Digital Ecosystem: A Mechanism of Economic Organization of Enterprises of the Future

Oleksiy Osiyevskyy
University of Calgary, Canada

Yurii Umantsiv
State University of Trade and Economics, Ukraine

Yuliia Biliavska
State University of Trade and Economics, Ukraine

Abstract

Today's era of massive accumulation of digital data allows tracking consumers' digital footprints and market trends up to minor nuances, enabling new models for managing businesses. Today's firms are interested in leveraging these processes, as they allow combining the analysis of changing consumer needs with the assessment of internal business processes. This combination forms a direct path from Industry 4.0 to the broader digital ecosystem as a model of economic organization. This article presents a holistic model of an enterprise's digital ecosystem, describing its enablers, components, and internal and external environments. Furthermore, despite numerous advantages, one should not forget about risks at all levels of the digital ecosystem, as they carry varying degrees of threat to the enterprise. For the latter, we present a practical tool (digital ecosystem risk matrix) to protect the enterprise and preserve its resource potential.

Introduction

Despite its unquestionable relevance in explaining today's global economy, the "Industry 4.0" paradigm is slowly losing its position as a trend of the future, becoming the mainstream, short-term strategy on the agendas of many enterprises in both developed and emerging economies.[1] To explain

the trajectory of development of modern enterprises, organizational theories must aim at cooperation between enterprises and empowering automation, cloud technologies, artificial intelligence, 3D and virtual reality, and various technologies for business transformation and management.

Virtual customer interface, digitization, digital business models, data lifecycle, digital workflow and other recently emerging terms are actual tasks and jobs of the near future, not strange words from a futuristic blockbuster. Changes happen rapidly across all industries and *force majeure* circumstances such as pandemics, wars, and disruptive innovative technologies (such as generative AI) dictate new daily challenges to society.

More and more often, the performance of business tasks is becoming automated, and robots are taking people's jobs. We also constantly see the changes that business expects from employees, and the HR service of enterprises of the future faces organizational challenges that require the search for talent and the ability to work under conditions of social upheaval, destabilization and unprecedented risks. Competition for talent is growing fiercer than ever as more emphasis is placed on soft management skills and the ability to navigate the constantly changing industrial paradigms by adjusting the organizational models, structures and practices.

The history of technology systems is eventful and continues to evolve rapidly. The emergence of modern management systems and digital transformation is inextricably linked to the achievements of industrial revolutions. During the First Industrial Revolution, industry experienced rapid development and became the new foundation of the economy. New modes of transportation and the mechanization of production paved the way for mass production, which became vital during the Second Industrial Revolution. With the development of technology, the Third Industrial Revolution was marked by the discovery of biotechnology, the development of telecommunications, computers and the Internet. Such conditions allowed the world to move to the Fourth Industrial Revolution and plunge into the digital world. Enterprises are mostly completing the digitization phase, e-commerce, digital marketing, social media, high-tech manufacturing are rapidly spreading, and general business management processes are changing. Thus, the mentioned industrial changes, under the influence of globalization processes, are transforming the present into a new stage, the stage of the digital ecosystem (Table 1).

