Model of transformation of system of management of industrial enterprises under digitalization conditions

Irina Tronina*, Galina Tatenko¹ and Svetlana Bakhtina¹

¹ Orel State University named after I. S. Turgenev, Komsomolskaya str., 95, Orel, 302026, Russia

* E-mail: irina-tronina@yandex.ru

Abstract. It was established in the course of investigation that the experience of digital transformation had turned out to be successful not for all companies. It has been defined that a system of management meeting the requirements of digital economy is necessary for adaptation of a company to the changing environmental conditions owing to the breakthrough technologies. The investigation provides a model of transformation of the industrial enterprise management system under digitalization conditions. A methodological approach has been offered for conducting organizational diagnostics and structuring the problems of management of an enterprise that selected the strategy of digital development based on the integrated organizational concept. The parameters for diagnostics have been selected on the basis of analyzing experience of digital transformations of companies in the domestic and foreign practice (data have been received from the open information sources). The proposed approach makes it possible to identify possible reasons of organizational problems of enterprise digital transformations as well as plan activities for settling these problems.

1. Introduction
The digital transformation is not the process that can be deposited into a software product procured from an IT company. The digital innovations are to be built through the mechanisms of organizational culture inside of the enterprise itself, irrespective of its industrial affiliation better understanding its own business and clients. All elements of production and managerial system of an industrial enterprise should be involved into this process. Absolutely any processes related to organizational and strategic transformations directly concern changes of not production system alone, but the control system too. In this regard the problems of development of the industrial enterprises management system under modern conditions are always relevant.

2. Research objective
The advanced information and communications technologies definitely provide immense opportunities for companies development expanding a range of data and algorithms for analyzing thereof. But a capability of implementing these new abilities of the environment depends on the company management system. Basically, particularly the system helps to build the company as a unified economic and social system forming the processes of efficient functioning and development therein. This is precisely why the research objective consists in studying issues of organization management system readiness to carry out control of its digital transformation.
3. Model of transformation of industrial enterprise management system under digitalization conditions

The following can be referred to as the relevant external challenges related to the process of digitalization so far: globalization, competitive expansion, growth of requirements to eco-friendliness, growth of intricacy of control system, automation [1]. The enterprises need to quicker adopt efficient decisions under such conditions, in order to keep competitiveness in the longer term. In order to do so, flexibility as strategic characteristic pointing at the ability of implementing real-time changes at the company, including implementation of fundamental transformations of business model becomes an important quality of success. It is necessary to incorporate a large variety of different technologies not only in production sphere, but in control too to reach this goal. All organization shall be prepared to supporting and incorporating continuous changes.

In order to establish a constantly developing and flexible company ready to continuous adaptation to changing environmental conditions due to relevant technologies, a strong management system is needed compliant with the requirements of digital economy. The question of how this system should look like is rather difficult and is open so far [2]. Figure 1 provides a descriptive model of modern enterprise management system reflecting a need for transformation for the sake of development of capabilities to effect control of enterprise digital transformation.

**Challenges of digitalization process:**
globalization, competitive expansion, increasing requirements to ecological compatibility, increasing complexity of control systems, automation

**Traditional management paradigm**
- autocratic managerial style;
- centralized planning system;
- linear functional structure;
- weak horizontal relations;
- vertically-stretched process of taking decisions;
- obsession with material values;
- irresponsible attitude to organizational culture;
- feeble involvement of employees into process of taking decisions;
- difficulties of staff turnover;
- resistance to changes

**New management paradigm**
- impermissibility of using autocratic managerial style;
- re-framing hierarchy;
- substantial force of team spirit;
- emphasis on organizational architecture;
- shaping key values of millennials;
- data transparency;
- necessity of stress management;
- organizational therapy;
- company’s health as a new corporate goal;
- appearance of value conscious management

**Skills and abilities of managers:**
systems thinking, theoretical skills, time management, analytical capabilities, logic, personal development, arithmetic reasoning, lean production, risks management, intercultural communication, creativity, planning skills, project-oriented thinking, commitment, public speaking, strategic thinking, quality control, etc.

