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New Models of Work Organization in an Industry 4.0 Enterprise - Evolution of the Form of Work

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Abstract:

Purpose: *The purpose of the article is to indicate factors shaping a model of work organization that takes into account new forms of work in an Industry 4.0 enterprise which will function in the future post-pandemic period.*
Design/Methodology/Approach: *The basis for identifying factors shaping a new work model was research on the future of work organization carried out in 2020-21 at a multinational automotive corporation, which successfully implemented Industry 4.0 principles in its executive and management processes. The research in the form of a case study was conducted in two stages. The first stage - a survey with an analysis of results based on descriptive statistics, the second stage - qualitative research focusing on observation techniques and desk research.*
Findings: *The first part presents an analysis of the theory fundamentals characterizing the conditions of new forms of work. The second part describes research methodology and presents research results representing the issues under investigation. The result of the analysis is the presentation of key factors that should be taken into account when creating a new model of work including on-site, hybrid and remote work.*
Practical implications: *The decision-making areas shaping a new model of work organization which are indicated in the article may serve as a model for other enterprises (especially manufacturing ones) regarding assessing the possibility of introducing new forms of work and key factors that will determine them.*
Originality/Value: *As for the theoretical aspect, the article organizes the existing knowledge in the range of factors determining new models of work organization. As far as the research aspect is concerned, it is a source of knowledge about solutions developed in an Industry 4.0 enterprise.*

Keywords: *Work organization, remote work, hybrid work, on-site work, Industry 4.0.*

Paper Type: *Research study.*

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1. Introduction

The situation caused by the COVID-19 pandemic introduced a new dimension into discussion on work organization in enterprises (Carroll and Conboy, 2020). The traditionally dominant on-site form of work has in many cases been replaced by remote work performed outside business premises. Before 2019, in most enterprises, remote work performed outside the physical place of work with the use of online communication was not a large-scale solution (Bloom, 2020, Latest Work-At-Home, 2020, The 2020 State of Remote Work, 2020). As a rule, it was an incidental form of work conditioned by an employer (global scope of company activity - differences in time zones, development of company allocation), or by an employee (personal situation, distance between home and workplace). As research shows, both in the current pandemic situation and in the post-pandemic future, remote work will be an equivalent form of work in the economic reality and in some industries (or areas in enterprises) it may become a dominant way of performing work.

Such a perspective requires enterprises to define a new model of work (Dittes, Richter, Richter and Smolnik, 2019; Grant, Wallace, Spurgeon, Tramontano, and Charalampous, 2019; Prodanova and Kocarev, 2021) organization which will cover:

- singling out three groups of workplaces; the first one - including positions predisposed only to on-site work, the second one where hybrid work is allowed (on-site and remote), and the third one where work can be performed entirely in a remote way,
- developing work rules and regulations that take into account new forms of work as well as, in the case of an international corporation, local solutions regarding labour law,
- indicating necessary hardware and software for employees to perform remote work,
- determining the costs and effectiveness of a new work model,
- determining the rules of teamwork as well as motivating and evaluating employees.

For the proper development of a model of new work organization, enterprises should conduct internal research that will allow to assess the attitude and capabilities of an employee to perform remote work and verify the possibilities of collaboration, communication (Włodarkiewicz-Klimek, 2016) and work management in a remote way (Ferreira, Pereira, Bianchi, and da Silva, 2020).

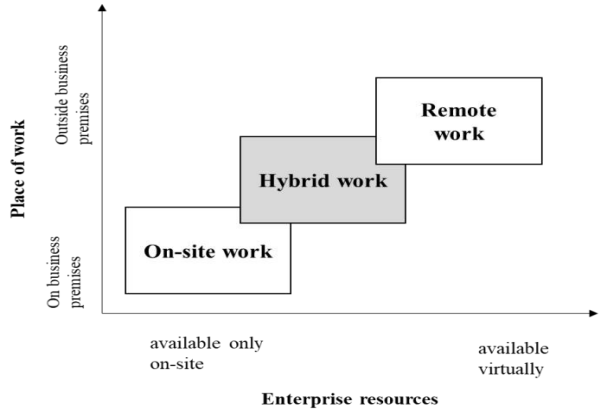
The aim of the article is to indicate factors shaping a model of work organization that takes into account new forms of work in an Industry 4.0 enterprise which will function in the future post-pandemic period. The basis for the development of the model was research on the future of work organization conducted in 2020-21 at a multinational automotive corporation, which successfully implemented Industry 4.0 principles in its executive and management processes.

