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Digital Transformation as a Source of Innovative Growth for Small and Medium Enterprises in Russia

Tatiana Kokuytseva and Oksana Ovchinnikova

7.1 Introduction

Currently, around the world, the digitalization of human life processes has reached its most intense stage, which is manifested primarily in the implementation of public programs for the digital economy development. Since 2017, the Russian Federation has also been implementing the program "The Digital Economy of the Russian Federation" (2017), which is aimed, among other things, at "creating the necessary and sufficient conditions for an institutional and infrastructural development, eliminating barriers and constraints in establishing and (or) developing high-tech businesses". The overall objective of the program is to increase the global competitiveness of the national economy and ensure a technological breakthrough.

T. Kokuytseva (✉) • O. Ovchinnikova
Center of Industry Management, Peoples' Friendship University of Russia, Moscow, Russia

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The modern information society is evolving so rapidly that a lag between theoretical, fundamental research and its practical implementation is almost disappearing. Large corporations that cannot afford such a time lag attract small innovative companies to solve specific technological problems as a part of open innovation. This is reshaping the world's general industrial map, demonstrating that the world today is largely composed of SMEs, among which there are companies with a number of different technological trends. Business, especially SME, has a pretty good reaction to changing external environment. Given the strong uncertainty of all processes that currently characterizes all spheres of human activity, SME acts as a kind of marker that allows us to assess the evolution of the technical and economic wave.

In general, company executives understand that digital technologies currently provide them with a competitive position in the domestic and foreign markets (Medovnikov et al. 2017). At the same time, any firm evaluates everything in terms of the "cost/profit", therefore, it implements only those digital projects without which it cannot any longer do its business, gradually investing in strategic areas of digital transformation. Thus, the purpose of this study is to highlight the key positions of innovative development and competitiveness based on the study of the possibilities and consequences of digital transformation of the SMEs.

7.2 Theoretical Foundation

The digital economic development in the near future will be the key driver for the global development of innovation, competitiveness and economic growth. And if the concept of "digital economy" has been generally accepted and defined as the result of the transformational effects of new general-purpose technologies in the field of information and communication, which influence all areas of the socio-economic development (Sudarushkina and Stefanova 2017), the concept of "digital transformation" is relatively new in Russian practice. In 2014, the RF President launched a project of the National Technological Initiative (NTI), the main purpose of which is Russia's inclusion in forming standards for the future global markets and winning a significant share in

these markets by Russian companies. It is the start of the process of digitalization of the Russian economy.

Since then, there have been adopted Decrees of the President of the Russian Federation dated May 9, 2017, No. 203 "On the Strategy for the Development of the Information Society in the Russian Federation for 2017–2030" and dated May 7, 2018, No. 204 "On National Goals and Strategic Tasks of the Development of the Russian Federation for the period up to 2024", which defines the national goals and strategic objectives of the Russian Federation for the period up to 2030, as well as the Government Executive Order dated July 28, 2017 No. 1632r, approving the program "Digital Economy of the Russian Federation". These documents introduce the concept of "digital transformation".

The scientific platform characterizing this direction is just being formed in the Russian Federation. There are several research works dedicated to some aspects of the digital transformation of economy. Meanwhile, in the foreign scientific literature, there are many serious publications in the field of economy and industry digitalization. For example, among the earliest works we can name R. Boyer's monograph "The Future of Economic Growth: As New Becomes Old" (2005), in which the author offers his own definition of digital transformation.

The correlation between digital transformation and competitiveness is shown by Kartajaya H., Kotler P., Huan H.D. (2019) and Oprescu G., Eleodor (2014). The correlation between digitalization, business modeling and the effectiveness of SMEs is highlighted by Bouwman H., Nikou S., Reuver M. (2019). Such a study has been conducted for the first time ever. The authors analyze 321 European SMEs that use social networks, and big data information technology to innovate their business models. For conducting this analysis, the authors of the article apply the method of qualitative comparative analysis with fuzzy sets (fsQCA), partial least squares structural equation modeling (PLS-SEM). The authors consider that the overall effectiveness of the company is the main result influenced by four components: (a) resources for experimenting with business models, (b) practices for implementing the business modeling strategy, (c) practices for experimenting with business models, and (d) innovativeness. Applying the PLS-SEM method, the authors showed that the time and resources spent on experimenting with business models and

implementing the strategy contribute to the overall efficiency of the company, which is due to the higher level of innovation and the practice of experimenting with business models. The authors proved that innovation plays an important role by mediating the correlation between resources for experimenting with business models, as well as implementing a business modeling strategy and overall firm performance. The fsQCA method also indicates that innovation is an important term in two configurations.