**Super-professional skills and abilities of managers:**
systems thinking; programming / robotics technology / artificial intellect; interdisciplinary communication; multilingualism and multiculturalism; customer-oriented approach, people business; projects management; ecological thinking; design thinking; lean production

**Figure 1.** Model of transformation of industrial enterprise management system under conditions of digitalization.
Presently, there is a great number of works of scientists (theoreticians and practitioners) in foreign and national scientific literature, which are devoted to the problems of development of modern management. Nevertheless, Russian management the same as any other science pursues its own path towards reaching the goal of its development accordance with the evolving world trends. Having a sufficient number of contradictions, unfortunately, the system of management of a Russian enterprise does not correspond to characteristics of the new management paradigm, pointed out, among others in works of I. Adizes [3]. Besides, a set of super-professional skills and abilities of managers is also to be a subject to correcting [4]. In the context of our research we place emphasis on the following components of the industrial enterprise management system using an integrated focus on the company of P. Jenster and D. Hassi: goals and objectives, strategy, structure, personnel, information system, process of taking decisions, control system, stimulation system and culture [5]. Except but a necessity of these elements interaction with each other for attaining a positive synergy effect must be stressed (figure 1).

4. Methodological approach to conducting organizational diagnostics of enterprise

The studied experience of implementing the strategy of digitalization in the domestic and foreign practice helps to draw a conclusion that the intended positive result does not always come true [6]. Since the strategy of digitalization in and of itself assumes a set of complex reorganization measures, the transition to a new business model is inevitable, which means the transition to a new control system. It is quite difficult to predict and take into account all potential problems, which the enterprise may encounter in the period of strategy implementation in such complex of strategic solutions [7]. In this regard, the methodology of conducting organizational diagnostics and structuring the problems of management of enterprise that selected a strategy of digital development has been proposed for understanding the enterprise readiness to establishing a strategy of digital development (figure 2).

![Figure 2. Methodological approach to conducting organizational diagnostics and structuring management problems of enterprise that selected a strategy of digital development.](image)
It is necessary to distinguish parameters making it possible to give an estimate of the current state of system of management of enterprise being analyzed under conditions of digitalization at the first stage of conducting organizational diagnostics. In the context of our research the assessment parameters have been selected on the basis of analyzing experience of digital transformations of the companies in the domestic and foreign practice (data have been received from the open information sources), author Adizes [8], author Porter [9], and author Lalu [10]. The proposed parameters are reflected in table 1. The proposed parameters are reflected in table 1.

**Table 1. Parameters for assessing the management system of an enterprise that selected the strategy of digital development.**