2. Determinants of Work Organization in Enterprises

Work organization aims to appropriately design an organization's activities which will allow it to function in an efficient, harmonious, and uninterrupted way. Work organization determines the type of activities that should be implemented, the manner, place and form of their performance, and indicates who should perform them. From the point of view of the place and access to enterprise resources, work organization may adopt the following forms:

- on-site - performed on business premises, in the indicated place, using the company infrastructure and equipment in accordance with its working time schedule,
- remote - performed outside business premises with the use of remote communication technologies,
- hybrid - combining elements of on-site and remote work in accordance with arrangements between an employer and employee.

Figure 1. *Forms of work organization in an enterprise*



Source: *Own creation.*

Performing remote work requires the creation of appropriate conditions and providing resources both by an employer and employee. Remote work can be performed when:

- an employee possesses appropriate skills and technical and venue-related capabilities, and the type of work makes this form possible,
- it is performed by means of direct remote communication, and it concerns the production or provision of material services,
- an employer provides materials and tools for work performance as well as logistic services or when an employee agrees to use private resources while maintaining full confidentiality of business information,

- legal and organizational regulations related to recording, calculating and remunerating remote work have been determined.

The introduction of remote work rules requires enterprises to develop new work rules that give a sense of security, protect an employee, and stimulate proper efficiency and a sense of connection with an organization (Leclercq-Vandelannoitte, 2020; Sinclair, Stephens, Whiteman, Swanson-Biearman, and Clark, 2021). New work environment creates and, at the same time, forces employees to develop new competencies and skills. Carlo Tramontano (Tramontano, Grant, and Clarke, 2021) indicates five groups of new competencies that should be developed by an organization and employees in order to positively advance remote work. They include:

- E-skills (Knowledge and Personal efficiency competencies), reflecting their capabilities to manage their workload and work tasks using digital technologies,
- Trust building skills (Trust competency), reflecting their capabilities to build trustworthy relationships,
- Self-care skills (Self Care competency), reflecting their capabilities to effectively and positively manage work-life boundaries that digital technologies provide through being able to access work at any time or from any place,
- Remote social skills (Social & Relational Competency), reflecting their capabilities to manage and promote social relationships remotely,
- Remote emotional skills (Emotional Competency) reflecting their capabilities to manage and act on their emotions when working remotely.

The possibility of commissioning remote work to employees depends primarily on the type of work performed by them. The type of work in this case should be assessed in the context of such factors as: the necessity to use machines and devices located on business premises, the continuity of production and maintenance processes, direct customer service and other. An important element determining remote work is the industry in which a company operates, the type of business activity (trade, service, production), and the level of development of information systems in an organization.

3. Industry 4.0 Enterprises - Factors Favouring the Implementation of New Forms of Work

Over the past few years, digital technologies have thoroughly remodelled the modern economy. Knowledge and access to Internet technologies as well as network-based relationships with business partners and customers have become the basis for building the value of enterprises (Włodarkiewicz-Klimek, 2018). The Industry 4.0 Revolution, becoming part of the global economic reality, has caused rapid technological growth in manufacturing industries. There are nine technological pillars central to Industry 4.0. The developing innovative technology blurs the