Table 1. The evolution of industrial revolutions and the digital ecosystem

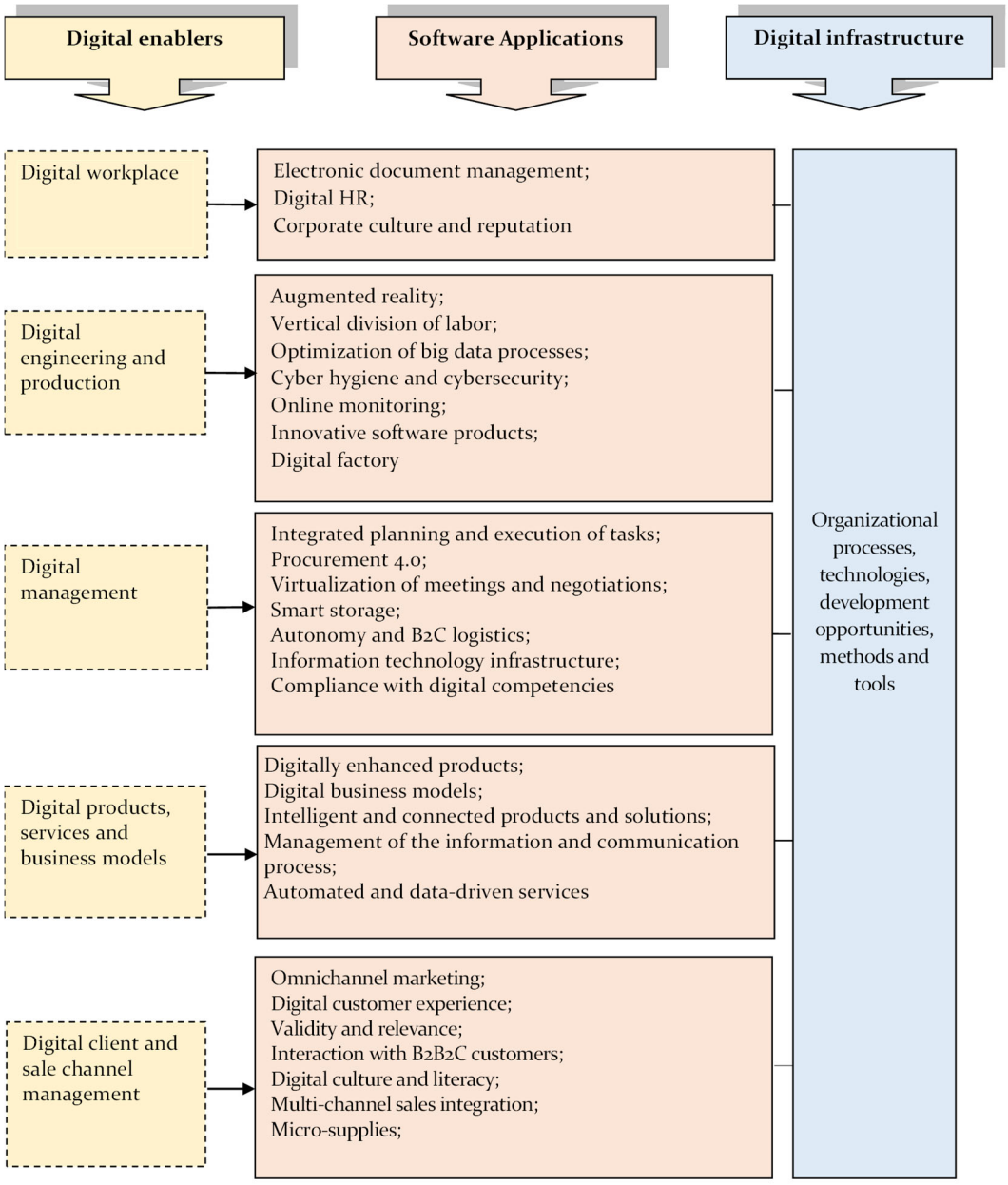
Mechanization	**STAGE 1 (1770-1890)** **The First Industrial Revolution**	**STAGE 2 (1890-1950)** **The Second Industrial Revolution**	*Electrification*
	The invention of mechanical production using water and steam marked the beginning of the First Industrial Revolution	The transition to electrification and assembly lines due to the change from coal to oil, the invention of electricity and the electric motor. The first conveyor was launched, which made it possible to significantly increase labor productivity.	
Digitalization	**STAGE 3 (1950-2010)** **The Third Industrial Revolution**	**STAGE 4 (2010-2025)** **The Fourth Industrial Revolution**	*Robotics*
	Formation of a post-industrial society and transition to informatization driven by to advancement of communication and information technologies, the Internet and the ability to work with information	Accelerated development and convergence of the latest technologies and universal innovations. The prospects for automation and robotization of all areas of production, the emergence of artificial intelligence opening up wide opportunities for the global economy for individuals and society	
STAGE 5 (from 2025) **Digital ecosystem**			
Virtualization			
The key features of this stage are the virtualization of processes and systems, digitization of documents, and the expansion of cybersecurity and cyber hygiene regulations. Expanding opportunities for sectoral cooperation through fast information processing, flexible and integrated networks in the activities of enterprises			

The Emergence of Digital Ecosystem

A digital ecosystem is a digital space based on one or more digital platforms. It includes a set of services that enable users (customers) to satisfy various needs within the framework of implementing a single process.[2] The rise of the importance of digital ecosystems makes enterprise management a unique talent which hinges not only on professional knowledge, abilities, and skills, but also on the mastery of technologies and innovations (Figure 1).

On a broad level, the evolution of national consciousness is accompanied by permanent transformations in all the areas of social relations. Going through the complex path of choice and self-identification, society tries to determine priorities and guidelines for its prospects, and today the digital ecosystems allow to speed up and facilitate management processes. The spread and use of the Internet impacted science, technology, culture, art, and politics, but, above all, it affected the economy and business.

Figure 1. Digital enterprise enablers in the ecosystem



Source: proposed by the authors based on the PWC Report[3]

That is why organizations or enterprises of the future are focused on implementing digital ecosystems. An ecosystem envisages the full application of innovations, where big data, artificial intelligence, 3D printing, industrial robots, digital workplace, genomics, VR technologies, 5G communications, digital sale channels, cloud sources of information and smart cities become normal business processes of an enterprise. As presented

in Figure 1, digital enablers contribute to the implementation of a digital ecosystem, which may include many interacting organizations that are not governed by vertical hierarchical authority. Despite this, every ecosystem has a leading organization at its centre (an ecosystem organizer). It owns a digital platform and, accordingly, sets the architecture and defines the main parameters - the rules of interaction of ecosystem participants, standards, and interfaces. At the same time, other participating entities have the right to develop their own pricing policy, assortment, service level, etc.

Thus, the digital ecosystem is a set of interconnected digital enablers such as workplace, engineering and production, digital management, digital products, services and business models, and digital client and sale channel management that create value for internal and external market participants through digital platforms and technologies. The digital ecosystem saves resources by digitizing information and virtualizing management processes and customer relations. Digital technologies define and facilitate the traditional interdependence between businesses. Within this view, managers have learned to transform the business environment into a digital ecosystem, and digital ecosystems provide companies with new sources of value and new ways for growth. Two sets of concepts underpin this framework: (1) production and consumption ecosystems and (2) digital envelopes and product-in-use information.[4]

As software takes over the world, leaders in nearly every industry must have an understanding of digital ecosystems. The tech world has been waging an ecosystem battle, with Apple, Amazon, Microsoft, and Google as the most prominent combatants over the last few years. A notable competitor in the digital ecosystem market is Facebook, which is evolving from a social network to a digital ecosystem and something like an operating system for individual digital identity. Facebook must have realized this a long time ago and allows customers to fragment the interface by separating Facebook chat as a separate app and keeping Instagram and Whatsapp as separate apps.[5] Horizontal integration of digital ecosystems should also include customers, partners and third-party services. Facebook serves brands and enterprises looking to take advantage of Facebook's broad user penetration with Atlas and Pages Manager. At the same time, Facebook allows third-party developers to create apps and services through the Facebook App Center, Open Graph, and Pars, and enables co-creation and open innovation while enabling data collection via Facebook Connect.

