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## **The human factor in contemporary organisations and changes in modern technology**

### **1. Introduction**

People – the human factor – form the social subsystem of an organisation. They are a key element of an organisation, an entity endowed with personality, creativity, capabilities (Knosala et al., 2019), awareness and the ability to think abstractly (Lichtarski, 2015; Sułkowski and Lenart-Gansiniec, 2021). Their deliberate behaviour leads to the realisation of the organisation's goals and objectives. Without the human factor, it would not be possible to use material, financial, information, time, knowledge and technology resources to achieve goals (Król, 2006b), deliver value to customers and build the organisation's competitive position in the environment (cf. Moczulska, 2023). It is thanks to man that modern technology has developed, the achievements of which are applied to the functioning and development of contemporary organisations (Cierniak-Emerych and Gableta, 2022; Wojtczuk-Turek, 2020).

The role of the human factor in an organisation, in relation to its other

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subsystems, has been characterised in various organizational models emerging and evolving with the development of management and quality sciences and organization theory. In today's knowledge-based, digitised economy (digital age), this role is being modified (Götz, 2018; Cellary, 2019; Wojtczuk-Turek, 2020). People in organisations today face many challenges and new tasks.

The beginning of the 21st century is a period of unprecedented growth in information and communication technologies (ICT) (Bielińska-Dusza, et al., 2023), e.g. artificial intelligence (AI), mobile Internet, cloud technology, Internet of Things, Internet of Services, robotics, 3D printing. These technologies are changing the functioning of modern organisations (Kelan, 2023; Okoń, 2022). They are causing digitisation, networking of production, changing business models and strategies (Götz, 2018; Shpak et al., 2023). Thanks to them, the fourth industrial revolution is taking place, Industry 4.0 is developing, next-generation production systems are being created, increasing efficiency, speed and flexibility in responding to customer needs (Cellary, 2019; Götz, 2018). Advanced technology, its implementation and use in an organisation, requires the collaboration of specialists (knowledge workers) with interdisciplinary and diverse competencies, the mutual alignment of the social and technical subsystems, and the involvement of top management in the process (Amarilli et al., 2023; Ghobadi and Mathiassen, 2024). People – the human factor – in modern organisations are 'invariably the most important' (Piątek, 2017). But they too have to adapt to the demands of modern technology (Cellary, 2019) and functioning in the information society (Cierniak-Emerych and Gableta, 2022). 'The effect of the fourth industrial revolution is the blurring of the boundaries between man and machine, human and robotic work (...)' (Wojtczuk-Turek, 2020, p. 13). People therefore need to develop their creativity, specialised knowledge, traditional technical skills (handling new technologies, programming) as well as digital and social competencies (e.g. openness to change, teamwork, communication) (Piątek, 2017; Wojtczuk-Turek, 2020).

Hence, the study seeks to answer the following research questions: 1) What is the role and importance of the human factor in an organisation in relation to its subsystems, in particular to the technical subsystem? 2) What challenges (expectations) to the human factor, related to technological change, exist in contemporary organisations? Answering the above questions requires the realisation of the following objectives: 1) to identify the role and importance of the human factor in selected organizational models in relation to the other

subsystems, including the technical subsystem; and 2) to identify the challenges (expectations) facing the human factor related to technological changes in contemporary organisations.

The study is theoretical in nature. A critical analysis and the relationship of the human factor (a key component of the social subsystem) with other subsystems, including the technical subsystem, are presented. In the second part of the study, based on a rapid review of the literature (a type of systematic review), the main challenges (expectations) facing the human factor in a contemporary organisation caused by the technological changes of the digital age were indicated. The whole study ends with a discussion and conclusions.

## 2. Literature review

An organisation is 'a group of people who work together in an orderly and coordinated way to achieve a certain set of goals' (Griffin, 2007, p. 5). It is a socio-technical system that is open to its environment, dynamic in its operation, behaves deliberately to achieve its goals and has a defined organisational structure (formalised way of ordering) and a coherent managerial component (Adamik, 2019). Its appropriately configured elements: people, machines, materials, methods and environment pursue the objectives set by the management (Grudowski, 2003; Gorzelany-Dziadkowiec and Smutek, 2020). The close relationship between the organisation and the environment signifies that the organisation obtains the resources it needs from the environment, and it transfers to the environment the results of its activities (products) (Kozłowski and Latusek-Jurczak, 2017).

The two most important characteristics of an organisation are related to the human factor. Firstly, the organisation has people with awareness and abstract thinking skills. Secondly, through these people, the organisation gains the ability to behave deliberately, leading to the realisation of its objectives (Kozuch, 2020). Hence, people - employees in various positions (executive and managerial) in the organisational hierarchy - play an important role in the smooth operation of the organisation and in its development (Lichtarski 2015; Sułkowski and Lenart-Gansiniec, 2021; Prouska et al., 2023).

People are often referred to by the terms: human factor, human resource or human capital (cf. Jamka, 2011). To use the term factor<sup>1</sup> in reference to

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1 Factor - one of the causes of a given phenomenon, one of the components conditioning something, determining something (Sobol, 2002); making something happen in a certain way (Wielki słownik języka polskiego).

employees is to consider them as the determining element, causing things to happen in a certain way in an organisation. It also indicates the special position of the human factor in the activities of the organisation, in the realisation of its objectives (cf. Kopertyńska, 2020; Jagoda, 2017; Przybyszewski, 2007; Pocztowski, 2007; Mroziewski, 2005; Prouska et al., 2023). 'In this new era, people must be treated and respected as valuable human capital, more essential to an organisation's effectiveness than its financial capital' (Armstrong, 2021, p.16).