The authors also showed that policies aimed at encouraging SMEs to use the business capabilities created by digitalization should be oriented to encourage SMEs to use information technologies, big data and social networks as a means for more practice in experimenting with business models, as well as introducing new strategies. This is more topical because more fundamental developments related to digital transformation, such as the Internet of Things, the intelligent industry, machine learning, artificial intelligence, intelligent services and comparable "technologies" will require SMEs to rethink their business model. The authors further make the assumption, suggesting that SMEs that experiment with business models are more innovative and high-performing, and therefore have free resources for further transformations of their business models.

Loebbecke and Picot (2015) are somewhat broader in their analysis of the digitalization impact on the company. They examine the impact of digitalization, including the analysis of big data, both on business models and employment, in particular in the context of cognitive tasks and resulting from social transformations. The authors identify five mechanisms by which the digitization and analysis of big data complements and replaces labor differently in all sectors of industry and work processes:

1. Replacement of labor in production processes (airports, train stations, security services, etc.).
2. Elimination of processes of cognition and cognitive work (reduction in the number of nonmanual workers, meteorologists, etc.).
3. Replacement of the growing share of high-ranking decision makers through machine decision-making (development and implementation of decision support systems).

4. Widespread amateurism. Replacing traditional professions, products and services with their digital equivalents, which require less expenses and, consequently, significantly reduce transaction costs. As a result, all this leads to the disappearance of existing professions and a decrease in demand for traditional specialists.

An interesting study of the correlation between digitalization and the business model strategy is given by Rachinger et al. (2018). The authors concentrate on two industries: media and automobile. They analyze how digitalization affects the value of a company and how they deal with problems arising from the increased digitalization. In their study, they come to the conclusion that it is not digitalization itself, but the introduction of innovations in the business model through digitalization that creates value. They highlight the following key issues—management and employee competencies. These issues are typical for any industry and company. Kiel et al. (2016) examine the impact of Internet of Things on the companies' business models. The Industrial Internet of Things (IIoT) will lead to managerial effects, the transformation of value chains, and, consequently, the emergence of new business models.

In an increasingly competitive environment, entrepreneurial SMEs use digital platforms to enhance their business strategies (Li et al. 2016). Digital platforms thus transform the way companies create their competitive advantage (Parker et al. 2016). They play a key role in the value propositions of many companies, enabling them to apply information management (Cenamor et al. 2017). Li (2016) demonstrates that information and communication technologies (ICT) contribute to improving the efficiency of companies. Recent studies indicate the complexity of implementing a digital platform and the uniqueness of entrepreneurial SMEs. On the one hand, literature supports the thesis that digital technologies alone cannot directly bring benefits. In particular, companies need ICT-enabled capabilities that mobilize and implement digital technology to make significant organizational changes. In fact, the ICT-enabled capabilities can transform the company through expanding its dynamic capabilities. However, digital platforms are a more complex form of ICT that facilitates collaboration between different partners.

On the other hand, publications traditionally consider the introduction of digital technologies in large companies, while specific information about entrepreneurial SMEs is relatively scarce. Entrepreneurial SMEs face unique challenges in implementing digital platforms, as they may lack the essential resources, skills and commitments. Digital platforms can be a key source of resources and can provide valuable opportunities for entrepreneurial SMEs. For example, Jin and Hurd (2018) show that the Alibaba digital platform facilitates the internationalization of SMEs in New Zealand, while Nambisan, Siegel, and Kenney (2018) show that crowdfunding platforms facilitate the access to metropolitan networks.

Li et al. (2016) show that there is an indirect link between the capabilities of the digital SME platform and productivity. The issues of planning the measures for digitalization in SMEs with applying the methods of a digital factory are considered in the article by Stoldt et al. (2018). They show that SMEs implement two types of digitalization strategies. The first one consists in the phased digitalization, when one object or process is involved, then the next, and so on. In this case, SME changes in the production system, IT infrastructure and staff skills can be determined quite easily, while some risks such as the loss of productivity and lack of acceptance are reduced. The second strategy is more far-reaching. In this case, a company determines the current and target business models, carries out the capacity assessment and feasibility study, and then a new strategy is implemented to build the target business model by introducing prototypes and developing business models. Then, general management processes change to adjust the entire organization.

Digital factory tools can support more frequent changes in companies associated with the introduction of innovations and the creation of new competitive products. The term "Digital Factory" is defined by the Association of German Engineers (VDI) as follows: "Digital factory" is a general term for a comprehensive network of digital models, methods and tools, including modeling and 3D visualization, that are integrated through integrated data management. Their goal is holistic planning, evaluation and continuous improvement of everything necessary: structures, processes and resources of a real plant in connection with a product.