Some researchers properly reveal the essence of digital platforms as destroyers of classical forms of business, defining them as a modern model of interaction of both the company's partners and its cooperation with customers.[6] The activities of the digital team combine offline and online

forms of business processes, which ensures its cross-channel interaction with customers. The digital team model involves the digitalization of knowledge movement in the organization, which includes digitizing the knowledge base and using online sources of knowledge and information (including crowdsourcing technologies).

One of the significant factors that directly affect the efficiency of the enterprise and the achievement of its strategic goals is the uninterrupted supply of goods, raw materials, components, consumables, and tools. Today, enterprises are developing in the context of intensifying competition for target markets, new information and communication technologies, new forms and distribution channels, and the introduction of innovative services.[7] Summarizing the given definitions, we conclude that enterprises' activities require the implementation of digital ecosystems as this is an integral part of the transition to new life cycle stages.

Digital ecosystems are oriented toward the enterprises of the future, and therefore the opinion of F. Laloux, who identified seven stages through which organizations around the world passed, is interesting and relevant. Some of them are "turquoise" organizations or companies of the future. Their main idea is that everything is built on three main principles: self-management, pursuing evolutionary goals, and integrity. In fact, the first turquoise organizations appeared 30 years ago, when people were tired of total management control and internal competition. Now there are more such organizations, and changes in management views increasingly require the development of digital ecosystems.[8] Thus, studying the digital ecosystem as a trend of the future, we consider it appropriate to view it in two directions: the digital ecosystem of the internal environment and the digital ecosystem oriented towards the external environment.

Digital ecosystem of the internal environment

The internal environment of the enterprise is a set of factors that are created, controlled, and determined by internal variables, that is, situational factors within the enterprise. Within the framework of the digital ecosystem, it is useful to distinguish between the digital objects and the infrastructure of transmission, storage, use, processing of information, and also the users of this system and factors that affect the interaction of participants. All these indicate the peculiarities of the ecosystem of the internal environment of the enterprise.[9]

The transformation of information systems takes place under the influence of information flows, while the information itself in such conditions becomes a resource that can be produced and used alongside material inputs.[10] Although consumers are at the center of the ecosystem, and

they want to receive services and make purchases quickly and in one place, this will not be possible without the effective operation of the internal environment, clear organizational processes and the creation of shared values between customers and business representatives are necessary. Features of the components of the internal environment of an enterprise that uses a digital ecosystem are shown in figure 2.

Taking into account the peculiarities of the internal environment of the enterprise, it is worth noting that the formation of an effective digital ecosystem is quite possible if a clear strategy is followed, which would fully correspond to the opportunities that open up in a fully digital environment. It should be based not only on the enterprise's current activities and business model but also on new business models that will become available after the implementation of the digital ecosystem.

The strategy and vision of the enterprise, as elements of the internal environment, should support the implementation of the following tasks:

1. Adjustment of processes. The functioning of any enterprise is possible thanks to clearly organized processes and the formation of an effective business process as a whole. The digital ecosystem needs adjustments, namely the expansion of the information infrastructure and its renewal or change.