Human beings, regardless of their position in an organisation, are subjects (Daniecki, 2018) and should be treated subjectively (Król, 2006b). The use of the term 'human resource' seems to contradict this approach. A human being is not an organizational resource. He or she only has the resource of his or her knowledge, skills, experience and attitudes, which he or she puts at the disposal of the employer, together with his or her values, work motivation, and health (Pocztowski, 2018). A person is distinguished by his or her uniqueness which is the result of years of accumulated knowledge, acquired skills and practice (Lipka, 2000), which translate into organisational effectiveness (Oczkowska, 2020). Because of their knowledge, members of an organisation are often referred to as 'knowledge workers' (cf. Surawski, 2018; Szelałowska-Rudzka, 2018; Wojtczuk-Turek, 2020; Jamka, 2011). This term is used to describe individuals who have 'a high level of expertise, education or experience, and whose most important goals include the creation, dissemination or practical application of knowledge' (Davenport, 2007, p. 23), knowledge being the source of innovation, customer value and the organisation's competitive position in the environment in a knowledge-based economy (Oczkowska, 2020; Cierniak-Emerych, 2012).

The knowledge-based, global, networked, digital economy, characteristic of the turn of the 20th and 21st centuries, is associated with the development of a subjective approach to employees in organisations. It has resulted in the development of the concept of human capital management, viewing employees as carriers of knowledge and the key competencies of the organisation and as creators of its human capital (cf. Pocztowski, 2018; Oczkowska, 2020; Juchnowicz, 2014; Król, 2006a; Swanson, 2023; Jamka, 2011). Human capital (HC)<sup>2</sup> is the potential inherent in people, the intangibles embodied in

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2 his new (capital-oriented) approach to the human factor in the organisation draws attention to: 1) the decisive contribution of HC to the creation of value and the competitive position of the organisation (thanks to the creation of innovation and the organisation's innovativeness and readiness for change); 2) the recognition of employees as a profit

employees rather than the employees themselves. They are 'competencies multiplied by commitment', a combination of intelligence, skills, and expertise that give an organisation its specific character (Juchnowicz, 2014, p. 34). They make employees capable of learning, change, creativity and innovation (cf. Szelałowska-Rudzka, 2018) and, with the right motivation, they can ensure the sustainability of the organisation in the long term (Bacon and Armstrong, 2008).

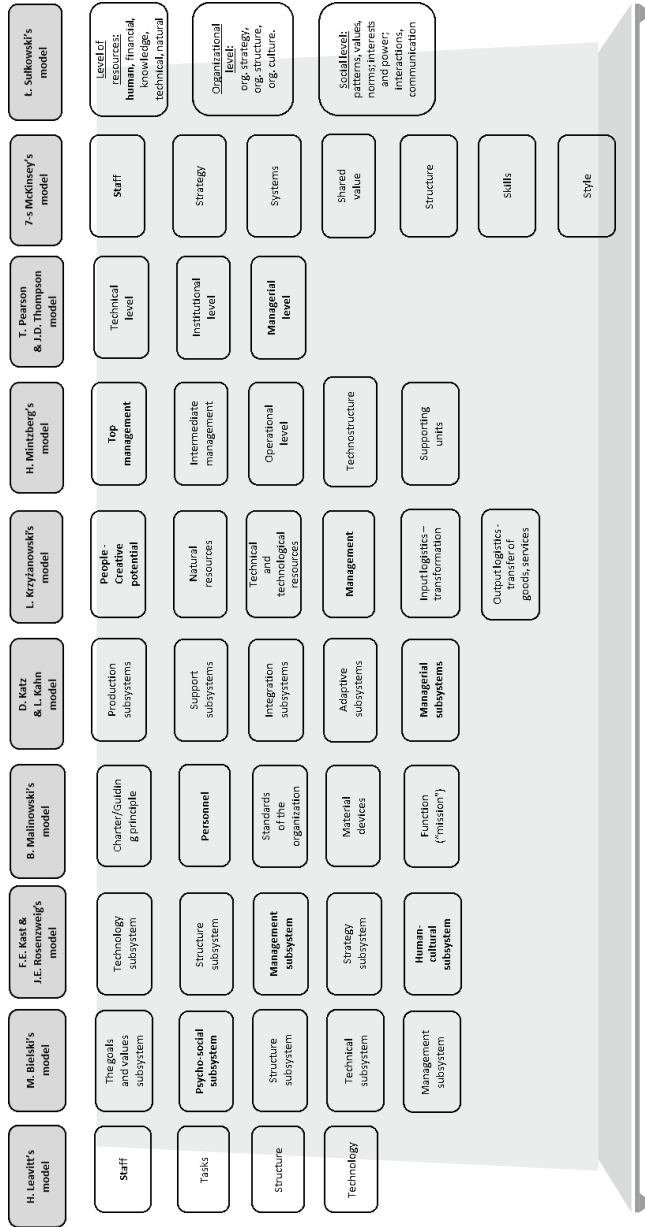
As can be seen from the above considerations, the human factor as an organizational subsystem is developing along with the changes taking place in the modern economy. Its involvement in work, organisational matters, achieving expected results is crucial for the realisation of the organisation's goals and tasks, and building its competitive position in an unstable environment (Jamka, 2011; Prouska et al., 2023). The importance of the human factor in the organisation is also evidenced by the role it plays in various organizational models in relation to its other subsystems.

