ATLANTIS PRESS
Advances in Economics, Business and Management Research, volume 105
1st International Scientific and Practical Conference on Digital Economy (ISCDE 2019)

Industry 4.0.: advanced approach

Pyankova S.G.
Ural State Pedagogical University
Yekaterinburg, Russia
silen_06@list.ru

Yalunina E.N.
Ural State Pedagogical University
Yekaterinburg, Russia
yalunina@usue.ru

Zakirova E.R.
Ural State Pedagogical University
Yekaterinburg, Russia
erzakirova@inbox.ru

Astanakulov O.T.
Tashkent Financial Institute
Yekaterinburg, Russia
astanakulov@gmail.com

Veselukhina P.V.
New Projects LLC, Ural State Economic University
Yekaterinburg, Russia
pveselukhina@devvela.com

***Abstract* — The article contains the basic concepts that characterize the term Industry 4.0, presents the research results of leading analytical agencies, presents a comparative description of the traditional approach and flexible management methods, analyzes the "digital" trade balance of European countries, presents the technologies that form the basis of the fourth industrial revolution, gives comparative characteristics of hierarchical structures of production and management of traditional enterprises using flexible principles of design work. According to the results of the research, it was concluded that Industry 4.0 brings great opportunities for innovative manufacturers, system suppliers, and entire regions. But, as in the previous modernization stages, Industry 4.0 also poses a serious threat to companies and regions that are not keeping pace with modern challenges. As business models, economies, and skill requirements change, major changes in management decision-making practice will become apparent.**

Keywords — fourth industrial revolution, industry 4.0, digitalization, information technology, project management, management, automation.

I. INTRODUCTION

For countries with leading positions in the manufacturing sector, Industry 4.0 promises enormous opportunities. In order to maintain and expand their competitiveness, leading countries (or aspiring to this place) should start using the huge potential of the fourth industrial revolution as soon as possible; participate in the formation of the digital restructuring of the industry. Therefore, studies on this issue are relevant.

II. REVIEW OF LITERATURE

The term Industry 4.0 refers to the potential of the new industrial revolution, which will combine advanced manufacturing technologies with the Internet of Things to create production systems. These systems will not only be interconnected but will also be able to transmit, analyze and use the information to transform intelligent tasks for use in the real (non-digital) world.

Industry 4.0 is based on two processes: creation of network structures and self-regulation. Previously, industrial enterprises controlled the equipment centrally. Information was collected in different systems and processed by people who then made adjustments. This approach will fundamentally change with the fourth industrial revolution. In the digitized future, all machines (equipment), as well as the components themselves, will be equipped with sensors. Through sensors, machines will be able to communicate; transfer information. Not only with each other, but also with other systems (departments): production, sales, development, even customers and suppliers will be included in this networking.

Centralized management is being replaced by decentralized self-optimization. This is the next step in factory automation, the so-called Smart Factory. Robots and machines are no longer simple machines, configured to repeat production operations: thanks to the integration of all production processes into a network, they independently decide which component passes through production.

The results of a study by McKinsey Global Institute, an American analytical company, show that leading European countries have not fully realized their "digital" potential. In Germany, the digital trade deficit with the US is 4.2% of total services (Figure 1). Digital Potential is based on a business digitalization index calculated by McKinsey Global Institute experts. It includes digitalization at the industry level due to digital spending, the share of labor in digital jobs and other indicators. For each country, the aggregated digitalization indicator is calculated based on the internal structure of the business.

