The Role of Digital Talents in the Transition to Circular Business Models for Environmental Conservation

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Abstract: The problem of environmental conservation and resource-efficient functioning of enterprises is currently one of the most urgent for developed and developing economies of the world. The opportunities for improving the efficiency of companies' activities in the field of environmental conservation in Industry 4.0 conditions are strongly connected with new business models and technologies of the digital economy. The use of digital solutions can significantly reduce emissions, increase the rational use of resources, improve energy efficiency, etc. Moreover, the whole concept of interaction of economic agents with each other and with the environment is changing. In general, this allows, firstly, deploying different solutions to improve the interaction of economic entities with the environment due to the application of different digital technologies (deep technologies, including Artificial intelligence, Industrial Internet of Things, Blockchain, Additive manufacturing, etc.). Secondly, to switch to new business models those are most effective in the context of human interaction with the environment. An example is the circular business model. However, the implementation of both options requires the availability of appropriate specialists in the field of the digital economy – digital talents. Now there is a significant gap in this area between demand and supply in the labor market. A shortage of digital talent exists. The distribution of digital talents in enterprises is unreasonable. The lack of digital talent, especially high-end technical specialists, is prominent, as is the lack of low-end technicians and technicians familiar with the industry. The core characteristic of digital talents is the ability to quickly and accurately find out novel information and new situations in the information field amidst the constant renewal of information technology. This requires the ability to learn continuously and independently. The training of these technicians in universities is essential. The solution to existing challenges is possible based on the development of effective interaction between educational institutions and the subjects of the labor market. The paper contains the main directions of digital talents cultivation in the context of transition to circular sustainable business models.

Keywords: Environmental development, Digital talents cultivation, Circular economy, Circular business models, Digital transformation.

INTRODUCTION

Currently, the development of society can be characterized by two main global trends. First is the digital transformation as a result of the Fourth Industrial Revolution. Such a digital transformation involves not only the use of information and communication technologies in various types of economic activities but also fundamental changes in socio-economic processes and ecosystems as a result of the introduction of disruptive innovations and cross-cutting technologies of the digital economy [1-4]. The process of digital transformation manifests itself in new institutional mechanisms, introducing new values, practices, and structures that affect the established rules of the game [5]. Secondly, there is increasing attention to achieving the Sustainable Development Goals as a balance of social, environmental, and economic components of the development of society [6]. The increasing negative impact on the environment, inefficient use and waste of natural resources, climate change lead to a large number of risks [7]. It is necessary to implement a set of efforts at the national and supranational levels (institutional decisions), as well as at the level of individual organizations and, accordingly, business models (organizational and managerial decisions) to neutralize or reduce these risks.

Significant opportunities for providing sustainable environmental development and reducing the negative impact of anthropogenic pressure are associated with the convergence of these trends, the implementation of the concept of Industry 4.0 and the digital transformation of business models in line with sustainable development [8-15]. One of the core areas of research in the context of combining the concept of Industry 4.0 and its cutting edge technologies and the concept of sustainable development is the circular economy [16-22]. The main principles of the circular economy are based on the renewal of resources, the

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processing of secondary raw materials, the transition from fossil fuels to the use of renewable energy sources. Business models based on the concept of a circular economy involve the construction of mutually beneficial symbiotic relationships between participants in various cyclical value chains. They ensure the sustainable functioning of organizations as a result of a balance of economic, social, and environmental goals, as well as contributing to an increase in the efficiency of resource use [23]. At the same time, cross-cutting digital technologies act as a catalyst for the transition to circular business models [24-25]. They also provide significant social and environmental positive effects [26]. First of all, the main elements that discussed in the article are intelligent and cutting edge technologies of Industry 4.0, including artificial intelligence, blockchain, the Internet of Things, Big data, etc. Therefore, to create circular business models, talents with appropriate digital and technological competencies are required. However, existing research in the field of circular business models for sustainable development is focused more on technological aspects, while sufficient attention is not paid to the staffing of the designated transition. This study is aimed at overcoming the indicated gap.

CIRCULAR BUSINESS MODELS FOR SUSTAINABLE DEVELOPMENT

In the modern economy, a business model with the help of narratives, figures, and/or graphical models describes how an organization creates, delivers, and captures value in the existing economic, social, institutional, cultural, technological, and another context, taking into account the internal logic of activity and relations with external stakeholders [27].