Thus, the digital factory is focused on:

- increase in economic efficiency and quality of planning,
- reduced product development and its introduction,
- transparent communication,
- standardized planning processes and competent knowledge management.

The positive effects are a reduction in time of entry into the market, a reduction in the number of correctional cycles and errors in planning, as well as the storage of expert knowledge resulting from experience that no longer leaves the company with an employee (Eberling 2019). Digital factory tools can be used for planning the digitalization strategy (Stoldt et al. 2018) of industrial SMEs.

The analysis of Russian and foreign publications shows that, despite a significant number of publications on the topics of digital transformation and innovative development, just a few studies address the issues of changing business processes when implementing digital transformation in SMEs and its impact on their innovative activity. Moreover, the analyzed research emphasizes that such studies should be carried out in view of the novelty of the phenomenon and the great fundamental and practical significance of their results.

7.3 Discussion

7.3.1 SMEs in Russia

According to Russian legislation, small businesses are companies whose total number of employees is not higher than 100 people and its income does not exceed 800 million rubles per year. Companies are considered medium-sized enterprises, if the number of employees ranges from 101 to 250 people and income is no more than 2 billion rubles per year. There are more than 6 million SMEs in Russia, including 236 thousand small businesses and 2.6 million micro-enterprises, 19 thousand medium-sized businesses. In addition, 3.2 million people are individual entrepreneurs without forming a legal entity (Russian Federal State Statistic 2020). Relating to the country's population (146.7 million people), it turns out that 1 SME accounts for approximately 24 people. Considering the

territorial distribution of SMEs in the Russian Federation, there are almost half of all SMEs in two of the eight federal districts (FD) of the Russian Federation: Central FD (31.25% of all Russian SMEs) and the Volga FD (17.82%). They are followed by the Northwestern, Southern, Siberian FDs, in each of which there is 11% of all SMEs. In the Ural FD—8.57%; Far Eastern FD—4.3%; North Caucasus FD—3.29% (Statistika MSP). One of the most important factors in this distribution is the uneven distribution of the solvent demand, or rather people who are able to pay in the country.

The largest number of SMEs are in trade and service organizations (36% of the total number of SMEs). Unfortunately, the digitalization of the main business processes in them is insignificant. This field is followed by real estate, rent and the provision of services (22.6%), construction (11.8%), manufacturing (9.6%), transport and communications (6.9%), agriculture, hunting, forestry and fishing (2.6%). The digitalization of the main areas in SMEs consists of the following digital tools:

- creation of Internet sites as a commercial tool. This tool is widely used by commercial organizations and is already a classic;
- personalization as a tool for smart digitalization. New technologies of smart digitalization open up new opportunities for SMEs: offering related products, reminding customers of the availability of goods in their baskets, mass text messaging with the smart processing of big data (these messaging is used, for example, by cafes that inform their customers who live or work close to them; travel companies that track the number and preferences of travel clients, etc.);
- digitalization of trade and intermediary services.

The above-mentioned tools today are no longer just a fashionable trend but an opportunity to save companies, which is especially important for SMEs. For example, the current costs for maintaining an online store is much less than in the case of offline trading. Smart messaging saves resources and allows increasing its efficiency due to targeted threads. Trigger mailing gives you an opportunity to constantly communicate with clients, creating a motive to return to the store or cafe. Digital technologies open

up new opportunities for SMEs, provide increased efficiency, access to new markets, and realize the full innovation capacity of SMEs.

7.3.2 Digital Transformation: Tools and Stages

Digital transformation as a whole is a process of unlocking the capacity of digital technologies through their maximum utilization in all business processes of the company. However, just the introduction of technology is not enough for a complete digital transformation. The digital transformation process also involves setting clear goals, defining business objectives, formalizing business models, and identifying the databases used in this process. Thus, digital transformation is a unity of three main pillars: formulating business tasks and a business model built on their basis, a strictly defined database and technology.

Digital transformation is often identified with breakthrough products and ideas that arise from the introduction of digital technology. Often companies foster hope that the introduction of digital technology will yield quick win over their competitors. In real life, to ensure sustainable business development, it is most important to conduct a competent digitalization of the core business from the perspective of optimizing business processes and finding additional sources of growth. Any company faces new, "digital" tasks, the solution to which is directly related to the digital transformation of the entire enterprise regardless of its size. In digital transformation an enterprise must rely on the following basis:

- a high level of automation of operations, virtualization of infrastructure and processes, high quality of enterprise IT systems and their willingness to conduct digital transformation;
- the ability to synchronize data: all information about the enterprise should be systematized and available in real time for making informed management decisions;
- the business model, operating model, organizational structure and internal processes should be flexible, based on relevant facts (numbers, trends, dependencies), velocity (real-time data processing, course

adjustment as information becomes available, accounting for changes in external and internal environment).