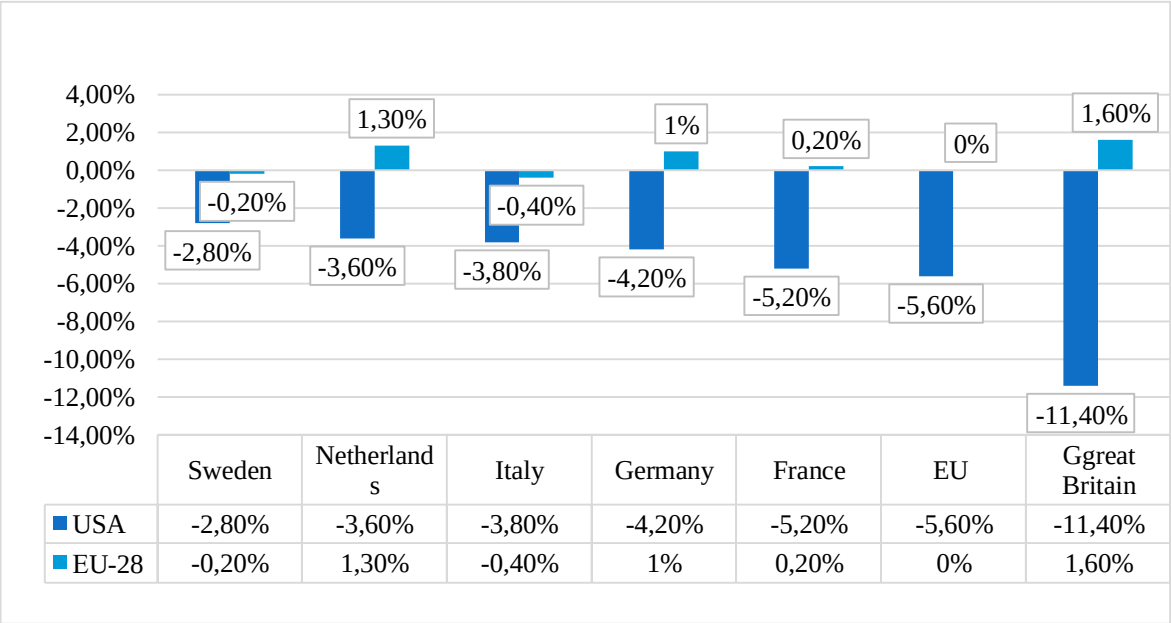

Fig. 1 Digital trade balance (from services provided) [3, P. 11]

III. Research Methodology

Due to the variety of logical operations throughout the entire production cycle, the concept of using Industry 4.0 places high demands on cooperation in companies. Often, various departments, such as the department of production, IT, procurement, new product development, and sales, must work together to find their clients in a highly competitive environment. That is why design thinking and ideas used in flexible management methods (Table 1) can help accelerate internal processes and quickly bring to market the best solutions or production processes.

The traditional approach involves a hierarchical structure that provides order and control among employees. The main objective of management is to develop processes that increase the productivity of the organization and produce results. Managers strive to demonstrate authority in decision-making and are internally motivated to achieve power and career growth.

It is assumed that in 4.0-management, managers are not distanced from subordinates, and managers are open to new opportunities, welcome change as a challenge and adapt their management style to the needs of others. They aim to inspire and develop knowledge, skills, and abilities, to support individual employees and teams to achieve their goals.

TABLE I. Comparative characteristics of the traditional approach and flexible management methods [13, P. 215]

Description	Traditional approach	Flexible methods
Project requirements	Clearly compiled with a low probability of change	Creative, innovative, vague requirements
Users	Not involved in the project	Close and frequent collaboration
Documentation	Formalized and Mandatory	Not formalized
Project volume	Big	Small
Team members	Project unfocused, dispersed team	Close-knit, small team
Project plan	Rigid linear tasking system	Compound and Iterative Plan

According to a BCG consulting company study of 2017, companies that have successfully implemented 4.0 management methods will be able to reduce conversion costs (associated with switching to new products) by 40% [18, P. 3] in 5–10 years.

A joint survey of the consulting company Sopra Steria and the FAZ-Institute of Management and Information Technology, conducted in 2018 among more than 300 German managers and top managers from various fields, shows that there is an interest in using flexible management methods: 8 out of 10 managers consider it appropriate [14, P. 25, 43, 45]. However, only 14% of respondents have already restructured the management system. In 28% of companies, the management model is still classically hierarchical, and another 19% adhere to a leadership style based on stakeholder participation. Only 30% of the managers surveyed are

currently working on the abolition of the hierarchical management system.

Obviously, the use of flexible principles of project management means not only the application of a digital strategy throughout the company aimed at creating a highly specialized (client-oriented) product, but also creating a new culture of cooperation. Flexible organizational cultures are characterized by transparency, ongoing dialogue, trusting relationships, and short-term feedback mechanisms.

However, there is a flip side to the coin. With the wrong approach, a situation may arise when smoothly functioning, rehearsed operations and processes suddenly stop. Employees feel taken aback, they do not keep pace with the rapid pace and organizational changes. Suddenly everything is being called into question, everyone is responsible for everything. There are problems of prioritization, employees do not accept new roles and tasks, fear of losing control, lack of experience and cultural obstacles — these are one of the main reasons for the failure to use flexible principles of project work.

IV. Practical relevance, suggestions, and results of implementations, the results of experimental studies.

The current digital transformation has just begun. In addition, there is no clear understanding of what drives digital conversion and what prevents it. Nick Tune, director of strategic development at Navico (the world's largest manufacturer of marine electronics systems) identifies three obstacles to the company's successful digital transformation [16]:

1. the company is focused on optimizing existing processes without questioning the appropriateness of the processes themselves;
2. faith in the self-fulfilling effect of the introduction of flexible management methods;
3. hostility to the developed methods and technologies.

Undoubtedly, one must be attentive to new fashion trends in management. Company executives have always sought to simplify processes and use modern technology to expand and improve their business; better adapt to changing market conditions, understand customers, etc. — in essence, what is meant by the modernization potential of the fourth industrial revolution.

Managing within Industry 4.0 means learning from mistakes together, rather than continuing in the “what's wrong and who is to blame”-mode. Last but not least, everyone should ask themselves the question: How can I change and what do I need for this? The use of flexible management methods can only be effective if everyone (from top management to simple performers) changes his attitude to the processes of the company that has embarked on the path of digital modernization.