A model is 'a simplified reflection of the object being modelled' (e.g. an organisation) (Czerska, 1996, p. 54). It is a representation of reality in a simplified way, showing the relationships occurring between the individual elements that make up a given system (fragment of reality), taken into account after a prior analysis of it (Smyczek, 2015; Kizielewicz, 2016). Thus, the organisational model is a simplified representation of an organisation as a socio-technical system indicating its main components - subsystems - and the relationships between these components. A selection of (traditional<sup>3</sup>) (Ścigała et al., 2014) organisational models is shown in figure 1.



lever rather than a cost element; 3) the treatment of employee development as a form of joint investment by employees and employers (there is a return on this investment); 4) the placement of the concept of HCM in the paradigm of the 21st century referring to the flexible and dynamic management of the contemporary organisation (as a response to turbulent changes in the environment) (Pocztowski, 2007). HC develops as its owner-employee acquires experience (Juchnowicz, 2007; Witczak, 2017).

3 These models - the traditional ones - are applicable in various types of organisations and can therefore be comprehensively analysed. Other models found in the literature, e.g. the virtual organisation model, the network organisation model, the quantum organisation model, are not applicable to every type of organisation therefore they were not included in the study (cf. Ścigała et al., 2014).



**Figure 1. Models of the organisation as a socio-technical system according to various authors**

**Source:** Author's own elaboration based on: Bielski, 2002; Koźuch, 2020; Zakrzewska-Bielawska, 2019; Ścigala, Tworek, Martan, 2014

One of the first and most well-known is Leavitt's universal organisational model (the so-called Leavitt diamond). In it, the social subsystem is made up of people and goals and tasks. The technical subsystem consists of the formal structure, equipment and technology (Ścigała et al., 2014). The efficiency of the organisation and the effective use of the opportunities provided by technology and engineering are achieved through the social subsystem (Kozuch, 2020; Amarilli et al., 2023). According to Leavitt, people - individuals and groups - are the most important element of an organisation. It is they who create and develop the organisation and, through their actions, interaction and cooperation, ensure that its goals, tasks and functions are realised. To achieve this, they use their qualifications, aptitudes, motivation, attitudes and value systems as well as the organisation's resources.

Bielski's (1992) system model of organisation (an extended version of Leavitt's model) depicts the organisation as a whole separated from its environment (open) and connected to it through inputs and outputs. The individual subsystems of the model (figure 1) are interrelated and interact with each other.

Organisational participants (individuals and groups), form the psychosocial subsystem, which includes their interactions with each other, goals and motives for action, values, interests, needs, attitudes towards reality, organisational roles, organisational climate (Kozuch, 2020). People influence and are influenced by organisational culture; they are the most unreliable element of an organisation (Kozłowski and Latusek-Jurczak, 2017) and at the same time the guarantor of its survival and development (Zakrzewska-Bielawska, 2019).

The organisational model proposed by Kast and Rosenzweig (Morgan, 2013) (similar to Bielski's concept) is supplemented with a strategy subsystem (a set of organisational goals and planned directions for their realisation) and a human-cultural subsystem. The latter connects the participants of the organisation (their individual motivations, goals and actions) with the collective systems of values, norms and patterns of behaviour. People (input), together with the organisation's resources and flows (matter, energy and information) influence the organisation's performance (output) (Sułkowski, 2002).

The importance of cultural phenomena in the functional model of an organisation is emphasised by B. Malinowski. The author defines culture as the work of people, resulting from their biological needs, as the means by which people achieve their goals (security, comfort, happiness). People create organisations to achieve these goals.

The organisation model of Katz and Kahn is based on five subsystems (Bielski, 2002). The production subsystem (the technical subsystem in M. Bielski's model), includes the core activities determined by the genotypic function of the organisation. Input and output handling is provided by the support subsystem. The integrating subsystem is responsible for recruiting employees, engaging them, remunerating them, transferring the organisational culture and tasks to them. The adaptation subsystem makes it possible to track changes in the environment, assess their impact on the organisation and - in response - adapt to them in order to survive and continue to grow. Coordinating the work of all the subsystems, resolving possible conflicts between them and ensuring the organisation-environment balance, is the domain of the managerial subsystem.

The differences indicated by Katz and Kahn in the way the different organizational subsystems operate are highlighted in the model of Pearson and Thompson (Bielski, 1992). These authors distinguished three levels of organisation: technical (operational), managerial and institutional (strategic). To function efficiently, they require differentiated and adapted structural solutions and methods of organisational management. The tasks for the technical level and the conditions necessary for its operation (its protection, ensuring the required rationality of operation (certainty and stability), while causing the necessary adaptation processes in it) and the operation of the institutional level are provided by the managerial level. The human factor - namely, competent management of the organisation - plays a key role in it.

An interesting model of organisation, an intermediate solution between the model of Bielski and the model of Katz and Kahn, is the model of Krzyżanowski (Ścigała et al., 2014). The author considers the following as the basic components of an organisation: people - the most valuable, creative potential of an organisation, natural resources (natural) and technical-technological resources (artificial) (Sułkowski, 2002). At the same time, he criticises all the authors of earlier models, who did not notice and take into account natural resources (processed into the products of the organisation) as an integral element of the organisation and its environment (Bielski, 2002). The resources listed in the model of Krzyżanowski are included in the components that ensure the functioning of an organisation connected to its environment through mutual feedback (Ścigała et al., 2014). The main component of the model is the managerial element (management subsystem). It determines the domain, mission, objectives, strategy of the organisation and ensures the



participation of lower levels of management and employees in the decision-making process (Krzyżanowski, 1999).