Due to the high reliable data and the possibility to use it, new, more flexible ways to develop and sell products, their introduction to the market, the search for new markets, optimization of supply chains, as well as the formation of a radically decentralized management structure, necessary for flexible and quick decision-making, arise. A similar management structure is formed within the framework of the so-called agile concept, when the project is implemented at the enterprise by small cross-functional teams. In this case, there is no rigid hierarchy of operations that requires time and physical input to coordinate actions; such work is characterized by a limited time length. This approach allows companies to get tangible results on new projects, much faster than while using traditional methods and business models. Digital transformation includes three main tools:

1. engine for company growth:
   - identifying and developing new digital business models
   - ensuring long-term competitiveness
2. increasing the efficiency of activities:
   - reducing costs and optimizing business process
   - utilizing available infrastructure
   - building a base of digital competencies
   - forming a digital value chain
3. establishing the framework for breakthrough innovation
   - identifying growth points for the company
   - ensuring access to new technologies
   - building a corporate incubator
   - forming new sources of projects funding

At present, those companies that begin to form a digital ecosystem in proper time, filling it with data about a process or phenomenon and processing them, obtain an unprecedented advantage. A competitor may have

the same technology or improve it, but it will not be able to get the same result with the same rate of costs. This is the fact that setting relevant goals, determining the range of tasks, planning and velocity of achieving results, optimizing business processes are tools with which the company can significantly reduce costs and outperform competitors in the market.

In the rapidly changing external environment, outperformed companies can be content with only "small optimization" of business processes and "patchwork" solutions. Such companies, if they can keep their position in the market, will have to buy ready-made technological and managerial solutions from leaders, as well as try to adapt their business model to their own business. Thus, the digital transformation of the company is not only and not so much the digitalization of all processes, but rather a change in the nature of management based on collecting and processing a significant amount of information in the field that is closest to the operations of the company and meets its value principles. The digital transformation of the enterprise includes three stages:

1. The first contour: implementing decisions based on business cases and introducing technological solutions to ensure business efficiency;
2. The second contour: restructuring the organization and forming a "digital" business model
3. The third contour: building digital ecosystem and agile-organization

When implementing digital transformation, the organization will inevitably face certain risks—first of all, resistance of the organizational environment. When implementing unsuccessful projects, organizational resistance will increase and only the will of leadership and a clear understanding of development goals will contribute to a successful digital transformation. However, the first positive results can have an educational and motivational effect on the team and will contribute to the scaling of successful technological and managerial decisions. That is why when implementing large-scale digital transformation, it is important to start with small ("anchor") projects that are well thought-out and do not carry significant risks. In this case, the main business processes of the organization will not be affected. This will be a local "trial balloon" that will allow the organization's CEOs to see many positive and negative

points and make managerial decisions aimed at mitigating organizational resistance. Nevertheless, this process should not be protracted and should not consist only of small, low-risk projects.

Therefore, the next stage in implementing digital transformation is the transition from individual projects to the transformation of the organization's business model. At this stage, all business processes, as well as the organizational structure, undergo changes. In addition, the competencies of personnel are changing as well as the strategic goals and tactical tasks. This is a large-scale project that affects all employees and all processes, and therefore requires a comprehensive digitalization program. The final step is to change the company's interaction with suppliers and customers. New online ways of interacting, promoting and working emerge. At this stage, digital technologies are fully integrated into the organization's business processes and are aimed at creating new ecosystems and interaction channels. In the core of such an organization there is a digital platform in which the unique competencies of the organization and new business models of the organization are implemented.

7.3.3 Capsule Solution for SMEs

SMEs' viability is determined by the number and quality of their activities. Moreover, their development is determined by the capsule nature of the company's technological and managerial decisions (Fig. 7.1). The capsule solution implies the possibility of replacing and (or) assembling various solutions to carry out a specific project or develop (improve) a product that should meet the changing needs of the client.