A vivid example of the blind introduction of flexible principles of project work can be a statement by Igor Dmitriev, the former director of the monetary policy department of the Central Bank of the Russian Federation, on the sidelines of the 2018 Gaidar Forum on the use of the Kanban Board for planning tasks. Dmitriev highlighted that the division of the tasks of the department on a 7.5-meter board was his initiative, supported by other employees. However, such changes caused confusion among some employees, because change is difficult.

An absolute pioneer in the implementation of innovative ideas, in particular in management, is Sberbank. Back in 2016, the head of the bank German Gref announced the transition to flexible principles in management, which allowed to implement many projects faster.

A survey of the consulting and auditing company PwC among 235 German companies from the information and communication sector and the processing industry showed that for 59% of respondents an important reason for cooperation in the context of Industry 4.0 is the ability to better meet customer requirements. Only for 11% does Industry 4.0 provide opportunities to minimize risks [10, P. 34]. This is a natural result since for the vast majority of companies around the world, the upcoming fourth industrial revolution is characterized by the following challenges [6, 7, 8, 9]:

- unclear economic benefits and excessive investment;
- insufficient qualifications of employees;
- lack of standards, rules and forms of certification;
- incomprehensible legal situation using external data;
- issues regarding data security (including cybersecurity);
- lack of priority/support from senior management.

We can say that the upcoming (advancing) digital era is characterized by the concept of uncertainty (i.e. risk). As noted above, the achievements and technologies of the fourth industrial revolution should be adequately perceived by the people who are at the head of the companies. They must consciously apply flexible working principles suitable for the level of development of their companies, be able to identify advanced production trends based on automation and digitalization.

V. Conclusions, discussion of the results

Thus, Industry 4.0 brings enormous opportunities for innovative manufacturers, system suppliers and entire regions. But, as in the previous modernization stages, Industry 4.0 also poses a serious threat to companies and regions that are not keeping pace with modern challenges. As business models, economies, and skill requirements change, major changes in management decision-making practice will become apparent. One of the sources of development of producers and the regions as a whole can be institutions of socio-economic development [15].

References

[1] The Bank of Russia is preparing for an “agile transformation”. RIA News. January 18, 2018. URL:

http://web.cs.wpi.edu/~matt/courses/cs563/talks/education/IEstatic.html (access date 07/07/2019).

[2] Culture First! – Von den Vorreitern des digitalen Wandels lernen: Change Management Studie 2017. Capgemini Consulting. Offenbach am Main, 2017. 71 P.

[3] Das digitale Wirtschaftswunder. Wunsch oder Wirklichkeit? McKinsey Global Institute, 2017.

[4] Die agile Transformation. Unternehmen auf der Reise zur Anpassungsfähigkeit / PwC, 2018. 15 P.

[5] Dr. Zimmermann G. (2019) Warum ist Agilität für Industrie 4.0 wichtig? Die Notwendigkeit neuer Organisationsformen im digitalen Zeitalter / LBBW. 48 P.

[6] Industrie 4.0 – Chancen und Herausforderungen der vierten industriellen Revolution / Strategy&, 2014.

[7] Industrie 4.0 – Volks- und betriebswirtschaftliche Faktoren für den Standort Deutschland / Bundesministerium für Wirtschaft und Energie. Berlin, 2015.

[8] Industrie 4.0 und Digitale Wirtschaft – Impulse für Wachstum, Beschäftigung und Innovation. Bundesministerium für Wirtschaft und Energie. Berlin, 2015.

[9] Industry 4.0 – How digitalization makes the supply chain more efficient, agile and customer-focused. NBER, 2016. 31 p.;

[10] Industry 4.0 – Opportunities and Challenges of the Industrial Internet. PwC, 2014. 50 p.

[11] Industry 4.0 – The Capgemini Consulting View: Sharpening the Picture beyond the Hype / Capgemini Consulting. 2014. 36 p.

[12] Industry 4.0 – The Future of Productivity and Growth in Manufacturing Industries. The Boston Consulting Group, 2015. 16 p.

[13] Jovanović M., Lalić B., Mas A., Mesquida A.-L. (2015) The agile approach in industrial and software engineering project management. Journal of Applied Engineering Science. No. 13. Pp. 213–216.

[14] Potenzialanalyse Agil Entscheiden. Sopra Steria Consulting, 2018. 55 P.

[15] S. Pyankova, O. Ergunova (2018) The role of regional development institutions in the social and economic development. 5th International Multidisciplinary Scientific Conference on Social Sciences and Arts SGEM 2018, 26 August – 1 September. Vol. 5. Issue 1.3. Pp. 885–892

[16] Tune N. Digital Transformation… The Hard Parts. InfoQ. URL: http://web.cs.wpi.edu/~matt/courses/cs563/talks/education/IEstatic.html (access date 07/07/2019).

[17] Was ist Industrie 4.0? Plattform Industrie 4.0. URL: http://web.cs.wpi.edu/~matt/courses/cs563/talks/education/IEstatic.html (access date 03/20/2019).

[18] When Lean Meets Industry 4.0 – The Next Level of Operational Excellence / The Boston Consulting Group, 2017. 15 p.