Research Article

Conditions of a Corporate Communication in the Industry 4.0: Case Study

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Abstract

In recent years, the conditions for the functioning of enterprises have changed revolutionarily. These changes are so significant that it is more and more often referred to as the Fourth Industrial Revolution. A company operating on the market has to take up the challenge of meeting these changes. If the foundations are changed, the whole construction must also be rebuilt. One of the essential elements of any enterprise that requires adaptation to new operating conditions is undoubtedly; communication. The purpose of the article below is to discuss the issue of communication in an enterprise operating under the conditions of Industry 4.0. The analysis of the literature regarding this issue has been significantly enriched by analyzing the business case of the implementation of a particular communication solution in the factory of a German corporation producing passenger cars in Poland. The authors in the first part of the presented article discuss the concept of the Fourth Industrial Revolution. The further part of the article presents the characteristic and the role of the communication process in enterprises in the conditions of Industry 4.0. The final part of the article is devoted to business case and discussion of key conclusions.

Keywords: Industry 4.0, corporate communication, Poland

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Introduction

unquestionably, the most important resource of every organization is people. Proper use of this resource is conditioned by the creation of a coherent system, which includes people, their goals, material resources, and an effective organizational structure. The creation of such a system is not possible without a proper flow of information; without effective communication. Effective communication consists in sending messages in such a way that the message received has a similar meaning to the intended message (Griffin 1993). By applying this general definition to the corporation, the term corporate communication was coined. The pioneers in this field were E. Bernays (1923), R. Allen (1977), and J.Grunig (1922) who made significant contributions to defining the principles of traditional corporate communication. Initially, the mainstream of work related to corporate communication was focused on external communication, regarding procedures, PR activities, and activities aimed at partners and competitors. As Hatch and M. Sultz (2008) emphasize, the organization is not a black box, which is why the importance of internal communication is also important. In this trend, employees are considered to be the key in vis-a-vis relation. Corporate communication also becomes a type of the institutional reality (Balmer, Greyser 2003)

As with the organization itself, the communication system was subject to significant changes over time. Originally, internal communication was to ensure proper transmission of orders from the supervisor to subordinates. Gradually, along with the increasing participation of employees in the decision-making process, the tasks of the communication system began to widen. The system became more and more diverse and specialized, both in terms of goals and tools used (van Riel and C. Fombrum 2007). Currently, in a situation where employees in their narrow specializations often have knowledge that significantly exceeds the knowledge of their superiors, communication must ensure the possibility of coordination within a very diverse system. According to C. van Riel and C. Fombrum (2007), communication is to provide distribution of information, by a variety of specialists and generalists in an organisation, to retain the organisation's ability to operate. It is important in this process not only that the content is passed, but also that the rate of information flow is correct, that distortions are not added, that any desire to reduce the number of nodes is adhered to, etc.

In addition, the already complicated situation is further complicated by the fact that more and more often we are dealing with a situation in which a very diverse part of the communication process involves a prefusion of devices. They feature to a lesser extent in the role of the communication channel as the sender or recipient of information. What is important is that they convey important information not only to man, but also between themselves without his mediation. We have become participants in what has been referred to for some time as the Fourth Industrial Revolution.

The purpose of the presented article is to characterize communication in enterprises in the conditions of Industry 4.0. The analysis of the business case of the implementation of the communication solution in the factory of a German corporation producing passenger cars in Poland supplements the literature considered in the text.

The first part of the article discusses the concepts of the Fourth Industrial Revolution. Next, the conditions and the role of the communication process in enterprises in the conditions of Industry 4.0 are presented. In the last part of the article, the business case and the indicated conclusions are presented.

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Industry 4.0

A great deal of scientific work and practical papers about the Fourth Industrial Revolution has been produced (Zezulka et al., 2016). Putting the term "Industry 4.0" into Google generates about 140 000 000 results, wherefore a lot of different definitions of the Fourth Industrial Revolution exist.