In accordance with this concept, during the development of the initial business, the company develops certain competencies, compiles and processes the database, which allows it to launch related projects using technical and managerial solutions identified in the framework of early projects. By implementing such a strategy, the company forms a pool of businesses that use the same technology platform and capsule solutions. From the managerial point of view, such a construction of a business resembles the work scheme of a large holding company, while the entrepreneur's capabilities due to the relatively small scale of certain areas of

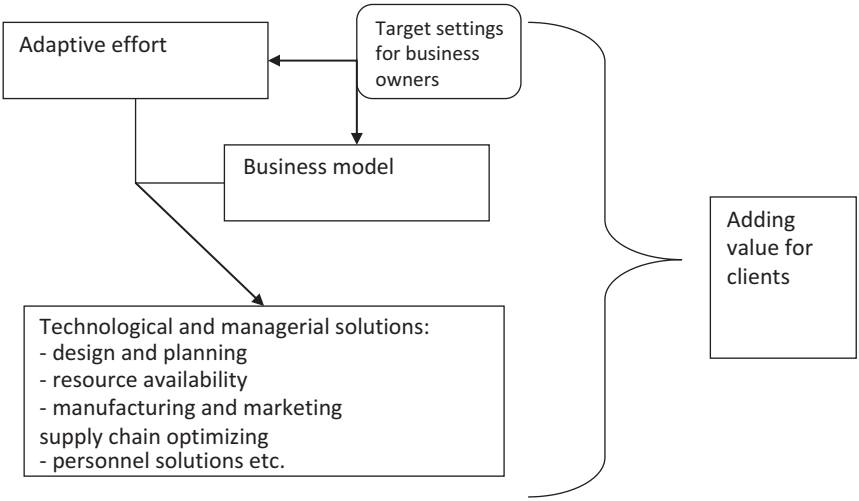

Fig. 7.1 Capsule solution for SMEs

activity are limited by resources, mainly time and human. It is in this case that it is necessary to create a new business model that allows carrying out digital transformation and significantly reduces time and other resource costs.

The need for a new business model arises when traditional economic relations become problematic. An example is online trading, which managed to erase the time and physical boundaries between the seller and the buyer. In addition to trade, a change in the traditional business model is characteristic of an innovative business, the main resource of which is time. Basically, the transition to a service-oriented business model is being examined by a number of scientists (Chesbrough 2011). However, these studies affect the construction of a business model based on the following elements (Barykin and Ikryannikov 2013):

1. value proposition for the client;
2. target audience and distribution channels;
3. resources, competencies and business processes;
4. financial relations.

It is these elements that formed the basis of the business model template proposed by Osterwalder and Pigneur. A business model that includes these elements is focused on turning cost centers into profit centers. However, the business model of any business has its own specific features, which can be summarized in four blocks: scalability of solutions, protection from imitation, time during which the business model will be profitable, the amount of resources needed to ensure the business model working capacity. On the whole, the business model is the result of strategic decisions made earlier by the company's management that affect the areas of business development. Based on strategic guidelines, a range of tactical tasks is determined. If the strategic decision is digital transformation, then tactical decisions come down to the formation of capsule solutions based on the IT platform (Fig. 7.2).

This model includes a number of business experiments that implement a specific strategic task. The development of such business experiments helps to model possible scenarios. With capsule solutions based on an IT platform, a company can develop an optimal business model that meets

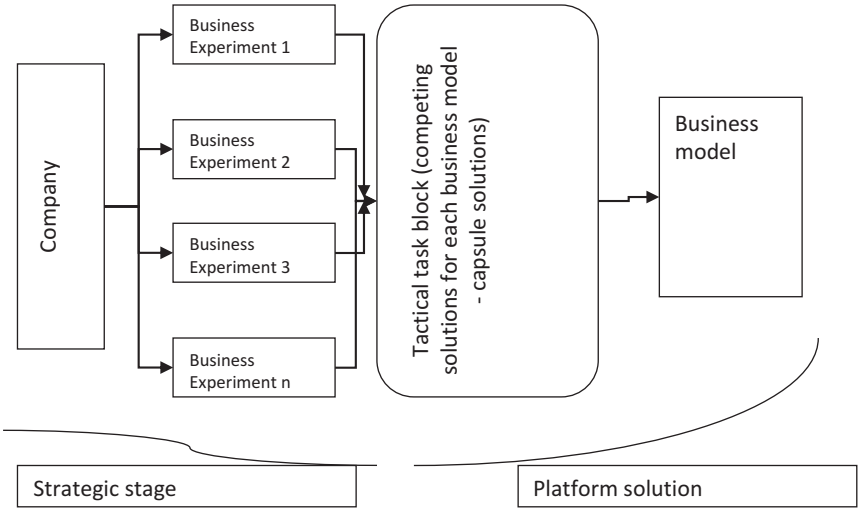

Fig. 7.2 Implementation of the company's business model for digital transformation

the organization's development goals. In general, the formation of a business model in the implementation of digital transformation in SMEs should go through the following stages:

1. business idea. A business idea arises on the basis of a certain direction of the company's development corresponding to its strategic goals.
2. business experiment. At this stage, the business idea is tested and pilot projects related to the launch of new or updated business lines are implemented. The objective of such projects is to verify the adequacy of the business idea put forward at the design stage and analyze business models that can implement this business idea. In addition, as part of this phase, the testing of operational self-sufficiency of business models is carried out.
3. scaling. Scaling projects are aimed at eliminating the existing structural, organizational and other types of restrictions that are characteristic of the current business model. Such projects are implemented on the basis of existing business operations and lead to a decrease in the flexibility and adaptability of the business model.
4. creating conditions for the effective functioning of the business model. Such projects are aimed at removing barriers that may impede the implementation of the business model.
5. moving away from the existing business model to a new one. Due to the fact that it is not possible to change the business model overnight, projects are implemented that transfer existing tools and interaction channels, as well as available resources to a more modern business model in the optimal time frame. In so doing, a number of tools and resources can be optimized. Thus, the business model has its own life cycle, which consists of four stages:

1. creating/launching a business model:

   - business idea
   - creating a "prototype" of a business model
   - experiment/tests

2. business model scaling
   - creating conditions
   - scaling
   - operations
3. business model adjustment
   - business model adjustment
   - experiment/tests
   - solution
   - operations
4. abandoning business model
   - taking decision about abandoning the business model
   - preparatory stage
   - abandoning business model

Successful implementation of the business model requires the following issues to be addressed: the choice of the business model scheme and its description (presentation); highlighting the criteria for a business model analysis; regulation of the designing of a business model process; determining the parameters of business model testing; choosing software for implementing the business model. In addition to these, the forecast horizon should be taken into account, which will be a guideline for the viability of the business model. Within the company, employees who will be involved in the analysis of business models and timely identify "aging" and non-viable business models should be distinguished. Despite the fact that such an approach may entail an increase in an enterprise's expenses for business development, in the future it will pay off due to the modernization of not only production but also the allocation of business operations and markets that will allow a small company to increase its own competitiveness in the market.

7.3.4 Small Business Competitiveness

The process of generating competitiveness is a combination of organizational and economic measures to bring manufacturing programs for

producing goods of a certain volume, assortment and quality in accordance with the existing production capacity. The production capacity is most often described through the Cobb-Douglas production function, which establishes the dependence of one or another resulting indicator of manufactured products on the quantity and combination of resources used, for example, indicators (metrics) of the quality and cost of manufacturing. The dependence is sought by applying regression relationships on a fairly significant sample of statistical data, as a result of which the desired parameters of the production function are found with, sometimes, significant requirements for input data. The required indicators reflect some of their average characteristics, which are basic figures for their comparison, which is necessary for assessing the place of SMEs among similar enterprises. In our case, let us write in a general form the indicators of the quality and cost of manufactured products that affect the competitiveness of the enterprise, in the form of a functional dependence on a set of factors of the external and internal environment of its functioning.

(1) $y_{ijk} = F_{ijk}(x_{njk})$, where y_{ijk}—value of j—competitiveness indicator of production of products i of enterprise k, $j \in J$, $i \in I$, $n \in N$, $k \in K$, $j = 1$ reflects the quality of products, $j = 2$—prime cost, x_{njk}—characteristics of factor n, influencing indicator j of an enterprise k.

Depending on the objectives of the enterprise's competitiveness and products study, the environmental factors include:

- technical (for example, the level of engineering and technology development),
- socio-cultural (for example, the type of consumer culture),
- economic (for example, the degree of support for SMEs, household's incomes, taxation, access to financial resources).

Based on the theory of complementarity and the goals of our study, we consider as environmental factors: the volume of product demand in the market, standard requirements of regulatory bodies and requirements of third parties recently emerged, the degree of accessibility of public ICT. As factors of the internal environment we consider: the volume of production, the degree of the enterprise digitalization, the quality of

human capital, material, technical and financial resources. Let us dwell on the indicated factor: standard requirements of regulatory bodies and requirements of third parties recently emerged. This factor, with the development of Internet technologies, is beginning to acquire a significant influence on the products of many industries in the world.