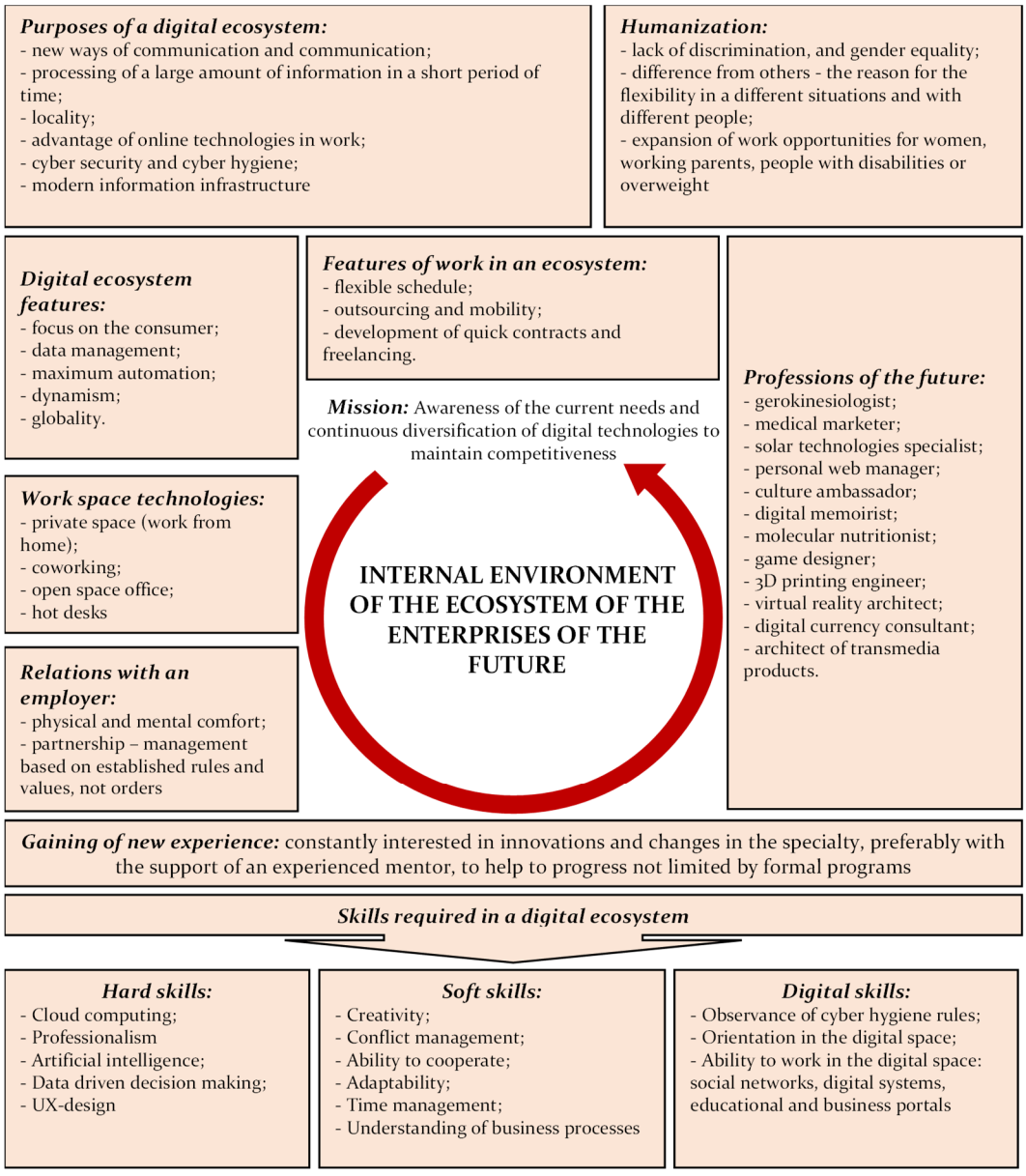
2. Organization and skills. Transitioning to the digital ecosystem requires the improvement of knowledge and skills. Achieving this will also require a shift to an open digital culture that learns quickly and facilitates the communication process between different media, applications and user groups. Cultivating talent and experience is necessary to create technology and implement new operations in the digital ecosystem.

3. Performance management. Develop a set of simple business rules covering the management of the digital ecosystem, as well as the key performance indicators needed to measure results.

4. Partnership and teamwork. Digital ecosystems require a focus on clearly defined tasks of each participant in the process. Internal processes require resource and technology providers.

5. Technologies. A digital ecosystem is not possible without the development of a technology roadmap, including the level of information integration, databases and analytical capabilities, as well as cloud technologies.

Figure 2. Virtualization of the internal environment of the enterprise of the future



When studying the possibilities of the internal environment of the enterprise in the context of digital transformation, it is important to take into account the time for adaptation of IT processes, as well as globalization changes. In this case, it is important to ensure constructive leadership of the management apparatus because the enterprise's activity requires effective internal organizational processes and cooperation with stakeholders as participants in the external environment.

Under the influence of globalization changes, it becomes evident that the formation of digital ecosystems is influenced by consumer requests to receive goods and services as quickly as possible using digital channels; rapid development of technologies (for example, big data API), which makes it possible to organize the interaction with customers in digital channels; changing the views of the modern consumer regarding the processing and use of personal data. Thus, the digital ecosystem is not only the internal business processes of the enterprise, but also the main direction of the enterprise's life in the conditions of the external environment.

Digital ecosystem of the external environment

The digital ecosystem is designed to meet the needs of a key participant in the external environment, namely the consumer. Satisfying different customer needs, the digital ecosystem operates in different market segments. If its elements work separately within the limits of their activities, they will not be able to achieve a synergistic effect. By interacting, organizations work to complement each other. Functioning within the digital ecosystem contributes to: (a) increasing the competitiveness of each of its participants; (b) entry of enterprises to new markets; (c) reducing the costs of attracting new customers; (d) expansion of the client base; (e) receiving profit from non-core activities; (f) increasing investment attractiveness; (g) strengthening the brand and increasing the value of the business.

Competition research provides conclusions about the efficiency of the market, factors for its development, and weaknesses in market infrastructure and provides recommendations for solving existing problems.[11] An enterprise, as a participant of the external environment, can participate in one or several ecosystems and play different roles in each of them. World leaders in the digital ecosystems' development, such as Amazon, Apple, IBM, Ford, Intel, SAP, Cisco, Tesla, invest in the creation of their own ecosystems, thereby contributing to the development of other participants' capabilities in the implementation of innovative projects.

J. Moore introduced the term "entrepreneurial ecosystem" and argued that enterprises do not develop in a "vacuum", but in a specifically defined environment where there is interaction with representatives of its environment, suppliers, customers, investors and financial institutions. In his scientific works, J. Moore suggests considering the enterprise as part of a business ecosystem that crosses different industries, and not as a representative of one. Thus, the entrepreneurial ecosystem allows enterprises to combine their capabilities. This approach is especially important in the process of supporting and developing startups, since such businesses require special operating conditions, and the ecosystem is designed to provide such

