that impede or slow down the process of digital transformation, as well as establish such aspects of the culture that facilitate the implementation of the relevant strategy. In particular, experts believe that

among the most important cultural values of a digital enterprise are rapid change and leadership. Even if there is a lack of resources or other priorities, management should actively pay attention to local digital initiatives within individual projects, functions, departments, or channels, as their implementation contributes to the formation of values characteristic of the digital culture.

Digital goals and standards that are shared across business units should become values in themselves for the new organizational culture. Digital technologies help leaders build shared values by allowing them to share values with everyone in the organization through simple emails or social media posts. With the increased visibility of communication, influencers can more effectively communicate their values and encourage others to share them.

The definition of digital culture as a means of organizing interaction with external stakeholders, including customers and all participants in the value chain, has significant functional significance. Obviously, the key characteristic of digital culture is digital congruence, which implies a similar degree of digital maturity of business partners and a common digital agenda through the development of modern ecosystems based on cloud and multiservice software and hardware platforms, in accordance with the Industry 4.0 architectural model (RAMI 4.0). In this context, an important task is to clarify the concept and develop a methodology for assessing digital maturity, which covers not only competitors but also existing and potential partners.

Ensuring the spread of digital culture in the business environment involves the creation and cooperation of a critical mass of startups, professional investors, and a support ecosystem that understands smart financing. Establishing trust between participants will ensure that the results obtained through financial innovation can be scaled up.

Discussion. The findings of this study reinforce the notion that digital culture serves as a foundational element for successful digital transformation. A key insight is the fractal nature of digital culture, influencing transformation across macro, business, and organizational levels. This supports Alpakova's [1] assertion on the critical role of national strategies in promoting a digital economy and Veretiuk & Pilinskyi's [3] emphasis on Ukraine's digital priorities.

The study demonstrates that digital culture represents a paradigm shift, necessitating the alignment of leadership, values, and resources with technological advancements. Arbabi's [4] view that digital transformation demands systemic innovation and rethinking of business models is strongly reflected in the findings. Leadership and resource development, combined with cultural adaptation, emerge as crucial components for achieving digital maturity, as also noted by Koliadenko [6].

A significant challenge identified in the research is the digital divide, which remains a critical barrier to digital transformation. The disparity in ICT infrastructure and access, particularly in Ukraine's frontline areas, hinders inclusive digital growth. This aligns with the State Statistics Service of Ukraine's reports [9, 10] and the UKRAINE 2030E vision [12]. Addressing this gap is essential for ensuring equitable opportunities for transformation.

The study also emphasizes the human factor in successful digital transformation. Reverse mentoring, as highlighted by Rasool [8], provides a practical approach to bridging generational skill gaps and fostering collaboration. This approach aligns with the values and expectations of the new digital-native workforce, promoting innovation and inclusivity.

Another notable contribution of the study is the introduction of digital congruence as a critical feature of effective ecosystems. Shared digital maturity among partners enables seamless collaboration and innovation, aligning with Howard's [11] exploration of cohesive digital ecosystems. This concept highlights the importance of aligning organizational values and partner dynamics with transformation objectives.

While the study provides a comprehensive framework for understanding digital culture's role, further empirical validation is necessary. Future research should focus on assessing the impact of digital congruence in specific industries, developing methodologies for measuring digital

maturity, and exploring the interplay between organizational culture and digital competency development.

Conclusion: This study contributes to the understanding of digital culture as a critical foundation for successful digital transformation in enterprises. It highlights the fractal nature of digital culture, influencing transformation across macro, business, and organizational levels. By emphasizing the role of leadership, digital literacy, and resource development, the study provides a framework for aligning cultural values with the strategic goals of digital transformation.

The research identifies several challenges to embedding digital culture, including digital divides, resistance to change, and gaps in digital competencies. These challenges mirror global trends and underscore the necessity for comprehensive strategies that prioritize cultural adaptation alongside technological implementation. Reverse mentoring, fostering digital congruence, and addressing digital maturity are proposed as effective approaches to overcoming these barriers.

The findings also emphasize the importance of aligning organizational culture with the principles of digital transformation, as cultural misalignment is often a primary reason for transformation failures. The concept of digital congruence, ensuring shared digital maturity within ecosystems, adds a novel perspective to existing frameworks, highlighting the importance of collaboration in achieving digital maturity.

From a practical standpoint, the study offers actionable recommendations for organizations embarking on digital transformation. These include fostering a digital-first mindset, addressing infrastructure gaps, promoting intergenerational knowledge sharing, and adopting frameworks for assessing digital maturity. The integration of digital literacy programs and leadership engagement at all levels of transformation is also emphasized as a critical success factor.

Future research could focus on empirically validating the proposed strategies, exploring industry-specific digital transformation models, and developing standardized tools for assessing digital culture and maturity. Investigating the interplay between cultural values, digital competencies, and organizational performance in diverse contexts would further enhance the understanding of digital transformation dynamics.

In conclusion, the successful integration of digital culture is a multifaceted challenge requiring a balance between technological advancements, cultural adaptation, and human resource development. Enterprises that embrace a cohesive, inclusive, and data-driven approach to digital culture will be better positioned to navigate the complexities of the digital economy and achieve sustained competitive advantage.

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Цифрова культура як основа успішної цифрової трансформації підприємств

Анотація. Концепція цифрової культури як основоположного елемента успішної цифрової трансформації досліджується через фрактальну структуру, що охоплює макро-, бізнес- та організаційний рівні. У статті визначено ключові завдання для просування цифрової культури, у тому числі підвищення цифрової грамотності, інтеграцію організаційної культури в цифровий контекст та формування культури технологічного підприємництва. Дослідження підкреслює критичну роль цифрової культури у створенні цінності за допомогою трансформаційних технологій, таких як штучний інтелект, блокчейн і великі дані, водночас наголошуючи на викликах, з якими стикаються організації в процесі адаптації своїх культурних рамок до цифрових вимог. Надається розуміння інтеграції цифрової культури з лідерством, розвитком ресурсів та організацією знань, демонструючи її вплив на цифрову зрілість та конкурентну перевагу. Обговорюється роль цифрової конгруентності у забезпеченні ефективної співпраці в екосистемах, необхідність подолання цифрового розриву та використання зворотного наставництва як методу підвищення цифрових компетенцій. Основна увага приділяється тому, як цифрова культура змінює бізнес-процеси та цінності відповідно до вимог Індустрії 4.0. Дослідження підкреслює важливість розвитку цифрової культури як стратегічного імперативу для підприємств, які прагнуть процвітати в умовах цифрової економіки, що швидко розвивається. Рекомендації включають рамки для оцінки цифрової зрілості, просування цифрової грамотності та узгодження організаційних цінностей з цілями цифрової трансформації.

Ключові слова: Цифрова трансформація, цифрова культура, цифрова грамотність, цифрова зрілість, Індустрія 4.0, лідерство в цифровій економіці, цифрова конгруентність, стратегічний розвиток бізнесу.
Класифікація JEL: M15, O33, L21, O32.
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