In Mintzberg's model, the criterion for separating organizational elements was their participation in the management process - setting and implementing the organization's goals. The main element of the model is formed by the subsystem of the top management and the operational level. They are supplemented by technostructure and auxiliary units. The top management is the most important element of the organisation (as in the models of Bielski, Katz and Kahn or Pearson and Thompson). Its task is to formulate the goals and strategies of the organisation, to maintain the (external) balance between the organisation and its environment, to coordinate the internal functioning of the organisation. The activities of top management in larger organisations are supported by the activity of middle management and lead to the creation of a harmonious, resilient whole (Bielski, 2002).

In McKinsey's 7-s model, its authors Peters and Waterman (Sułkowski, 2002) assume that the success of an organisation is only possible when both soft factors are developed and integrated, i.e.: people (their attitudes, behaviours, motivations, systems of training, remuneration, and appraisal), skills (of employees and the organisation), styles (of directing people and managing the organisation), shared values (overarching goals, philosophy of action, characteristics and aspirations connecting the other subsystems), as well as hard factors: strategy, structure, systems. Due to the development of the modern knowledge-based economy, Ścigała, Tworek and Martan (2014) proposed supplementing McKinsey's 7-s model with an information technology subsystem.

The most complex systemic model of organisation was proposed by Sułkowski (2002). The author, on the basis of an analysis of the previous models, highlighted the role and importance of organisational culture (the configuration of patterns, values, norms of behaviour that give the organisation its identity) as a key (causative) factor for effective organisational management. An organisation is viewed by him at three levels: resources, social (communication, power sharing, conflicts related to the formation of social groups) and organisational. In the latter, as a result of feedback and the learning process, legal and institutional rules, the strategy and goals of the organisation, the formal structure, and the organisational culture are created, and the process of organisational management takes place. The human factor is involved in the implementation of activities at all these levels.

In most of the analysed organisational models (Leavitt, Bielski, Krzyżanowski, Kast and Rosenzweig, Malinowski, McKinsey's 7-s) (Fig.1) people create

a separate subsystem, crucial for the functioning of the whole, they act as a causative factor of the actions taken; they are a thinking, creative entity, which puts at the disposal of the employer its potential, resource/human capital in the form of knowledge, skills, experience, motivation, attitudes and health necessary to achieve success and the competitive position of the organisation in the environment (Cierniak-Emerych, 2012). A factor that, even when it does not occur on its own, as in Katz and Kahn's, Mintzberg's or Sułkowski's models, is a key component of the organisation's other subsystems. It is also essential for the proper use of the other subsystems, including the technical one. The role of the human factor is emphasised and appreciated especially in the Krzyżanowski's and McKinsey's 7-s models. These models ensure the participation of executive staff in the process of organizational management.

Some models (those of Bielski, Katz and Kahn, Mintzberg, Pearson and Thompson, Kast and Rosenzweig, McKinsey's 7-s) additionally distinguish a management (leadership) subsystem that highlights the increasing importance of employees with managerial competencies. The importance of the human factor and leadership (management) is also emphasised in integrated management models (emerging from the systemic approach). It assumes the implementation of at least two standards and separate management systems to enable the organisation to permanently adapt to its environment (cf. Gorzelany-Dziadkowiec and Smutek, 2020).

As the above analysis shows, the role and importance of the human factor in the discussed organisational models is complex and irreplaceable from the perspective of organisational performance. It is the human factor - employees in managerial and rank-and-file positions - that integrates all subsystems of the organisation, including the technical subsystem based on rapidly developing technology, ensuring the smooth operation and development of the organisation. In turn, the development of information and communication technology in the environment, economy 4.0, i.e. the economy of the digital age, or the gig-economy based on the implementation of tasks and projects, implies changes in organisational management (e.g. agile management), in forms of employment and in the organisation of work. It poses challenges to the human factor in organisations (cf. Wojtczuk-Turek, 2020).

### 3. Methodology

To answer the research questions and achieve the resulting objectives, the method of critical analysis of the literature on the subject was used. The

methodology of traditional and systematic literature review (Czakon, 2015) of the Scopus and Web of Science Core Collection databases was used to gather data. The literature review (traditional and systematic) was used to identify the state of knowledge about organizational models and their subsystems, primarily the social and technical subsystems, to determine the role and importance that the human factor plays in these organizational models, and what challenges the human factor faces in contemporary organizations in connection with the development of modern information and communication technology (ICT).

As defined by Libereti et al. (2009), a systematic literature review is 'a research method and process for identifying and critically evaluating relevant studies, as well as collecting and analysing data from them' (Lenart-Gansiniec, 2021, p. 43). The study presented in the paper uses a rapid review as a type of systematic literature review (Lenart-Gansiniec, 2021). A rapid review has the character of a simplified synthesis of knowledge and does not require a large time commitment (it can also be conducted by a single researcher). Despite the shortened procedure, it has the character of a rigorous review. It allows for a critical evaluation of studies conducted by other researchers and for the preparation of tabular summaries. It provides an overall assessment of the quality of these studies and a general summary of their results and conclusions.