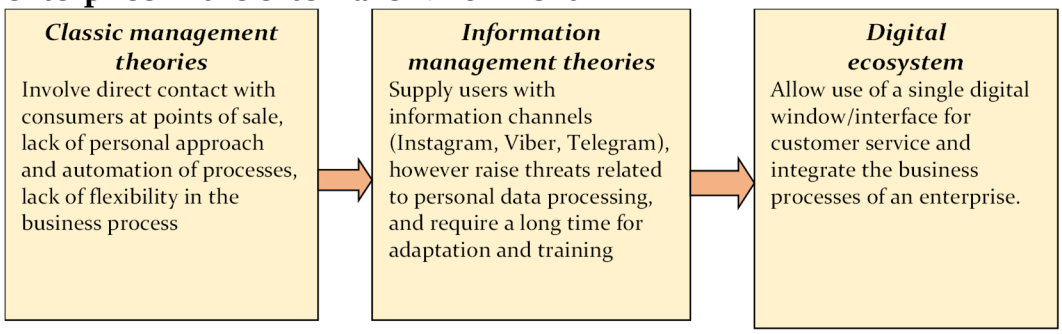
conditions, in that all its components work together and are competitive to support innovative developments, ideas, predict customer needs and satisfy them.[12] That is why the digital ecosystem, which is oriented towards the external environment, performs certain joint tasks regardless of the domain of activity of the company or the country.

First, the digital ecosystem is considered as a set of participants, i.e. interacting organizations involved in the creation of a value chain.

Secondly, it is a trading platform where you can buy various goods and services without visiting various stores, order delivery and pay for them, i.e. marketplace.

Thirdly, the digital ecosystem is an evolving organization, that is, an enterprise that uses innovative approaches to creating and promoting its products. That is why the digital ecosystem can be a process involving suppliers, consumers, producers, the state and other stakeholders that form a collective result. And this result is impossible without digitization and IT technologies that can unify the process and accelerate the execution of each individual element in the set time period (Fig. 3). That is why the digital ecosystem can be a process involving suppliers, consumers, producers, the state and other stakeholders that form a collective result. And this result is impossible without digitization and IT technologies that can unify the process and accelerate the execution of each individual element in the set time period (Figure 3).

Fig. 3. Evolution of changes on the way to digital transformation of the enterprise in the external environment



The evolution of changes in business management is the formation of an open digital ecosystem for participants, state support and the formation of a competitive environment due to the conditions for the development of digital services. In such conditions, the state does not directly participate, but it is very important when it can create an environment for development due to an effective business support strategy. Therefore, in today's conditions, the limiting factors that inhibit the development of digital ecosystems include

the low level of quality and competitiveness of products, and sometimes the absence of production and dependence on the import of raw materials; significant physical and moral wear and tear of equipment, which affects not only the competitiveness of goods or services, but is also unable to implement the digital ecosystem; non-compliance with environmental policy and resource-saving technologies, which is one of the main tasks of the digital ecosystem.

Enterprises are increasingly taking the path of creating and using digital ecosystems in their work, choosing platforms with the appropriate information technology infrastructure. This makes it possible to automate work processes, increase competitiveness and combine various types of activities within a single ecosystem. From the point of view of macroeconomic parameters, the development of digital platforms and ecosystems can lead to positive effects, in particular, to an increase in the rate of economic growth, an increase in enterprise productivity and innovative activity in the economy, the expansion of international trade, and also influence the labor market, inflation and other macroeconomic variables (Table 2).

Table 2. Study of the impact of digital ecosystems on economic development

KPI	Features	Examples
Pace of economic growth	Contributes to increasing the rate of economic growth due to direct influence; reduction of transaction costs; growth of enterprise productivity	The largest e-commerce market can be seen in China. Retail is growing and developing at a rapid pace.[13]
Production capacity	There is a reduction in information asymmetry between market participants; elimination of the least productive players and increased competition among the remaining ones; reduction of transaction costs.	Industry initiatives and public and private investment promote digital innovation. This, in turn, helps to improve production capacity, accelerate processes, and form a digital ecosystem. As part of the EU initiative "Digitalization of European Industry", up to 50 billion euros of public and private investments are expected to support the industrial digitalization.[14]
Labor market	The emergence of digital platforms reduces transaction costs and enables enterprises to outsource part of services, primarily non-core services such as cleaning, security and logistics. The development of freelance platforms can increase the flexibility of labor supply and demand, reduce geographic	On July 18, 2022, the European Commission published The EU Pact for Skills - Skills Partnership for the Digital Ecosystem. In June 2020, the European Commission presented the European Agenda for Skills, which outlines key measures in key areas such as joining forces in collective action, supporting lifelong learning, investing in skills and abilities.[15]

	barriers in the labor market, and increase the number of employees due to the involvement of people with disabilities.	
International trade	The digital ecosystem contributes to the growth of international trade by reducing the transaction costs of buying goods abroad.	International trade is undergoing significant changes under the influence of force majeure circumstances such as the COVID-19 pandemic. It is worth highlighting the development trends in certain regions: the United States is the leader in the number of e-stores; Asian countries dominate the global market in terms of online sales; European countries are leaders in the quality of online trade infrastructure.
Customer demand	The digital ecosystem of consumer demand can be traced in the growth of the number of participants in platform markets due to the appearance of new services, increased ease of use of services due to a single point of access to various categories of services, loyalty programs, savings due to package deals.	An important trend today is the digitalization and robotization of business processes in retail. Consumers are already accustomed to digital communications (chatbots, ChatGPT, callbots, messengers). Retailers are launching mobile applications and constantly improving their functionality to provide comprehensive information to consumers. Artificial intelligence helps to personalize products, increase the relevance of personalized offers, and ensure sales growth.[16]

From the examples presented above, we observe quite positive trends of the implementation of digital ecosystems, but the concept of a digital ecosystem in most countries still remains informal. Most often, the states, in the form of regulators, highlight some features that make it possible to form an idea about these objects, but do not ensure their full-fledged operation. That is why, in different countries, the concept of an ecosystem varies from a set of objects that carry out activities with the help of digital technologies, to the inclusion of infrastructure and rules for the use of digital technologies. Modern challenges of digital transformation are changing traditional business models. For the sustainable strategic development of the enterprise, it is necessary to analyze the trends of digital transformation and monitor the threats and risks arising from it.