Circular business models are a general term for a wide variety of business models. It aims at using fewer materials and resources to produce products and/or services, extending the service life of existing products and/or services through repair and restoration, modifying the life cycle of products and completing it through reusing rather than recycling to benefit from the residual value of products and materials [28]. «The circular economy is designed to eliminate waste through cycles of assembly, use, disassembly and re-use, with virtually no leakages from the system in terms of disposal or even recycling» [29]. Accenture experts have developed a classification of innovative business models of the circular economy based on a comprehensive analysis of world practices [30]:

- Circular suppliers – a model in which limited resources are replaced by renewable sources;
- Resources recovery – a model based on the use of technological innovations for the recovery and reuse of resources;
- Sharing platforms – a model that is based on the exchange or sharing of goods or assets;
- Product life extension – a model that allows industrial enterprises to extend the life cycle of using their products through repair, modernization, reconstruction or restoration;
- Product as a service – a model in which customers use products by "renting" with payment upon use.

Each of the listed types of innovative circular business models can make a significant contribution to environmental conservation, provided that the circular models are widely distributed and reach a critical mass in the economy, as well as the most resource-efficient patterns, are fixed.

The roots of the circular economy concept are simultaneously two scientific theories: on the one hand, engineering, focused on research related to industrial ecology; on the other hand, environmental economics, focused on research related to the processing and efficient use of waste [31]. But at the same time, it should be noted that the practical implementation of circular business models in reality is due to digital technologies. It is due to the transformational potential of digitalization [32], the link between digital technologies and business model innovations [33-35], as well as the actual new possibilities of digital solutions in the context of environmental conservation and a new approach to the efficient use of resources at all stages of creating, delivering and capturing value [36-37]. «The digital logic allows to catalyze the socioenvironmental value creation and, second, it enables entrepreneurs to establish value propositions that merge environmental, social, and financial value for their stakeholders» [38]. This is largely achieved due to the analytical processing of large-scale data [39-40]. «The development of new cutting-edge technologies, as proposed by Industry 4.0, presents new opportunities for closing production cycles, maximizing the use of already applied resources, and therefore minimize extraction of raw material» [41]. A significant influence is given in modern research to the specific contribution of various digital technologies to the sustainable development and implementation of the principles of the circular economy [42].

Therefore, creating circular business models requires labors in organizations who have the competencies to develop, implement, distribute and use digital technologies in the logical course of a circular economy. In this case, this article refers to digital talents, whose quantitative and qualitative characteristics require further research. And this research also discusses about the importance of taking into account the convergence and merging of the characteristics of digital technologies and skills [43].

A number of studies have shown that various aspects related specifically to personnel, their competencies and views act as important barriers to the transition to circular business models. For example, it is possible to distinguish among such barriers, along with others [44]: lack of middle and lower level managers' support and involvement in promoting 'greener' products, inadequacy in knowledge and awareness of organizational members about circular supply chain initiatives; lack of appropriate training and development programs for supply chain members and human resources, cultural issues (linear mind-set); lack of knowledge, lack of skilled workers, lack of skills by employees in circular economy, poor leadership and management towards circular economy in supply chain, etc. The current situation indicates the lack of both hard skills and soft skills in this area of digital transformation in conjunction with the goals of sustainable development and the transition to circular models and value chains [45-46]. In turn, knowledge and competence issues simultaneously act as restrictions on the transition to Industry 4.0 itself, including such barriers as [47-48]: lack of knowledge about Industry 4.0, required continued education and training of employees, lack of skilled and qualified workforce for adaptation to Industry 4.0 technologies, etc. Here, barriers that are not related to technologies, institutions or infrastructure are deliberately highlighted.

DIGITAL LITERACY AND DIGITAL TALENT CULTIVATION IN ENTERPRISE TRANSFORMATION

Literacy is a person's intrinsic cultivation and is characterized by its dynamic and evolving nature. With the boom in emerging technologies, digital literacy has then flooded in and become one of the essential skills for survival in a digital society (Table **1**). Regarding the connotation of digital literacy, Professor Alkalai of the Open University of Israel formally introduced the concept of digital literacy in 1994 [49]. In 1997, Paul Gilster described digital literacy in his monograph Digital Literacy as the ability to understand and use various digital resources and information, and is a fundamental skill for people to survive and work in the digital age [50]. Since then, more and more institutions or scholars have been involved in the exploration and research of digital literacy. The UK Joint Information Systems Committee considers digital literacy to go beyond functional IT skills to encompass richer digital behaviors, practices, and identities. The European Union has issued several versions of digital literacy, stating that digital literacy uses digital technologies in a confident and safe way to serve work, learning and life [51]. For the fourth consecutive year, the US New Media Consortium included digital literacy as one of the solvable challenges in the Horizon Report and considered digital literacy as future-oriented development and employment, arguing that the connotations of digital literacy are not static and change with the digital environment [52]. In 2018, UNESCO identified digital literacy through the aggregation and analysis of high-frequency terms from various digital literacy frameworks social context - employment, access to decent work and entrepreneurship - and clarified the encompassing relationships with other related literacy concepts [53].