It is reliable, repeatable, updatable (and therefore rigorous). It proceeds through the following stages: literature search, abstract and title verification, publication review, coding, discussion of limitations (Lenart-Gansiniec, 2021). The results obtained from the systematic literature review are presented in the next section of the paper.

#### **4. Research results**

As part of a rapid review of the literature on the subject, publications retrieved from the Scopus database were first searched and analysed, then those from the Web of Science database. This review was conducted in May 2024. The results obtained are presented in tables 1-4.

**Table 1. Summary of the results of the rapid literature review of the SCOPUS database regarding the human factor and technology development**

Criteria used	Number of publications
'Human factor' AND 'organization' (field: title, abstract, keywords)	5039
AND technology (field: title, abstract, keywords)	1351
Range of years of analysis:1990-2023	1259
Category: business, management and accounting	143
Document type: article, conference paper	104
Language: English	97
Database keywords: human factor, information technology, industry 4.0	37
Open access	8

Source: own study

The following keywords were used as admissibility (analysis) criteria (Klimas et al., 2020) in the first two searches in the Scopus database: human factor, organization and technology linked by the AND operator (common parts were searched for). Subsequent searches used the standard criteria used in this database (table 1). Additional keywords to clarify the analysis were also used: information technology and industry 4.0.

**Table 2. Challenges to the human factor in organizations related to the development of technology - results of the analysis of papers from the Scopus database**

Authors of the publication	Conclusions of the analysis
Galanti, de Vincenzi, Buonomo, Benevene, 2023	Italian human resource management experts point out that the rapid changes in working conditions and methods imposed by technological progress (especially the development of digital technology) pose threats to employee well-being and satisfaction. As a result, experts suggest that organizations should quickly establish learning and training programs to help employees acquire the new skills required by Industry 4.0. In doing so, they point out the need for today's employees to possess not only greater technical skills but also the ability to collaborate and build relationships within the organization.

Thylén, Wänström, Hanson, 2023	The development of Industry 4.0 and the implementation of automatically controlled vehicles in organizations places new demands on the human factor and the organization, and requires interaction between subsystems: human, technology, organization. The introduction of autonomous vehicles in an organization should be supported by: a) new work procedures for managing the errors of these vehicles, b) determining what different operators should know about these vehicles, c) developing acceptance of these vehicles among employees. Taking the aforementioned actions can help managers involved in the implementation of automated guided vehicles in the organization to improve the efficiency of their work and the well-being of their employees.
Ergen, Unal, Saygili, 2021	Most cybersecurity research ignores the human factor and focuses solely on technological measures. Meanwhile, employee cybersecurity behaviour is important to organizations. The results of research conducted with cybersecurity experts presented in the article explain the causes of unsafe employee behaviour and make recommendations for effective training and guidelines for organizations on how to avoid these behaviours.
Gembalska-Kwiecień, 2018	The analysis of the development of tools to improve occupational safety in the studied industrial enterprise made it possible to conclude that available technology, work organization and human capital are the determinants for developing the best preventive measures to minimize the number of accidents.
Louis, Spinellis, 2001	Greek public sector organizations have only a basic level of awareness of information systems security. They have the greatest concern for the confidentiality of digital data. However, only a small percentage of these organizations have developed a systematic, complete and integrated approach to the security of their information systems, including internal audit procedures. The importance of proper training and the importance of the human factor in general in achieving a high level of information systems security is often underestimated.
Kobis, 2021	The author classified the main threat areas related to information techniques and technologies, as well as information system models used in business entities. He noted that the human factor is related to and also affects each of these threat areas.
Martinetti, Awadhpersad, Singh, van Dongen, 2021	The interaction between humans and other elements of the technical system plays a special role in the fault analysis associated with the maintenance process of Formula One vehicles during staging operations. The study produced useful guidelines on the most important aspects of the process (athlete fitness, crews, training, technology, organizational issues, safety, ergonomics and psychology) that should be taken into account in determining proper maintenance actions. The study found discrepancies in effective maintenance during downtime between Formula One cars and those used by companies. Car fleet maintenance at enterprises should be improved based on the findings of the Formula One vehicle study.
Boy, 2023	Human systems integration is a broader, transdisciplinary field in the increasingly complex world of humans and machines. It focuses on the integration of technology, organizations and people within a complex socio-technical system throughout the system's life cycle. It is necessary in order for contemporary socio-technical projects to take into account the complexity and tangibility of their human-centric, context-sensitive architectures and the integration of different areas of knowledge.

Source: own study based on literature from Scopus database

Eventually, eight open access articles were extracted for review. The synthetic conclusions drawn from them are presented in table 2.

**Table 3. Summary of the results of a rapid literature review of the Web of Science Core Collection database regarding human factors and technology development<sup>4</sup>**

Criteria used	Number of publications
'Human factor' AND 'organization' (all fields; fields)	511
AND technology (field: title, abstract, keywords)	127
Range of years of analysis: 2014-2023	127
Document type: article, review article	74
Category: management	8
Language: English	8
Open access	2

Source: own study

A rapid literature review of the Web of Science Core Collection database also used the keywords: human factor, organization, technology related to the operator (common parts were searched for) and the standard criteria used in this database (table 3). Finally, papers in open access were analysed, and due to their small number (which is a limitation and impediment to the analysis), abstracts of English-language articles from the management category were also analysed (8 in total). Synthetic conclusions of the analysis are included in table 4.

<sup>4</sup> The criteria used to review both scientific databases are identical. Some small differences (e.g., additional keywords in the Scopus database or a slightly different category/subject area) are only due to the specifics of their design; they do not differ in terms of content.