boundary between the physical and digital world, paving the way for intelligent and autonomous systems which include, Big Data and Analytics, Autonomous Robots, Advanced Simulation, Horizontal and Vertical System Integration, Industrial Internet of Things, Agile and Anticipatory Cybersecurity, Advanced Hybrid Cloud and Virtualization, Additive Manufacturing (3D Printing), Augmented Reality (Burrus, 2019). In addition to technology, important factors shaping Industry 4.0 are new business models focusing primarily on intelligent products and digital platforms as new market spaces (Culot, Nassimbeni, Orzes, and Sartor, 2020). Organizational changes are also an important factor, expressed through flattening the organizational structure, a dispersed decision-making system and, above all, the development of digital skills among employees at every level of an organization (Neumann, Winkelhaus, Grosse, and Glock, 2021).

Modern solutions in the area of technology, business and activity organization functioning in Industry 4.0 enterprises have been a special element facilitating quick adaptation to new working conditions during the pandemic. Many companies, even before the pandemic, introduced remote work in their organizational solutions. The adoption of such solutions was possible mainly due to:

- implemented integrated management systems allowing to provide remote service in all areas of an organization's operations,
- high level of automation of executive processes,
- providing employees with mobile devices with firmware,
- implemented cyber security principles,implemented division of duties and responsibilities and decentralization of decisions,
- task-based work system in many areas of an enterprise,
- knowledge management in an organization,
- employee continuous learning and improvement processes.

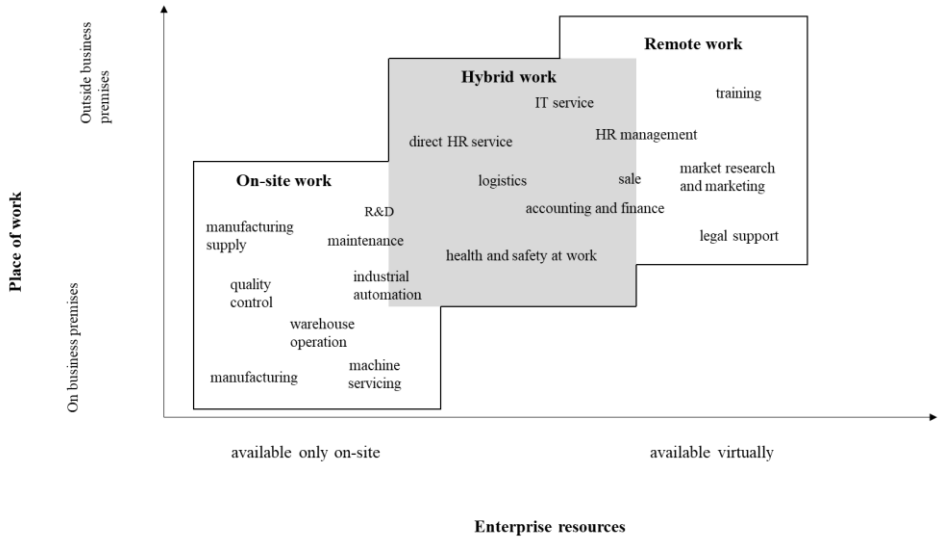
Despite the significant advantage of Industry 4.0 enterprises in the context of work being supported by advanced IT systems as well as existing organizational routines related to the implementation of remote work, most intelligent factories have faced the need to reorganize their operations during the pandemic. First of all, it has become important to distinguish groups of positions where employees:

- can perform their duties fully remotely without diminishing their value from the point of view of company effectiveness, must perform their duties on-site due to the specificity of the manufacturing process and the need to access company physical resources,
- can perform some duties in a hybrid form, e.g. analytical or preparatory tasks can be performed outside business premises, but the preparatory part requires direct presence.

Belonging to the above groups of positions is mainly related to the functional area (production, logistics, human resources, finance, and other) in which a workplace is

located. An overview of the location of workplaces in terms of a form of work in Industry 4.0 enterprises is presented in Figure 2.