As for third parties, a concept has recently been popular that each buyer can check information on the quality, safety and legality of products online, and regulatory authorities can access a full range of product information. Given the above, companies that have not been able to respond to the requirements of the market, regulatory authorities and third parties will face a decrease in the attractiveness of their business (Gajdash and Medennikov 2018). The integral factor, "the degree of production digitalization", depends on many requirements, mainly on the degree of development of the enterprise management system, on the level of automation of customer relations, on the degree of digitalization of technological processes, on the degree of the use of cloud computing services. As it was noted above, the ratio of these conditions is determined by differences in industries.

Based on the described considerations, expression (1) can be specified in the following form:

(2) $y_{ijk} = F_{ijk}\left(W_i y_i^H z_{ko} V_{ik} z_{kc} L_k M_k \Phi_k\right)$, where W_i—volume of demand for products i—in the market; y_i^H —regulation requirements, third parties requirements concerning products i; z_{ko}—expenses on ICT of common use of enterprise k, V_{ik}—output volume of products i of enterprise k; z_{kc}—total expenses on k enterprise digitalization; L_k—quality of human capital of enterprise k; M_k—material and technical resources; Φ_k—the amount of allocated financial resources for digitalization of the enterprise k.

Let us identify through y_{jk} j indicator the competitiveness of enterprise k $y_{jk} = \sum_{i=1}^{I} \alpha_i y_{ijk}$, where $= \sum_{i=1}^{I} \alpha_i = 1$, $0 \le \alpha_i$. Then we call the expression y_k an integral indicator of the competitiveness of enterprise k.

(3) $y_k = \beta_1 y_{1k} + \beta_2 y_{2k}$, $\beta_1 + \beta_2 = 1$, $0 \le \beta_1$, $0 \le \beta_2$.

In this situation, we can set the task of increasing the integral indicator of competitiveness of enterprise k.

(4) $y_k = max(\beta_1 y_{1k} + \beta_2 y_{2k},)$, where c_{ik}—price of products i of enterprise k in the market under constrains: $y_i^H \le y_{i1k}$ (requirements for quality of products i); $\sum_{k=1}^{K} V_{ik} \le W_i$ (the total volume of products for sale should not exceed the volume of demand for products i in the markets); $f_{ik}(y_{i2k}) \le c_{ik}$,, where c_{ik}—price of products i of enterprise k in the market (the price for products should not be lower than its prime cost, expressed through the corresponding indicator of competitiveness); $z_{ko} + z_{kc} \le \Phi_k$ (financial constrains).

Naturally, this statement illustrates only a general view on assessing the impact of the digital transformation of SMEs, on their market competitiveness, which depends on the effectiveness of IS. Moreover, at this stage of the digitalization of the economy, it is not possible to solve in general terms the problem of IS efficiency due to insignificant statistics on the evaluation of the effectiveness of information systems. While this remains a fundamental problem, many experts are working on a solution to it. Although the costs of digitalization become a significant cost item, investing in it is sufficiently blind, sometimes without a clear vision of the results, since there are many sources of efficiency, the main of which are (Medennikov et al. 2015):

- the first point is determined by saving production costs (reducing employees, reducing idle facilities expenses, the cost of storing materials, etc.);
- the second point is associated with an increase in production discipline, quality of labor.

The third point is associated with the possibility of enhancing the ICT of the mental abilities of users by arranging knowledge accumulations in the form of information products: software that implements higher modes of information processing, databases, electronic libraries, and so

on. If the first and second points can be somehow estimated, then the third point is difficult to be measured. Typically, individual approaches to calculating effectiveness are applied by assessing the occurrence of various sources. For example, in terms of productivity (the number of documents processed, the time spent on solving problems, etc.); availability and reliability of services (the ability to work in several time zones, the possibility of losses in case of downtime); comparison of income and expenses in the context of specific information services.

To formalize the rationale for the development of digital digitalization platforms for small and medium enterprises, we introduce the following notation: $S = \{S_m\}$—a set of IS, where $S_m = \{S_{rmp}\}$; $r = \overline{1,R}$; $m = \overline{1,M}$; $p \in P$; S_{rmp}—r-subsystem of m– IS for SME p. $P = \{P_{oj}\}$, where o—index, identifying the industry sector, j—index, reflecting organizational, economic, technological, ecological specific features of production process $j = \overline{1,J}$.

Let us designate $I_{sm}\left(i, \underset{l \in L_i}{U} K_l\right)$ as project of m– IS at a specific i—stage of design l, K_l—a set of data concerning data structures, where $K_l \subset K$; $l = \overline{1,L}$; $i = \overline{1,I}$.

In this case, we can write the design procedure in the following form.