**Table 4. Challenges to the human factor in the organization related to the development of technology - results of the analysis of articles from the Web of Science Core Collection database**

Authors of the publication	Conclusions of the analysis
Lescano Duncan, 2018	In services, technology, as well as innovation, information and added value, are important for building customer satisfaction. However, the most important factor, which requires the development and involvement of mid-level managers, is the human factor.
Lassen, Waehrens, 2021	In small manufacturing companies, the full use of Industry 4.0 technologies requires the development of the strategic and operational competencies of employees to support digital transformation. The human factor is crucial for the combination of existing and new technologies and the use of technology beyond the supplier's predetermined specifications.
Theriou, Chatzoglou, 2014	Developing good HRM practices in small manufacturing companies (including job security, teamwork and decentralized management, performance-based remuneration and incentives, training, career development opportunities, job descriptions and work harmonization) improves their performance.
Silva, Borges, Magano, 2022	Meeting the changing needs and expectations of customers by car manufacturers requires the integration of modern manufacturing and digital technology with the human factor. This is also important for improving quality control. Based on two projects implemented at CPMG PSA - Peugeot Citroen Group, it was found that their effectiveness requires the involvement of shop floor operators and a people-friendly focus at every stage of the implementation process. Digital transformation requires combining technology with the human factor in a way that supports people, instead of replacing them.
Preve, 2012	Large organizations that are building their strategic advantage based on IT can only maintain it by investing in the human factor. Knowledge workers and human capital constitute the core of an organization. The human factor can increase its productivity based on a well-organized IT department.
Khan, Alghathbar, Nabi, Khan, 2011	To ensure information security in an organization, raising employee awareness of the issue is just as important as using the right security technology. The human factor is an element used in various attack scenarios. For this reason, it is necessary to use various tools and techniques to increase information security awareness among employees based on psychological theories and models.

Vivek, 2021	The use of technologies, especially information technology (IT), brings numerous benefits to an organization. It also involves the danger of technostress, which is the result of an individual's inability to cope with constantly developing /information and communication technologies (ICT). This phenomenon may have a negative impact on an individual's productivity. Therefore, when designing a training program in an organization aimed at implementing a new technology, it should be tailored to the personality of individuals and their specific needs. This will help to implement this program more effectively and efficiently.
Gorod, Hallo, Nguyen, 2018	Technology projects are becoming increasingly complex, and there is increasing uncertainty due to the exponential growth of technology and the need for a steady increase in human factor involvement. Based on research after the Fukushima Daiichi nuclear power plant disaster in Japan, a new systems approach to project management in crisis situations was proposed. It provides for flexibility for employees' actions while maintaining the ability to regulate the degree of control over the technological system.

Source: own study based on literature from Web of Science Core Collection database

## 5. Discussion

According to a rapid literature review (a type of systematic review) of the Scopus and Web of Science Core Collection databases, technological progress, digitisation, the development of Industry 4.0 and information and communication technology (ICT) are changing the functioning of modern organisations (cf. Okon, 2022; Götz, 2018; Galanti et al., 2023; Kelan, 2023). They are causing the technical subsystem to evolve and the social subsystem - the human factor - to adapt to it (cf. Cellary, 2019; Wojtczuk-Turek, 2020; Cierniak-Emerych and Gableta, 2022; Ghobadi and Mathiassen, 2024).

On the one hand, technological changes challenge and threaten employee well-being and satisfaction (Galanti et al., 2023). They cause employees technostress, i.e. a new kind of stress related to rapid, constant technological progress that is difficult to keep up with (Vivek, 2021). They also cause the human role in the effective use of modern technology to be underestimated (Kobis, 2021; Louis and Spinellis, 2001) and even ignored. This is particularly true in the area of ensuring the digital security of information systems (Ergenet al., 2021; Louis and Spinellis, 2001).

On the other hand, the technological, digital and civilizational progress associated with the fourth industrial revolution (the digital age) continues to point to the particular role and importance of the human factor - a factor that



ensures the smooth operation and development of organisations. It is essential for the effective implementation and use of the gains of this progress in various industries (Thylén et al., 2023; Gembalska-Kwiecień, 2018; Martinetti et al., 2021; Lassen and Waehrens, 2021; Silva et al., 2022; Gorod et al., 2018), in services (Lescano and Duncan, 2018) and in the public sector (Louis and Spinellis, 2001). It also constitutes, directly or indirectly, a bond between all the organisational subsystems, in particular the social and technical subsystems - the main components of the organisation (in its various models) (Bielski, 2002; Kożuch, 2020; Zakrzewska-Bielawska, 2019). This confirms that people (the human factor) and human capital form the core of modern organisations and are invariably the most important (Preve, 2012; Piątek, 2017; Lichtarski 2015; Sułkowski and Lenart-Gansiniec 2021).

However, in order to ensure organisational effectiveness, to effectively exploit the opportunities provided by modern technology (Kożuch, 2020; Amarilli et al., 2023; Martinetti et al., 2021; Gorod et al., 2018) the human factor must adapt to the requirements of technology (Ghobadi & Mathiassen, 2024). This implies the need to introduce interactions between the human-technology-organisational subsystems in the organisation (Thylén et al., 2023; Boy, 2023) and to focus on people in a way that is friendly to them at each stage of the technology implementation process (Silva et al., 2022).