Figure 2. *Location of workplaces as regards the form of work in Industry 4.0 enterprises*



Source: *Own creation.*

4. Research on Factors Shaping a New Model of Work Organization in an Industry 4.0 Enterprise

The pandemic period forcing the introduction of remote forms of work in enterprises on the one hand has accelerated the inevitable evolution of forms of work, and on the other hand has become an excellent laboratory for analyzing employee behaviour and enterprise efficiency in changed working conditions. Using these experiences, many enterprises have undertaken research on a new work model.

The study presented in the article was carried out at an international automotive corporation, which is one of the leaders in the implementation of Industry 4.0 solutions. The research was conducted in two stages. The first stage - a survey concerned the assessment of remote work during the pandemic and the prospects for its continuation, the second stage - qualitative research focused on determining factors shaping the model of work organization in the future.

The first stage of the study was carried out in the fourth quarter of 2020 among office staff in all the plants belonging to the enterprise. The main objective of the research was to obtain information in the following three areas: 1) sense of professionalism, comfort and commitment during remote work, 2) assessment of relations with superiors and colleagues during remote work, including methods of

obtaining information, 3) interest in remote work in the future after the end of the pandemic.

Over 1,100 employees took part in the study, which constituted over 53% of all the questionnaires sent. The survey was completed by 12% of managerial staff and 88% of non-managerial staff. In the study population, 38% were women and 62% were men. Among the respondents, 31% worked remotely all the time, 35% worked remotely often, 27% sometimes, and 7% did not work remotely at all. The study was conducted using an electronic questionnaire via an internal IT system. The survey consisted of 15 questions which the respondents rated on a five-point scale, where 5 meant agree completely and 1 meant disagree. The survey results were as follows. Regarding the first area that concerned the sense of professionalism, comfort and commitment during remote work:

- 87% of the respondents believed that remote work during the pandemic was a good solution for them,
- 84% said that remote work had a positive impact on their commitment to work,
- 83% of the respondents stated that they were able to perform their tasks while working remotely,
- 83% believed that they did not experience limitations in the home environment while working remotely,
- 81% stated that they had full or partial access to enterprise resources in order to do their job well,
- 58% of the employees felt safe in the (on-site) workplace thanks to safety measures put in place,
- 53% of the respondents believed that working in a rotational system (1 week remote work, 1 week on-site work) was an optimal solution.

In the second area of research that concerned the assessment of relations with superiors and colleagues during remote work, the following results were obtained:

- 92% of the respondents agreed that their team coped well with remote communication while working remotely,
- 91% of the respondents said that communication was helpful in understanding how to act,
- 88% of the employees agreed that their contact with supervisors while working remotely had not deteriorated,
- 79% said that online meetings resulted in saving time and increased efficiency of their work,
- 78% of the respondents agreed that their relations with other employees during the pandemic had not deteriorated,
- 74% of the employees maintained that their team could do their job remotely as well as they did in the office.

The third area of the survey related to interest in remote work in the future after the end of the pandemic brought the following conclusions:

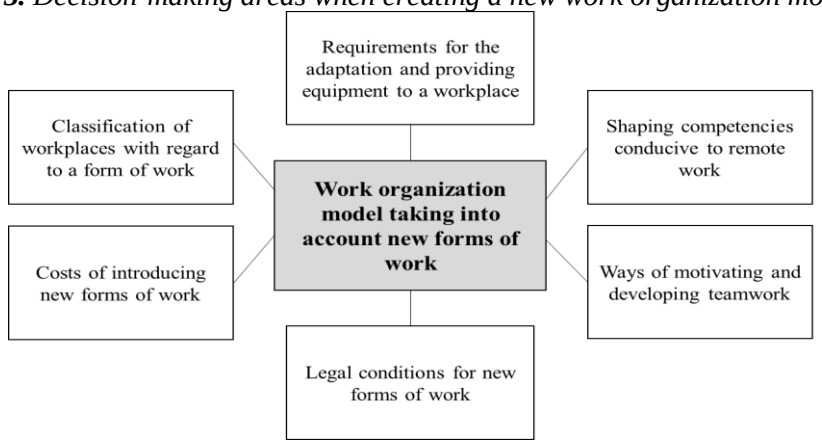
- 93% of the employees fully or partially agreed that remote work was a good solution, also in the future after the pandemic,
- 92% of the respondents declared fully or partially that remote work would have a positive impact on their commitment to work.