$I_{sm}\left(i, \underset{l \in L_i}{U} K_l\right) \xrightarrow{\Pi(i,i+1)} I_{sm}\left(i+1, \underset{l \in L_{i+1}}{U} K_l\right)$, where $\Pi(i, i+1)$ method of design, shaping IS project. $F(\Pi, P, K, S, J)$—as a criterion of the design procedure effectiveness, in so doing it should take on optimal value.

In the case of defining projects $I_{sm}\left(i, \underset{l \in L_i}{U} K_l\right)$, $I_{sm}\left(i+1, \underset{l \in L_{i+1}}{U} K_l\right)$ in the form of information arrays, and the design methods are applicable only for one enterprise $p = p_0$, then design refers to the category of an individual, if the design methods are applicable to a whole group of enterprises $P_1 \subset P$, then design refers to the category of typical, in the case of independent design methods from specific p and if the design method is framed in the form of tools, then this method belongs to the category of automated one.

In real life, the choice of design method depends on the resources allocated to design R_Π; means of design C_Π; IS structure G_{sm}, for example, scheduled re-engineering of management structure; system resources R_{sm}, e.g., a set of hardware; system characteristics B_{sm} (time, cost etc.). Then, for industries with a large number of homogeneous enterprises, which include

SMEs, to form digital platforms it is necessary to solve the following problem: by choosing design tools C_{Π} and design methods to achieve a given set of system characteristics $D_{sm} \subset D_o$. For example, in (Medennikov 2019) a mathematical model of clustering digital platforms is given. Then, based on the generated digital platforms, we write in the following form the model for evaluating the impact of the digital transformation of SMEs on their market competitiveness. Let us introduce the designations.

f_{jo}– j—management function of o– type of enterprise, $j \in J_o$, $J_o \subset J$,
s_k– s—is subsystem, $s_k \in S$,
E_{jo}—indicator of digitalization effectiveness j—management function of o—type of enterprise,

Then the total digitalization effectiveness of o—type of enterprise is written in the form $E_o = \sum_j E_{jo}$.

Based on this, it would be possible to plan a step-by-step optimal digital transformation of SMEs with the definition, corresponding local and integrated efficiency of this process. For example, one could calculate the degree of influence r_s on reducing losses in the total production of an enterprise $w = \sum_{n,m} \Delta y_{nm}\left(r_1,\ldots,r_i,\ldots\right)$, n—type of technology, n = [1, N], m—type of technological operation, m = [1,M]. In the calculation $k_s = \frac{\partial W}{\partial r_s}$ we obtain the coefficient of influence r_s on reducing losses in the total production of the enterprise.

Let us examine, as an example, economic calculations for some types of technologies in SMEs. The amount of additional revenue U_1 due to the reduction in the time required for technological operations during digitalization of production is as follows $U_1 = \sum_{i=1}^{M} c_i \cdot s_i \left(Q_i^2 - Q_i^1\right)$, where M is the number of types of products, c_i is the cost of production i products, s_i- the scale of production i—products.

Q_i^1, Q_i^2—productivity i—the number of products before and after manufacturing digitalization.

The amount of cost reduction due to the decreasing unplanned equipment downtime U_2 is determined by the formula $U_2 = \left(\frac{r_1 - r_2}{H} \right) \cdot p$, where r_1, r_2 is the annual number of equipment downtimes before and after digitalization of production, H is the annual number of hours worked by one conventional reference unit, p is the book value of one conventional reference unit.

The result of the calculations of clustering digital platforms (Medennikov 2019) for SMEs is a common information Internet space (CIIS) of their digital interaction. The indicated DP is formed on the basis of integration in some cloud of primary accounting databases, technological databases, small and medium enterprises according to common standards. The same cloud stores unified registers of all material, intellectual and human resources. Such an approach to the digitalization of SMEs will make it possible to develop standard management information systems with the typification of sites for all organizations involved in this digital interaction. This will reduce the cost of their digitalization enormously, which will significantly increase the impact of the digital transformation of SMEs on their competitiveness in the market.

7.4 Conclusions and Implications

Summing up the above, digital transformation is inevitable for both large enterprises and SMEs. This is a process that permeates all spheres of human activity, all enterprises and all processes, rapidly changing our understanding of things and the possibilities of their use. Large enterprises attract SMEs, which have greater flexibility and new technological solutions, for the production of new products and services, for solving global energy, climate and other problems. People increasingly use platform solutions because it saves the most expensive and irreplaceable resource—time—and makes life easier in general. Thus, the digital transformation is a change in the ideology of behavior, consumption that is a change in lifestyle in general. And this is characteristic both for an individual person and for large, medium and small enterprises. The world is changing and we are changing with it.

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