Overall, digital literacy relates to the basic ability of all people to live in a digital society and is a survival, work and learning skill. Digital literacy has connotations

Table 1: Meaning of Digital Literacy [49-53]

Year	Organization	Meaning of Digital Literacy
1994	Alkalai	Involves the ability to use software or operate digital devices; a variety of complex cognitive, sociological and emotional skills
1997	Gilster	The ability to understand and use a wide range of digital resources
2015	European Union	The ability to use IT confidently and innovatively in work, employment and social participation
2016	New Media Consortium	The ability to understand and use digital resources as they are accessed and created
2018	UNESCO	The ability to access, manage and integrate information in a secure and logical manner using digital technology

that change over time and context, is characterized by the dynamic and evolving nature of literacy, and is essentially a set of academic and professional practical skills supported by diversity and constant change. At the same time, digital literacy emphasizes the innovative and critical use of technology to identify, use, analyze and manage data and information, and to learn to live in harmony with the technological environment.

Digital literacy is a common skill in the future of work，not specifically means hard skills of digital technologies. They demonstrate it through a deep understanding of platforms, applications and collaborative tools used in their organization. The acquisition of relevant ICT skills is the main criterion for identifying digital talents, which are essential for the digital development of companies and industries.

At present, the distribution of digital talents in enterprises is unreasonable. The lack of digital talent, especially high-end technical specialists, is particularly prominent, as is the lack of low-end technicians and technicians familiar with the industry. According to the talent shortage survey by Manpower Group, there are at least 5 out of 10 of the most in demand skills in world are closely related to ICT talents [54]. For example, Analytics Insights survey shows that shortage of talents in artificial intelligence technologies reached 66% in 2020, cybersecrity at 64%, another ICT skill [55].

The training of these technicians in universities is essential. In the digital era, it has become an important issue as to which aspects of talent model training in universities are transformed. In the digital age, society is evolving rapidly, economic development is increasingly valuing intangible resources such as intelligence, competence and knowledge and information, and the life cycle of knowledge is becoming shorter and shorter. Universities must plan individual development paths for students with different talents and interests and provide a reasonable digital platform for knowledge, competence, and quality reserves and for exercising their abilities.

The education system must integrate resources, understand the talent needs of its corporate partners and have a clear talent development program. For universities, it is important to integrate the digital transformation strategies of companies into the development strategies of the university and thus develop interdisciplinary talent development strategies. For governments, the central question to consider is how to coordinate investment, policy, research, and other project systems to build and promote a healthy system of innovative talent for manufacturing. Governments need to integrate manufacturing talent development strategies into economic development strategies, they need to understand the barriers to manufacturing transformation and help remove them, and they need to make investment in talent a priority.

In recent years, strategic planning at all levels has pointed to a new round of industrial revolution and a reshaping of the global manufacturing landscape, with the systematic integration of products and services at the level of the industrial chain with new-generation information technology as the core, driving traditional manufacturing enterprises to accelerate their digital transformation. The accelerated digital transformation of industrial systems is a new challenge for engineering and technology talents, and a major test for national talent training systems.

In order to take the lead in the global digital competition, the EU has launched policies such as the Digital Europe and the Digital Education Action Plan, and is working with universities, companies, governments, and other organizations to develop a digital competency framework for engineering and technology personnel, to improve the digital skills of business engineers and university students. "The Edison Data Science Framework (EDSF) plays an important role in education and training, professional certification, organizational and individual skills enhancement, and covers the components of the Data Science Competency Framework, the Data Science Body of Knowledge, the Data Science Modelling Course and the Data Science Professional Profile [56].

The most essential characteristic of digital talent is the ability to quickly and accurately identify novel information and new situations in the information field amidst the constant updating of information technology, which requires the ability to continuously learn on their own. As the digital native generation, who have grown up in the Internet environment, gradually become the mainstay of the market, they need companies to provide a personalized employee experience, use technology to enhance teamwork and support unique learning opportunities and career development.

As a result, companies need to redefine talent, with employment changing from a single full-time employee to a combination of full-time employees, flexible workers, freelancers, and crowdsourcing, while employees are not limited to natural and social

attributes, but also include robots. The talent management mechanism also needs to evolve.

The Main Aspects of this Evolution Include:

- Firstly, from centralized control to a collaborative platform of shared services;
- Secondly, from rigid competence to soft skills and creativity;
- Thirdly, from individual value realization to collective wisdom and common prosperity;
- Fourthly, from division of labor to collaborative development;
- Fifthly, from industry chain collaboration to ecological symbiosis.