Based on the study, the following conclusions were formulated which became the basis for undertaking work on a model of work organization in the future:

- as a form of work, remote work was assessed as useful by the office workers having a positive impact on efficiency, results, commitment and cooperation,
- remote work does not deteriorate the effectiveness of communication with superiors and colleagues,
- almost half of the office workers prefer remote work to on-site work, even in comparison to a rotational system,
- the employees believe that remote work is a good solution worth keeping in the future.

The second stage of the study on the introduction of remote work solutions in the post-pandemic reality focused on qualitative research aimed at determining factors that influence shaping a work model. The research was carried out in a team of experts representing all the plants belonging to the corporation and all thematic areas requiring discussion when implementing new work solutions including: human resources, finance, law, information security management, work ergonomics, IT systems. The team started work in the second quarter of 2021 formulating analytical questions allowing for a full diagnosis of factors shaping a new model of work organization. The team's preliminary results of the study allowed to formulate areas requiring decisions, as shown in Figure 3.

Figure 3. *Decision-making areas when creating a new work organization model*



Source: *Own creation.*

The indicated decision-making areas were later supplemented with key factors that should be taken into account when creating a new work model. The basic overview of the factors is presented in Table 1.

Table 1. *Factors influencing taking a decision about the shape of a new work model.*

Decision area	**Factors influencing the decision-making process**
Classification of workplaces with regard to a form of work	- location of a workplace in the company structure - effectiveness of a given form of work at a workplace - a need to access enterprise resources
Requirements for the adaptation and providing equipment to a workplace	- remote workplace (home, co-working room) and its furnishings - ergonomics at work - health and safety at work - cybersecurity - securing the necessary equipment and IT systems
Costs of introducing new forms of work	- costs of adapting remote workplaces - costs of creating co-working rooms - new arrangement of the enterprise space (what to do with vacant offices) - determining the amount of compensation for the use of space at home - costs of benefits for on-site employees to compensate for a feeling of disproportion
Legal conditions for new forms of work	- labour law rules regulating remote work - intra-organizational work organization rules and regulations - attitude of trade unions
Ways of motivating and developing teamwork	- effectiveness of the existing incentive schemes - teamwork models - decision making models
Shaping competencies conducive to remote work	- predispositions to the long-lasting use of digital technologies - ability to keep work and home life separate - ability to manage emotions in remote work - ability to build social relationships

Source: *Own creation.*

5. Conclusions

The dynamic development of digitization in all aspects of human work, accelerated by the pandemic, has forced many enterprises to take decisions regarding the shape of future work organization (Ko, Kim, and Kim, 2021). Enterprises, wishing to keep up with global market trends and expectations of new generations of employees, must embark upon evolutionary changes in forms of work. The transformation of on-site workplaces into remote workplaces requires enterprises to perform an in-depth analysis of an organization's readiness to introduce changes (Sethi and Caglar, 2020). These activities should answer a number of questions, both in terms of an enterprise's ability to create and maintain remote forms of work as well as expectations and predispositions of employees to perform work in this way (George, Atwater, Maneethai, and Madera, 2021). As shown by the research results presented in this article, the nearest future of work organization (especially office work) will be characterized by hybrid forms of work. Comfortable organization of hybrid working conditions requires both the maintenance of on-site infrastructure in an

enterprise and providing equipment to a remote workplace. Such an arrangement causes modern organizations to be faced with the need to develop a new model of work organization.

The decision-making areas shaping a new model of work organization which are indicated in the article may serve as an example for other enterprises (especially manufacturing ones) regarding assessing the possibility of introducing new forms of work and key factors that will determine them.

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