| Directions of diagnostics | Parameters for assessing every direction of management system diagnostics |
|---------------------------|------------------------------------------------------------------------|
| 1. Goals and objectives   | 1. Corporate goal – harmonious company development both internally and externally |
|                           | 2. Motivational goal systems                                           |
|                           | 3. Compliance of goals and objectives with SMART criteria              |
| 2. Strategy               | 1. Availability of strategy (strategy section) of digital transformation |
|                           | 2. Availability of a person responsible for development of digital technologies in company |
|                           | 3. Flexibility of strategic planning                                   |
|                           | 4. Compliance of strategy with the level of industry scientific and technological development |
|                           | 5. Strategy considers company’s cumulative experience                   |
| 3. Information system     | 1. Common team responsibility for informational security              |
|                           | 2. Transfer of knowledge and information bottom-up and horizontally    |
|                           | 3. Availability of facilities for collecting data and data transmission (sensors, pictures made from space, drones, broadband Internet) |
|                           | 4. Availability of function of data storage and processing (technologies of handling databases and analysis of regularities) |
|                           | 5. Standard data interface                                             |
| 4. Culture                | 1. Personal responsibility for work quality                            |
|                           | 2. Concerted action within a team                                      |
|                           | 3. Emotional organization building through bringing the strategy subject matter to everyone’s notice |
|                           | 4. Emotional attitude towards brand                                    |
| 5. Process of taking decisions | 1. Ability of the administrative staff to work under uncertainty conditions |
|                           | 2. Flexible management                                                 |
|                           | 3. Capability of making measurements                                   |
|                           | 4. Automating the process of taking decisions (expert system, artificial intellect) |
| 6. Control system         | 1. Remote management of global teams                                   |
|                           | 2. Goal-oriented management (functional, emotional, social)            |
|                           | 3. Unified principles and methods of work of global, regional and local divisions |
| 7. Stimulation system     | 1. Complex system of initiative and experiments stimulation             |
|                           | 2. Tolerant attitude to the mistakes of employees who attempted to do something new |
|                           | 3. Up-to-date methods in staff relations (programs of information exchange, reverse mentoring, specialized computer programs) |
|                           | 4. New remuneration systems (flexible work schedule, personal assistant services, periodic research leave, allotted time for work for someone’s own project) |
| 8. Structure              | 1. New forms of inter-functional interaction                           |
|                           | 2. Differentiation and integration, lines blurring                     |
|                           | 3. New divisions responsible for data management, divisions for permanent product and customer’s experience management |
|                           | 4. Elements of short organizational structure                          |
|                           | 5. Flexible organizational structure with the elements of network architecture (flexible job duties, short-term leading roles) |
|                           | 6. Target-oriented project groups                                      |
|                           | 7. Deep cooperation and integration of IT and R&D                      |
The successful company’s “digitalization” or availability of factors putting it into unfavorable position in the point of view of digital transformations will be determined by the ability to act quickly and effectively in the face of external and internal conditions. This is primarily the result of the company’s managerial abilities and appropriate organizational mechanisms. The management system profile at the next stage of development should be determined on the basis of the ability to work in team of personnel, the readiness of the company to changes, the continuous learning of managers and employees, and the availability of digital competences with the company’s personnel. An evaluation of the parameters is to be given for every management system element specifically of the company’s personnel, management system diagnostics, integrating processes, control system, and culture. It should be noted that the list of parameters presented in table 1 is not the exhaustive one. New managerial approaches and instruments contributing to successful digital transformation will be formed with the advent of new technologies. Besides, it is necessary to consider profile, size, peculiarities of functioning of a particular enterprise as well as departmental specific features and the level of technologies development therein in the course of organizational diagnostics.

At the second state an expert appraisal will be carried out to help determine compliance of the management system elements of the enterprise being analyzed with the selected parameters. An assessment is to be given for every parameter to be later presented graphically. The company’s leading specialists are to act as experts. It is suggested to the experts to put an appraisal by points ranging from 0 to 5 in the specifically prepared tables with respect to the listed parameters characterizing this or the other management system element. The average-weighted criterion evaluation will be determined proceeding from the experts’ appraisals and significance of the parameter for a particular company. The integral assessment of efficiency of every direction of control system represents a system of average-weighted evaluations of parameters. The results of integral evaluations are required for building the management system profile at the next stage.

The third stage – building profile of the management system of the enterprise being analyzed [11]. The profile of the company’s management system corresponds to a sum of characteristics, owing to which it is possible to estimate a success or lack of success of digital transformations. An example of building profile of the company’s management system is presented in table 2.

| Management system element | Average-weighted evaluation, points |
|---------------------------|------------------------------------|
| Goals and objectives      | 4                                  |
| Strategy                  | 3                                  |
| Information system,       | 2                                  |
| Culture                   | 2                                  |
| Process of taking decisions | 4                                  |
| Control system            | 4                                  |
| Rewarding system          | 4                                  |
| Company structure         | 2                                  |
| Personnel                 | 2                                  |

The plotted profile of the company’s management system helps vividly see all merits and demerits of management. A combination of abilities and skills of employees, organizational resources contributing to successful transformation of company’s are the management system merits from the point of view of digital transformations. The demerit is the absence of important components for successful company’s “digitalization” or availability of factors putting it into unfavorable position. The analysis of management system merits and demerits (the fourth stage) gives a chance to establish, on the one hand, a link between potential and organization problems, on the other hand – a link...
between its merits and demerits, which helps determine the prospects for further company development [12].

The next stage is the building of the company’s management system problem field under conditions of digital transformation. A tree of problems can be used as the instrument for building the problem field. In order to build it, it is necessary to articulate the major key problem, reveal the problem consequences (problem-consequence) and identify the reasons of problem (problem-reason) emergence. An example of building the tree of organizational problems of the company is shown in figure 3.

![Figure 3. Example of building tree of company’s organizational problems.](image)

The identification of reasons of organizational problems of digital transformations at the company at the next stage of analysis can help in articulating goals when transmitting the goals to positive aspects of the intended future situation.