Digital ecosystems, business strategy and managerial practice

The vector of the long-term development of the enterprise and its ecosystem is a way to achieve goals in the market environment and address the challenges that arise in the management system. The business strategy creates guidelines for the development of the ecosystem and an action plan to build a competitive advantage, meet customer needs and improve

operational efficiency. Strategy shapes the company's vision and defines strategic goals for the following areas: marketing, financial results, operational performance, and capital investments.

Innovative technologies and modern global megatrends pose a number of challenges to companies in various industries, which should be addressed by a strategy. In Table 3, we rearrange the relationship between the elements of the digital ecosystem and the business strategy of an enterprise operating in any industry, since innovative approaches and technological development are necessary to maintain competitiveness in the market environment.

Table 3. Interconnection of digital ecosystem elements with the company's business strategy

Elements of the digital ecosystem	Global trend	Potential strategic challenges in the business
Process automation, selection and organization of a digital platform, digital literacy, effective operation of internal and external environment factors	Increasing the use of IT technologies in production	Application of effective technologies that ensure efficiency gains at minimal cost Adherence to the systems that are necessary for the company to maintain competitive advantages
	Increasing world population	Focus on innovative technologies in the creation of goods and food products to increase the number of products Aggressive strategy in growing markets or defending positions in stable markets
	Raising quality standards for consumer goods	Compliance with global quality management system control methods Be able to maintain competitive advantages and comply with international requirements and environmental standards
	Price segment management	Keeping more reserves or maintaining minimum stocks during peak prices. Formation of logistics routes to cover markets in other regions or reduce transportation costs for local consumers Consideration of risks when entering into long-term contracts

Strategy development begins with determining the goal and reasons why the company is not achieving its vision now. We believe that the SMART approach to developing a link between technological acceleration and shortening strategic timeframes is appropriate, as it will allow us to take into account the following areas: specific, measurable, action-oriented, realistic,

time-related. This will allow the business strategy and the enterprise ecosystem to form clear perspectives with answers to a number of questions.

1. Mission of the enterprise. Opportunities to understand the current situation of the business, taking into account the work of internal and external environment factors.
2. Criteria for success in the market. Identify quantitative and qualitative parameters for successful satisfaction of the needs of the enterprise and market participants (consumers, competitors, partners).
3. Scope of work and tasks. Determine what is and is not included in the strategy by forming an action plan with deadlines for a clear period of time.
4. Limitations. Determining the depth of the analysis and the presence of obstacles.
5. Sources of approach. It will help to answer the question of what are the best practices, expertise and approaches, as well as what skills and knowledge are needed.

Thus, the main goal of the strategy should be cascaded into reasons or hypotheses that together answer the main question in the formation or operation of the digital ecosystem. It is necessary to develop an effective structure of the problem that can be analyzed in the least number of steps and provide the necessary answer, as well as take into account potential risks.

Possible risks of implementing the digital ecosystem in the company's activities

Many researchers stress the risks inherent in managing digital technologies.[17,18,19] On the one hand, current literature on digital technologies tends to overestimate the positive impact of digitization and its transformative potential, but underestimates the potential risks associated with the implementation of such technologies.[20] On the other hand, the digital ecosystem risk management literature describes numerous models and frameworks for the types and sources of risks, as well as strategies for reducing them. In our research, we focus on the fact that in the conditions of digitalization, the key problem is the security of information data and the lack of qualified management personnel (who are focused on creativity, the implementation of innovations and are able to form a digital strategy), and this, in turn, provokes economic, organizational and information risks.

We believe that the development of a risk matrix will allow to identify and analyze possible threats to the enterprise's digital ecosystem. When researching risks related to digital ecosystems, it is important to take into account that they can be of economic, social, demographic, geopolitical, financial, informational, technological, and organizational nature, and also

arise at all levels of the ecosystem and carry varying degrees of threat to the enterprise (Table 4).

Table 4. Matrix for assessing the level of risks in the enterprise's digital ecosystem

Potential impact of an inefficient ecosystem	Impact, points	Potential probability, points		
		Low *1*	*Medium* *2*	*High* *3*
A large amount of data for analysis	*1*	1	2	3
Fraud and industrial espionage	*2*	2	4	6
Lack of digital competencies for creating digital content	*3*	3	6	9
Imperfect legal framework and state regulation of digitization	*4*	4	8	12
Competition and presence of monopolists in the market	*5*	5	10	15
Risks associated with business processes management	*6*	6	12	18
Lack of digital literacy and culture, both with respect to the consumers and the staff	*7*	7	14	21
Risks that disrupt the automation of processes	*8*	8	16	24
Operational disruptions, cyber security and cyber hygiene	*9*	9	18	27
Obstacles in the operation of the digital platform, which is the basis of the digital ecosystem	*10*	10	20	30

Low risk (green) *1-6 points*	Medium risk (yellow) *7-15 points*	High risk (red) *16 -30 points*

The risk matrix is an effective tool that helps to analyze the probability of a potential risk to optimize the operation of the digital ecosystem.

