Industry 4.0.: advanced approach

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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.
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.

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

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

<table>
<thead>
<tr>
<th></th>
<th>Traditional approach</th>
<th>Flexible methods</th>
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</thead>
<tbody>
<tr>
<td>Project requirements</td>
<td>Clearly compiled with a low probability of change</td>
<td>Creative, innovative, vague requirements</td>
</tr>
<tr>
<td>Users</td>
<td>Not involved in the project</td>
<td>Close and frequent collaboration</td>
</tr>
<tr>
<td>Documentation</td>
<td>Formalized and Mandatory</td>
<td>Not formalized</td>
</tr>
<tr>
<td>Project volume</td>
<td>Big</td>
<td>Small</td>
</tr>
<tr>
<td>Team members</td>
<td>Project unfocused, dispersed team</td>
<td>Close-knit, small team</td>
</tr>
<tr>
<td>Project plan</td>
<td>Rigid linear tasking system</td>
<td>Compound and Iterative Plan</td>
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</tbody>
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TABLE I. COMPARATIVE CHARACTERISTICS OF THE TRADITIONAL APPROACH AND FLEXIBLE MANAGEMENT METHODS [13, P. 215]
Advances in Economics, Business and Management Research, volume 105

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mistakes together, rather than continuing in the "what's wrong
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:


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


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


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

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

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


Potenzialanalyse Agil Entscheiden. Sopra Steria Consulting, 2018. 55 P.


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).