The conclusive stage of conducting company’s organizational diagnostics is the development of measures for rectifying revealed organizational problems.

5. Obtained results
Proceeding from studying the existing experience of functioning and development of industrial enterprises under digitalization conditions, the authors have developed a descriptive model of management system transformation as well as offered a methodological approach to conducting self-diagnostics for assessing the management system of the company, which has selected a strategy of digital development. The offered methodology has been tested on the materials of a regional industrial
enterprise of pharmaceutical industry. The company’s leading specialists played the role of experts during assessment, which resulted in building the profile of the management system of the company being analyzed, placing emphasis on merits and demerits in the development of management parameters. The use of the offered methodology helped reveal the hidden problems in the target model of organization and management structure, as well as giving a chance to substantiate an insufficient efficiency in using information and communication technologies at the enterprise. Earlier the company’s management paid attention predominantly to digital technologies not changing in this case the management system. Proceeding from the results of performed internal self-diagnostics, the administration of the regional industrial enterprise has corrected the digital strategy of development taking into account the revealed managerial problems.

6. Conclusions
The sustained trends of world development have certain impact on the practice of management gradually determining the need for a new managerial paradigm [13, 14]. Such a need is especially evident for Russia escaping from rigidly centralized management system [15]. In this regard, let us distinguish some modern trends of management development: enhancement of social orientation of management systems towards an employee, a consumer, an owner; a shift in the process of interaction of subject and object of management from the relations of domination and obedience to a dialog, agreement and cooperation between them; growing attention to a technology of managerial activity both on the basis of its improvement and optimization; professionalization of managerial activity with forming the super-professional skills and abilities of managers; transition from a direct impact on an individual to the establishment of microenvironment, where the people realize themselves as personalities (formation of strong organizational culture); enhancing awareness of social significance and usefulness of managerial activity, expansion of “service management” in practice — intellectual servicing by the staff of management of collective labor and vital activities of labor organizations; internationalization of theory and advanced practice of management.

7. Directions for further research
The offered methodological approach helps perform self-diagnostics of the company’s management system with revealing merits and demerits for determining possibilities of digital development. Further the methodology can be complemented with the scenario-based approach for developing strategic alternatives of digital development of an industrial enterprise. It is also possible to determine the principles of successful digital transformation for conducting multi-criteria analysis of the development strategy.

Reference:
[1] Loshkareva E., Luksha P., Ninenko I., Snagin I. and Sudakov D. 2017 Skills of the Future. What it is Necessary to Know and Manage in a New Complex World, https://edu2035.org/images/people/WSdoklad_12_okt_eng-ilovepdf-compressed.pdf.
[2] Mintsberg G 2018 Management: Nature and Structure of Organizations (Moscow: Exmo) 512
[3] Adizes I 2016 Managing Changes. How to Efficiently Manage Changes in Society, Business and Personal Life (Moscow: Mann, Ivanov and Ferber) 368.
[4] Atlas of New Specialties, http://atlas100.ru/about/
[5] Jenster P and Hassi D 2003 Analysis of Company’s Merits and Demerits: Determining Strategic Capabilities (Moscow: Publishing House “Williams”) 368.
[6] Nothing Could Make Us Change, https://hbr.org/archive-toc/BR1801
[7] Shwab K 2017 The Fourth Industrial revolution (Moscow: Publishing House “E”) 208.
[8] On the Brink of Managerial Revolution, https://hbr.org/archive-toc/BR1701
[9] Revolution in Production. “Smart” Technologies Remake Companies, https://hbr.org/archive-toc/BR1601
[10] Lalu F 2016 Opening Organizations of the Future (Moscow: Mann, Ivanov and Ferber) 432
[11] Savelieva N 2012 Strategic Management (Rostov-on-Don: Fenix) 382.
[12] Magretta D 2013 Key Ideas. Michael Porter. Manual for Development of Strategy (Moscow: Mann, Ivanov and Ferber) 272
[13] Adizes I 2016 New Deliberations on Management (Moscow: Mann, Ivanov and Ferber) 208
[14] Lifelong Lesson, https://hbr.org/archive-toc/BR1701
[15] Lafli A., Martin R., 2014. A Game to Win. How the Strategy Works in Reality (Moscow: Mann, Ivanov and Ferber) 304