Low potential probability of digital ecosystem risk. Risks that, according to the matrix, will fall into such an area require monitoring in the project process. The key task is to identify such risks in time and monitor the situation, conduct additional research, inform the working group and work on measures to improve work processes.

Thanks to big data analytics, it is possible to quickly and qualitatively interpret various information, find patterns and make forecasts. For example, with the help of dig data, it is determined in which part of the city there is a need for certain goods or services, which products will interest potential buyers, predict outbreaks of diseases and even places where crimes are most likely to occur. The more information you can learn, the more accurate the final result will be. However, the lack of an effective tool and methods for

processing a large amount of data can violate the time limits of the project and create inhibitions for the implementation of the action plan.

The development of the economy has always involved the monitoring and avoidance of industrial espionage, which, in most cases, is carried out with the aim of further undue influence on enterprises in order to cause harm. The lack of digital competencies for the creation of digital content is a risk on the way to the medium level of risks of the digital ecosystem, because such competencies ensure the development of digital content, editing and integration of digital content, primary programming skills, rights and licenses, use of digital technologies, identification of needs and their technological solution. The lack of such knowledge makes it impossible to set up and operate a digital ecosystem.

Average potential risk probability of the digital ecosystem. Risks in this segment involve conducting an audit and solving possible problems before the launch of the digital ecosystem. It is necessary to revise the plan or return to the initial stage. The imperfect legal framework and state regulation of digitalization is a risk for the digital ecosystem because it does not protect it from a legal point of view, and also does not receive support from the state. In this case, we are talking about documents that are needed directly for the digital ecosystem, and not for digitalization in general.

Competition and the presence of monopolists on the market complicates the possibility of entering not only the international market, but also functioning on the national market. It should be noted that China's ecosystems, when entering foreign markets, are primarily aimed at realizing their national interests, such as promoting Chinese products, supporting their own citizens abroad, etc. Risks related to management business processes are on the way to high probability because the lack of effective management will not allow the digital ecosystem to exist. At each of the levels, it is necessary to make management decisions and bear responsibility, to be able to organize and provide the necessary resources to each component.

The lack of digital literacy and culture, both among the consumer and among the staff, creates risks for the digital ecosystem because it makes it impossible to search and filter data, information and digital content; implementation of own requests and needs with the help of digital technologies; self-realization in the digital society; solving life problems with the help of digital technologies; data, information and digital content management.

High potential probability of digital ecosystem risk. Such risks should be avoided because they can destroy the digital ecosystem in a short period of time. Risks that fall into the specified range are mostly high threat, but even

one of them will not stop the work of the digital ecosystem, it will simply become ineffective. For example, automation can sometimes have a negative impact on business processes. Optimizing and automating processes can ultimately save resources by enabling easier scalability, but automation also has some drawbacks. Automation solutions can unwittingly introduce software incompatibilities or add a layer of redundant operational complexity. Operational failures, cyber security and cyber hygiene, are potential attempts by an attacker to harm a computer network or system. Cyber attacks are often carried out with the intention of gaining access to sensitive information, which is a way to disrupt or stop a business process.

Disruptions in the operation of the digital platform, which is the basis of the digital ecosystem, is the highest risk because it can lead to a stoppage of work. The characteristics of a digital platform include: the presence of several interconnected groups of consumers, i.e. several parties to the market, which are provided with services of different nature; the presence of cross-market network effects, i.e. the dependence of the value of the product for consumers on one side of the market on the number of players on the other side of the market; the ability to influence the volume of transactions on the platform and the number of users on each side of the market due to cross-market subsidization, in particular at the stage of attracting participants to the platform; availability of information technology infrastructure based on the use of digital technologies. Digital technologies can be used not only to ensure the interaction of market participants, but also, for example, to set the price of goods and services of the service itself for participants and the price of the agreement between participants of different parties. That is why a violation in this segment will prevent the functioning or development of the digital ecosystem. Therefore, the digital ecosystem of the enterprises of the future is not only the organization of the work of the internal and external environment, but also the identification and timely elimination of possible threats.

Conclusions

The modern management paradigm considers the digitalization of the enterprise as a real competitive advantage, which determines the success of its operation in the long term. The formation of an effective digital ecosystem is a tool for ensuring the forecasted strategic development of each business entity, a guarantee of high labor productivity of the staff and the degree of consumer satisfaction.

Therefore, it is obvious that the markets of goods and services are undergoing constructive changes. Traditional management business models cannot withstand competition and gradually begin to recede into the past,

and innovative models for shaping future strategies appear to replace them. Today, business management and its development does not take place around one scarce product, but within a large number of product groups and product categories, the selection of which is aimed at meeting the needs of the most demanding consumer. Ecosystems are becoming the main form of interaction between market participants in the era of digitalization. Based on this, in order to support and develop the life cycle of the enterprise, they need to create their own ecosystems or join existing ones. Digital ecosystems are a trend of the future, which is already being followed by China and the USA, but under the condition of effective scientific and technical, technological and personnel potential, other countries from both developed and emerging world will be able to join in the near future.