Klaus Schwab and World Economic Forum characterized this term by a range of new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries (Schwab, 2017). It is a very capacious definition that includes many technological phenomena that can be observed now in the economic environment. So, the question arises, what type of qualitative changes bring about the Fourth Digital Revolution compared to past cases, in which industrial revolutions were also described related to the emergence of new technologies.

The first industrial revolution is dated at the end of the seventeenth century. It was related to the mechanization of the textile industry in Great Britain and the construction of the prototypical factory. The Second Industrial Revolution at the turn of the nineteenth century and the twentieth century, through the development of methods of automation of production in the plants of Henry Ford, led to the mass production and development of the automotive industry. The third industrial revolution (also named Industry 3.0) erupted in the 1970s and concerned automation processes, thanks to the use of new computer technologies. The Fourth Digital Revolution, also called Industry 4.0, which has been observed for about 5-6 years, is about building interdisciplinary systems by integrating their physical and digital layers (Rifkin 2011), (Czyżewski et al., 2017). Industry 4.0 includes: smart factories, cyber-physical systems, self-organization, new systems in distribution and procurement, new systems in the development of products and services, adaptation to human needs, and corporate social responsibility (Lasi et al., 2014). Compered to Industry 3.0, which focused on the automation of single machines and processes, Industry 4.0 focuses on the end-to-end digitalization and creation of complex digital ecosystems with value chain partners (PWC 2016). In Industry 3.0, development opportunities depend on the limitations of technology and IT infrastructure. The fourth industrial revolution, on the other hand, involves completely new solutions in which technology becomes embedded in societies and even in human bodies.

It should be emphasized that under conditions of a turbulent environment in which we observe the discontinuity of trends, it is difficult to distinguish subsequent industrial revolutions. New technologies interpenetrate and the indication of breakthroughs is subjective. For example, the emergence of network protocols such as IP has been a significant breakthrough in the development of communication and process technologies in industry, and this invention is not associated with any formally highlighted revolution. Technological penetration and the degree of adoption of a specific set of trends additionally depend on the state of the economy in a given country. For example, the Fourth Industrial Revolution is defined in various ways and expressed in local strategies of development in many countries. We can list here: advanced manufacturing partnership 2.0 was established in the US, revitalization/robotics strategy in Japan, and manufacturing innovation 3.0 in South Korea (Manhwa et al., 2018).

The European leader in building economy 4.0 is Germany. This is related to the desire of this country's government to maintain the global competitiveness of industrial sectors including, in particular, the automotive sector, through the implementation of new technologies and innovative solutions within it. The term Industry 4.0 (German: Industrie 4.0) appeared for the first time at the Hanover trade fair and defined a joint initiative of representatives of business, science and politics aimed at developing the competitiveness of the German industry. Next, the Federal Government decided to put in place structures for cooperation between all actors of innovation in the country. In 2013, the Platform Industry 4.0 was improved by concluding an agreement between the associations BITKOM,

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VDMA and ZVEI as a step of larger project titled "Implementation of recommendations for the future project Industry 4.0". In Germany Industry 4.0, there is one part of the government initiative - "Action Plan High-tech strategy 2020" (plattform-i40.de 2018). In Poland, for which Germany is the largest economic partner, an analogous program is established - Industry Future Platform in Poland (https://www.mpit.gov.pl/strony/aktualnosci/ksz taltowanie-potencjalu-rynku-dla-przemyslu-40-w-polsce/ 2018). Considering the fact that there are many German factories in Poland, especially from the automotive sector, the assumptions of the German development plan are implemented in a natural way in Poland.

It should be emphasized that the Fourth Digital Revolution involves not only technological changes and new trends in this area: the development plans adopted in various countries show that the main element driving development in Industry 4.0 is the ability to implement new systems to the tissue of society and the structures of the enterprises themselves. The full integration of two areas - human (natural) and technological (artificial) - leads to success in the conditions of the Fourth Industrial Revolution.