Digital transformation means changing the way individuals live and work, the management and service models of governments and social organizations, and the way enterprises are organized and operated through the widespread use of digital technology [57]. The external manifestation of enterprise digitalization is that the application of digital technology makes enterprises work online, apply mobile and make data-based decisions, but its essence is a fundamental change in the assets, value creation methods and business ecology of enterprise operations, with the aim of improving the efficiency and effectiveness of internal management and achieving a win-win situation for enterprises, employees, business partners and society.

The first important feature of the digital transformation of enterprises is that data becomes the most important asset of the enterprise. "In the era of digital economy, all information can be expressed, transmitted and stored in digital form, and data has become the most critical production factor and the most valuable new resource in the digital economy"[58 P.59]. In the R&D and design stage, the changes and trends in customer demand are analyzed and inspected through big data technology, thus providing a basis for decision making on product and service innovation for enterprises.

In the manufacturing stage, intelligent production and large-scale personalization are achieved through data technology; in the marketing stage, live webcasting and remote trading all rely on the role of data technology; in the after-sales service stage, data technology will facilitate zero-distance communication between enterprises and customers, enhance the intimacy between enterprises and customers and increase the value of customer experience. Digital transformation is the deep integration of digital technology and business, thus driving business growth and innovation. Data technology has replaced traditional factors of production as the most important asset in the process of improving the efficiency of resource allocation and enhancing value creation in enterprises. "Based on the huge data resources obtained, data mining and analysis are carried out using cloud computing and artificial intelligence (AI) systems to achieve accurate decision-making and precise marketing, forming a new and efficient business operation model" [59, P.33].

The training of digital talents should follow the following rules. Firstly, based on the division of digital manufacturing technology fields in the whole product lifecycle supply chain, the specific jobs in digital technology fields and the career roles needed now and, in the future, should be determined, thus forming the overall career layout of digital talents. At the same time, the classification system should be refined and expanded from different latitudes according to the strategic layout of the digital industry, the industrial pattern, the maturity of the digital technology field and the stage of digital transformation of enterprises, to provide a basis for the subsequent diversification and phasing of the digital talent team. Secondly, the development of occupational skills standards based on the occupational layout should specifically include the perception of new occupations, occupational orientation, key responsibilities, competency requirements, required education and work experience. The development of a projection and classification of future digital talent and its skills standards will help to promote the development of training and education programs in the education sector for new skills in parallel with technological advances, and to promote the development of disciplines, upgrading and digital transformation in line with new technologies in digital manufacturing.

CONCLUSION

Digital technologies allow circular economy in environmental reservation step into a new stage, with the new model of circular business. The core of conducting the new model in related industry is the cultivation of digital talents who possess the competencies and skills that needed in the digital transformed enterprises.

The digital transformation of industry is closely linked to national strategic needs, industry technology development and enterprise development and operation, which dictates the need for multiple organizations to participate in the construction of a digital talent cultivation ecosystem. Government, universities, enterprises, industry associations and other organizations have their own roles to play in the talent development ecosystem, providing support for the development of digital talent in many ways. Universities should work together with enterprises, trade unions and industry associations to further analyze relevant career development trends and standards, innovate talent training programs in response to market needs, prepare new data-related majors, and work with enterprises to design data science projects.

Through resource conservation, intensive use and changing the way products and materials are produced and used, a circular economy can effectively increase the rate of resource output and reduce carbon emissions. The circular economy helps to achieve effective recycling of waste resources, which can enhance the efficiency of resource circulation, reduce the dependence of economic development on primary resources and ensure resource security [60, P.1].

At present, the scale of the circular economy industry in most countries is relatively small and the level of industrial development is not high. The production and consumption norms throughout the whole industrial chain have not yet been formed. And the circular economy network covering various regions, industries and fields is not smooth enough. The production system, distribution system and consumption system for green, low-carbon and circular development of enterprises have not yet been formed. At present, there is a need to build an information sharing platform at the national level so that corporate environmental information can be shared, and social organisations and the public can participate in monitoring corporate emissions reduction practices and government environmental governance. The achievement of all of these goals relies on the development of relevant talents, especially digital talents. Digital technology can use new production factors such as data and information to promote the combination of the digital economy with traditional industries and digitally transform and upgrade enterprises upstream and downstream of the industrial chain. This can improve the ability of traditional industries to cope with changes in the external environment and build a modern circular economy industrial system based on the digital technologies.

A sound industrial system and technology innovation system is the key to developing a circular economy. The deep integration of enterprises, universities and research institutions should be encouraged. It is also important to collaborate in training innovative digital talents in the field of circular economy, in order to build green and circular technology innovation projects and platforms, and to promote the transfer of green and circular technologies and the transformation of innovation results.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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