Authors

Oleksiy Osiyevskyy is an Associate Professor of Entrepreneurship & Innovation at the Haskayne School of Business, University of Calgary, where he also serves as the MBA program director. Oleksiy leads the Global Business Futures Initiative, an emerging thought leadership center aimed at preparing established businesses to thrive on disruption in the global marketplace. In his scholarship, supported by the Future Fund Fellowship, he concentrates on the problem of achieving and sustaining firm growth and prosperous longevity through successful engagement in entrepreneurial strategies. Oleksiy founded his first Internet startup back in 2003, during his undergraduate studies. Since that time, he has been actively engaged in real-world business practice across the globe as an entrepreneur, manager within large companies, consultant and educator. Oleksiy has mentored, co-founded, invested in, and served on the boards of numerous startups within a broad range of industries (education, food, medical devices, transportation, e-commerce, among others), and engaged in strategic innovation projects within large organizations.
email: oosiyevs@ucalgary.ca

Yurii Umantsiv is the head of the Department of Economics and Competition Policy of the State University of Trade and Economics, where he is also the guarantor of the second-level higher education program «Antitrust Management». In his research, Yurii focuses on the problems of the methodology of economics, competition and competition policy, as well as the functioning of corporations in conditions of global instability. Yurii provides consultations to companies in the financial and non-financial sectors and actively cooperates with a number of state authorities and local governments. The scientist is a member of a number of editorial boards of scientific publications of the USA and Ukraine. Yurii trained ten Doctors of Philosophy. The scientist was a participant in numerous international scientific and practical symposia, conferences and trainings. Yurii constantly

implements innovative teaching methods, ensures the integration of education, science and business.
email: y.umantsiv@knute.edu.ua

Yuliia Biliavska is an Associate Professor of the Department of Management at the State University of Trade and Economics, where she is also the guarantor of the Pharmaceutical Management educational program for applicants for the first (bachelor's) level of higher education. In her research, Yulia focuses on innovative management technologies, cybersecurity and digitalization research, enterprise development trends, and changes in staff skills in the future. Her professional activity also involves cooperation with stakeholders and business partners who provide practical training for higher education students. This contributes to the ability to diagnose business management not only from a theoretical point of view, but also to analyze the bottlenecks in the practical activities of enterprises. The solutions to the pilot issues were reflected in a number of scientific papers, including publications in the Montenegrin Journal of Economics and Scientific Horizons.
email: y.biliavska@knute.edu.ua

Endnotes

1. Atieh, A. M., Cooke, K. O., & Osiyevskyy, O. (2023). The role of intelligent manufacturing systems in the implementation of Industry 4.0 by small and medium enterprises in developing countries. *Engineering Reports*, *5*(3), e12578.
2. Schrauf, S., & Berttram, P. (2016). *Industry 4.0: How Digitization Makes the Supply Chain More Efficient, Agile, and Customer-Focused.* PwC.
3. Ibid.
4. Subramaniam M., Iyer B., & Venkatraman V. (2019). Competing in digital ecosystems. *Business Horizons, 62*, 83-94.
5. Hernæs, C. (2015, October 29). What does Facebook's digital ecosystem look like? [Blog post]. *Hernaes.com*.
6. Osiyevskyy, O., Shevchenko, L., Marchenko, O., & Umantsiv, Y. (2022). Hybrid firm: the future of organizing for Industry 4.0. *Rutgers Business Review*, *7*(3), p. 289–308.
7. Biliavska, Y., Mykytenko, N., Romat, Y., & Biliavskyi, V. (2023). Category management: Industry vs trade. *Scientific Horizons*, *26*(1), 129-142.
8. Laloux, F. (2014). *Reinventing organizations: A guide to creating organizations inspired by the next stage of human consciousness.* Brussels, Belgium: Nelson Parker.
9. Dong, H., Hussain, F. K., & Chang, E. (2007, July). *An Integrative view of the concept of Digital Ecosystem.* Proceedings of the Third International Conference on Networking and Services, IEEE Computer Society, Washington, D.C.
10. Baker K. S., &. Bowker G. C. (2007). Information ecology: Open system environment for data, memories, and knowing. *Journal of Intelligent Information Systems, 2*9, 127–144.
11. Umantsiv, I., Sonko, Y., & Yatsyshyna, K. (2019). Competition at product markets of various types of commodities. *Problems and Perspectives in Management*, *17*(2), 334–347.
12. Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review, 71*(3), 75-86.
13. Country commercial guides, China - Country commercial guide [Organization website]. (2023, April 7). *International Trade Administration.*
14. EU4Digital. (2020, July 3). Digitising industry: Best practices to promote the digital transformation of SMEs in traditional sectors of the economy. *EU4Digital*.

15. European Commission. (2022, July 18). New Pact for Skills partnership to boost digital skills. European Commission.
16. Marketing Charts. (2022, February 23). Consumers' spending trends in 2022: Disposable spending expected to dip. *Marketing Charts.*
17. Kuo, Y., & Kusiak, A. (2018). From data to big data in production research: the past and future trends. *International Journal of Production Research*, *26*, 1-26.
18. Roßmann, B., Canzaniello, A., von der Gracht, H., & Hartmann, E. (2017). The future and social impact of Big Data Analytics in Supply Chain Management: Results from a Delphi study. *Technological Forecasting and Social Change, 130*, 135-149.
19. Guha, S., & Kumar, S. (2017). Emergence of big data research in operations management, information systems, and healthcare: Past contributions and future roadmap. *Production and Operations Management, 27*, 1724–1735.
20. Flyverbom, M., Deibert, R., & Matten, D. (2019). The governance of digital technology, big data, and the internet: new roles and responsibilities for business. *Business & Society, 58*(1), 3-19.