The PwC report indicates that the biggest challenge for industrial leaders isn't technology - it is the people. "While digital technologies are rapidly becoming a commodity, success largely depends on an organisation's Digital IQ (PWC 2017), especially how well its digital leaders like the CEO, CTO, or CIO define, lead, and communicate the transformation. It's also dependent upon the digital qualifications of the employees who need to roll out digital processes and services" (PWC 2015), (PWC 2016). This underlines the role of communication as one of the leading areas in the Industry 4.0 ecosystem.

The role and determinants of communication in Industry 4.0

In the 20th-century, optimization consisted of human labor-cost reduction. In the 21st century, the reality of the knowledge-based economy is that the human labor resource is the key to success, and future management must have a clear understanding of members' strengths, interests, and knowledge (Park 2017). In the Fourth Industrial Revolution where human resources face plenty of new technologies, sensitivity, creativity and communication in enterprises should be improved (Manhwa et al., 2018). Industry 4.0 is based on the unique involvement of human resources in the use of technology. All previous revolutions were limited only to increasing efficiency through the use of modern work methods and technical inventions. Currently, ensuring comprehensive integration of the human and technological sphere requires profound changes in the social sphere - also among employees of enterprises.

At this point, the question should be asked if human resources in enterprises that transform their structures to the requirements of Industry 4.0 are ready to work under new conditions.

Surveys conducted in Poland as part of the Industry Leader 4.0 Incubator run by the Ministry of Enterprise and Technology show that among the desirable competencies that require development, as many as 54% of 106 surveyed business representatives pointed to communication techniques in industrial environments. It was the second most frequently indicated answer after knowledge of project management techniques, time and human team, which was indicated by 57.5% of respondents [https://www.mpit.gov.pl/strony/aktualnosci/ksz taltowanie-potencjalu-rynku-dla-przemyslu-40-w-polsce/ 2018]. This result shows that communication is a very important element of enterprise development in Industry 4.0, because every deep change requires proper communication, and employees must have appropriate access to information and the ability to process it. In the case of the Fourth Industrial Revolution, the technological change only superficially has an evolutionary character. In many manufacturing plants, the transition from the concept of linear production to smart-factory is burdened with the need to adapt the work method to an automated environment, filled with numerous sensors to collect and process data and in which some of the activities are carried out without human intervention, eg; in machine to machine technology. The situation is particularly difficult for low-skilled employees

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who are outnumbered in the automotive industry.

It should be noted that many of the articles on the concept of communication under the conditions of Industry 4.0 focus on technological aspects, describing how to manage transmission protocols or reference models, e.g. RAMI. This knowledge is specialized and relatively inaccessible to the average factory employees who may feel lost in the context of changes implemented in the environment.

In the scientific literature in the field of management and reports on Industry 4.0, there are basically three approaches to communication in the conditions of the Fourth Digital Revolution:

- A trend based on change to communication (Lies 2012); (Manhwa et al., 2018).

- A related trend focused on the transformation of selected areas of communication in the company (Hauer et al., 2018); (Murdoch, Johnson 2016), (PWC 2017).

- A trend focused on identifying new communication phenomena within advanced socio-cyber-physical systems (Murdoch et al., 2018).

In the first approach, the role of profound technological change taking place in the enterprise is emphasized, which is connected with the need to adapt to the methods of its communication. J. J. Lies indicates that organizational changes may give rise to uncertainty due to necessary restructuring of the organization, wherefore the way of communicating such changes reflects a key success factor (Lies 2012). The strategy for implementing these changes should be based on two principles – building *secure trust* and decision making with better *insight*.

The first strategy is to initially maintain secure trust as a precondition for securing the permanence of numerous relationships in the ecosystem of enterprise. Also, a strategy for decision making based on deep insight is needed." Insight is more important than predictions because of the high complexity of connections in the Fourth Industrial Revolution. In seeking insight, we seek the essence of the problem" (Manhwa et al., 2018).