Employees (in rank and file and management positions at various levels) need to know and understand modern technology and its products (Cellary, 2019) and know how to use them (Wojtczuk-Turek, 2020). For this, they need the right competencies, those that are strictly technical (Galanti et al., 2023) and those that are strategic and operational for supporting digital transformation (Lassen and Waehrens, 2021) and minimising associated risks (Kobis, 2021; Boy, 2023). Therefore, essential in both production and service organisations are activities as well as learning and training programmes for employees (cf. Galanti et al., 2023; Ergen et al., 2021; Louis and Spinellis, 2001; Theriou and Chatzoglou, 2014; Vivek, 2021) aimed at developing technical competencies as well as social competencies such as teamwork, relationship building (Galanti et al., 2023), communication (Prouska et al., 2023) and readiness for the changes that contemporary technology brings with it (Piątek, 2017; Wojtczuk-Turek, 2020).

Training and the development of interactions between people, human capital, technology, organisation (system) (Thylén et al., 2023) and work organisation (Gembalska-Kwiecień, 2018) ensure the development of employee knowledge and acceptance of modern technology achievements. They enable its proper

use and increase productivity (Theriou and Chatzoglou, 2014). They also ensure concern for employee well-being, occupational safety (Ergen et al., 2021) and minimising the number of accidents (Gembalska-Kwiecień, 2018). They make employees aware that the security of the organisation, including digital security, depends on their behaviour, adherence to security procedures and the proper use of IT systems (Ergen et al., 2021; Kobis, 2021; Louis and Spinellis, 2001; Khan et al., 2011). This conclusion confirms previous findings that indicate that the human factor is the most unreliable element of an organisation (Kozłowski and Latusek-Jurczak, 2017) and, at the same time, the guarantor of its survival and development (Zakrzewska-Bielawska, 2019; Boy, 2023).

Kobis (2021) adds that the human factor is associated with each of the risks relating to information systems' techniques, technologies and models. Therefore, it cannot be underestimated (Louis and Spinellis, 2001). On the contrary, in addition to training, it also requires the development of good human resource management (HRM) practices, including performance-linked remuneration and incentives, job security, career development opportunities, work harmonisation and teamwork (Theriou and Chatzoglou, 2014). It should be emphasised that it is essential to integrate modern manufacturing and digital technology with the human factor (cf. Wojtczuk-Turek, 2020); there is also a need for a friendly approach focused on people, in a friendly way, at every stage of the technology implementation process (Boy, 2023), in order to support people instead of replacing them (Silva et al., 2022), and to raise their awareness of information security, cyber security using tools based on psychological knowledge (Khan et al., 2011) and tailored to the specific needs of employees (Vivek, 2021). Involving all participants in the organisation (human factor) leads to gaining control (self-monitoring) which is crucial for ensuring the security of technological systems and therefore the organisation (Gorod et al., 2018).

An organisation is a socio-technical system created and constantly shaped by people using modern information and communication technologies associated with Industry 4.0. To function and achieve organisational goals in today's digitalised world, people need knowledge of these technologies, the potential risks associated with them (Boy, 2023), support from the IT department (Preve, 2012) and self-awareness of how to use this knowledge and the related skills effectively (Galanti et al., 2023; Khan et al., 2011; Kelan, 2023).

Based on a rapid literature review (a type of systematic review) of the Scopus and Web of Science Core Collection databases and a critical analysis

of the literature on the subject, the research questions posed were answered and the research objectives undertaken in the study were realised. It was found that the human factor plays a special (significant) role in organisational models, from the H. Leavitt model to the Ł. Sułkowski model and integrated organisational management models (Gorzelany-Dziadkowiec and Smutek, 2020). Without the human factor, the other subsystems of the organisation, including the technical subsystem, would not be able to develop, interact with each other, fulfil the organisation's goals and objectives, create added value for customers and the organisation's competitive position in the environment (Oczkowska, 2020; Cierniak-Emerych, 2012; Cellary, 2019; Götz, 2018). They would not be able to use the achievements of the modern technology of the digital age to the benefit of the organisation and its stakeholders (including employees).

However, today's knowledge-based economy, dominated by the spectacular development of ICT and Industry 4.0, poses challenges and risks to the human factor (Galanti et al., 2023; Götz, 2018; Cellary, 2019). To meet them, employees need to develop their technical, digital (operational and strategic, cybersecurity-related) as well as social competencies. To do so, they need the support of management and employers, concern for their well-being, job satisfaction (Prouska et al., 2023), and (tools for) countering technostress. Above all, they need the creation and implementation in organisations of human resource management tools and good practices, including training, performance-linked remuneration and incentives job security, career development opportunities, harmonisation of work and teamwork aimed at developing these competencies, and integrating the social subsystem with the technical subsystem so that they to work together and enhance each other's skills (Kelan, 2023). The effect of these actions should be to ensure that the human factor at each level of the organisational hierarchy knows, understands and is able to safely apply the achievements of modern ICT technology in the performance of their tasks (Ghobadi & Mathiassen, 2024). Then the individual has a chance to remain an element of the organisation more important than the products of modern technology (cf. Wojtczuk-Turek, 2020; Kelan, 2023).

## 6. Conclusions

### Theoretical implications

The development of modern information and communication technology and the increasingly widespread use of its achievements (e.g., artificial

intelligence, mobile Internet, cloud technology, Internet of Things, Internet of Services, robotics, 3D printing) prompts reflection on the role and importance of man (the human factor) in contemporary organizations. In scientific (and journalistic) discussions, the question arises: Will machines replace humans, or is the human being more important than the products of modern technology (cf. Kelan, 2023)? The article carries out a traditional and systematic review of the literature on the subject and its critical analysis. From these it has been concluded that the human factor plays a special role in an organization.

On the one hand, it is the core of the organization, the most important element that guarantees its survival and development in an ever-changing environment (Prouska et al., 2023). It is a factor directly or indirectly connecting all subsystems of the organization, especially the technical subsystem and the social subsystem, to ensure the smooth operation and development of the organization.

On the other hand, the human factor is the most unreliable element of an organization, especially with regard to the achievements of modern technology. This unreliability is due to human characteristics, mistakes made, and insufficient (at a given time) competence. It is also caused by a lack of concern for the well-being of employees, their job satisfaction, a lack of training and activities leading to the integration of people, technology and the organization. Hence, searching for comprehensive solutions leading to the integration of ICT technology with the human factor in the organization is indicated as a potential direction for further scientific research, which should ensure that modern technology supports people in their work, increases their productivity, and does not replace them. To make people and modern technology work together, mutually develop and complement each other (Kelan, 2023). Achieving this goal requires the development of human resource management tools (including training, performance-linked remuneration and incentives, job security, career development opportunities, as well as work harmonization and teamwork) that will help employees learn about and properly use the achievements (creations) of modern technology in their daily work.

### **Practical implications**

Management practitioners, owners, managers, and designers of organizations should develop and integrate the technical and social subsystems of the organization with equal commitment and care. Employees – the human factor – in order to fulfil their special role in the organization, need a concern for their

well-being, job satisfaction, effective motivation to develop new technical, digital and social competencies, for their benefit and that of the organization. To this end, employers and managers at all levels should strive to shape such an HRM system and instruments (including training, performance-linked remuneration and incentives, job security, career development opportunities, harmonization of work and teamwork) that will enable employees to meet the challenges of modern ICT, digitization, Industry 4.0. Decision-makers in the organization should also provide employees with their support and the support of the IT department so that the digital transformation, the spectacular development of ICT technology and its products support the human factor in its work, instead of replacing it. It is modern ICT, Industry 4.0 and their products that are supposed to serve man, ensuring the development of human civilization, not the other way around.

### **Limitations**

The research did not develop the topic of artificial intelligence (AI) as the achievement of modern ICT technology which has seen spectacular development and has revolutionized the operation of modern organizations (of various types). The focus has been on the general relationship between the human factor and the development of modern ICT technology, in order to draw attention to and emphasize the role of humans in the activities of organizations. And also to remember that technology and its creations should develop in order to support man in his work, instead of replacing him.

Another limitation of the undertaken research is the conducting of a rapid review of the literature, rather than a systematic review, and the difficulty of accessing some of the full-text publications selected for analysis. A rapid review is as rigorous as a systematic review, but provides more general conclusions. It has been treated as a kind of pilot and in this way the main themes of the proposed future scientific inquiries were signalled.

Yet another limitation is the narrowing of the study to theoretical analysis. Conducting representative survey research in organizations (companies), especially large ones that are successful in integrating the human factor and modern technology, would increase the importance and content value of the conclusions obtained. It would make it possible to develop recommendations for business practice (including for small organizations, the Micro Small Medium-Sized Enterprises sector).

### **Directions of the future research**

Future research on the relationship between the human factor and the development of modern technology should lead to the integration of the human factor (the social subsystem) with the technology of the digital age (the technical subsystem). It should focus on further identifying potential obstacles to this integration and the benefits that this integration can provide to organizations and the people they employ. Most importantly, this research should include the search for and creation of human resource management tools (system) that will improve the process of integrating people and modern technology, and will even make it possible in small organizations that are less advanced in technology and in the use of modern HRM tools. They will bring about a human-centred focus in a human-friendly way at every stage of the technology implementation process, in such a way that this technology supports the human factor in its work in the organisation, instead of replacing it.

### **Abstract**

The development of technology, the increasingly widespread use of its achievements prompt reflection on the role and importance of the human factor in contemporary organisations. The question arises: Will machines replace humans, or are humans more important than the products of modern technology? Therefore purposes of the paper are: 1) to identify the role and importance of the human factor in selected organisational models in relation to its other subsystems, including the technical subsystem; 2) to identify challenges to the human factor related to technological change in contemporary organisations. The study is theoretical in nature. A critical analysis of the literature on the subject was used as the research method. The methodologies of traditional and systematic literature review of the Scopus and WoS databases were used to collect data. The human factor plays a special role in organizational models. Without it, the other subsystems of the organisation, including the technical subsystem, would not be able to interact with each other, achieve the organisation's goals, create added value and the organisation's competitive position. The development of modern ICT technology, and Industry 4.0, poses challenges and threats to the human factor. It requires the development of the technical, digital and social competencies of employees. These competencies are essential for the integration

and effective collaboration of humans and ICT. Researchers should look for comprehensive solutions leading to the integration of ICT technology with the human factor in the organization, so that modern technology supports people in their work, rather than replacing them. This requires research on HRM instruments that will facilitate employees' proper use of ICT, avoiding mistakes and risks associated with its incompetent use. Employers should introduce training and other HRM tools that develop employees' technical, digital and social competencies; develop and integrate technical and social subsystems with equal commitment and care.

**Key words:** *human factor, organizational models, social and technical subsystems of the organization, ICT technology, industry 4.0.*

**JEL**

**classification:** D21, J24, L22, M12, O33.

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