In Industry 4.0, insight into cooperation with technology based on trust and transparency is much more important than just technology implementation (Manhwa et al., 2018). Thus, communication between company management, employees and partners in surroundings is crucial to create benefits in the Fourth Industrial Revolution.

The question of what features should be in communication in the modern enterprise of the Fourth Industrial Revolution is also becoming relevant.

The second approach is characterized by research describing the characteristics of changes taking place in the enterprise, due to the emergence of trends in the field of Industry 4.0.

With regard to the corporate communication, G. Hauer, P. Harte and J. Kacemi (2018) indicate impacts on it through Industry 4.0 in:

- Network communication, which is based on ICT (Information and Communication Technology) solutions implemented in a company.
- Digital communication, which concerns electronic content and channels use in communication (mobiles, Internet, communicators, cloud).
- Information in real time for users, that gives actual information for every actor within a corporate system.
- Flexible communication that is personalized and open for feedback and collecting information in double-side mode.

G. Hauer, P. Harte and J. Kacemi (2018), based on the conducted research, state that the

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research findings demonstrated the most significant changes within internal communication to be the implementation of new communication tools. It is particularly important that the tools implemented do not constitute another technological complication and build a sense of security in the digital environment. The main developments in corporate communications methods due to Industry 4.0 are; internal social-media channels, internal banners, and upcoming external interactive communication tools implementation.

In the third case, the authors of scientific studies and reports strive to identify the main phenomena associated with the introduction of Industry 4.0 assumptions to the company (Manhwa et al., 2018), (PWC 2016), (PWC 2017). Among these phenomena can be found:

- Digital thrust - concerns IoT trends, which involves a lot of different devices and personal data collection during communication. Users of these systems want to know that their information is in safe hands and can't be used without permission. The four keys to digital trust are: security, privacy, benefit/value and accountability (Murdoch, Johnson 2016).
- Digital relations – connects with fusing physical and digital tools to drive more effective relations between parts in the communication process. These kinds of relations are characterized by impersonal communication, self-serving actions and real time information (Accenture, 2013).
- Self-organization – concerns the connection of real and virtual worlds for human beings and consists of a digital transformation from the real world to the virtual world, optimization by tools based on big data, and analog transformation of optimized estimation (Manhwa et al., 2018). For example, the smart factory is characterized by a self-organized multi-agent system assisted with big data based feedback and coordination (Shiyong et al.,

2016). Communication is self-organized and concerns self-actualization and collaboration between every actor within the system.
- Cloud and big data technology communication tools – connect with implementation of systems based on cloud technologies, for example in Software as a Service (SaaS) model, which covers the whole socio-cyber-physical system. This system collects data using big data algorithms.

Regardless of the approach taken, human resource in socio-cyber-physical production systems has a huge potential. Its role in advanced systems opens up a wide field of development of new network systems and power production systems (Hozdic, 2015).

Business case

Information on the analyzed case was collected in 2018 from March to October at the German passenger car factory in Poland. The mentioned factory was qualified for the analysis, because its management declares the adoption of an industry development path compatible with Industry 4.0. The main assumptions of this strategy are modeled on the German headquater company, which takes active part in the German Government's program aimed at developing the automotive sector in accordance with the "Action Plan High-tech strategy 2020".

The company's internal materials, materials of IT solution suppliers as well as analytical and design documents were used for the study.

General situation

The analyzed business case concerns three factories producing passenger cars. Factories belong to a German corporation; however, they are located in Poland. The total number of factory employees is 11,000, of which around 20% are office workers and senior employees in the production hierarchy. The most numerous group are production workers, working in shift mode at production lines. Working teams are organized into functionally separate teams. The company's main cells are distinguished by

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Management, Marketing, Communication, PR, Sales (to many different channels), Information Technology Office, Purchase Office and Production.

Among the divisions listed, departments, and units were distinguished. Production teams managed by the Masters operate within production. The structure is highly hierarchical and there are many levels within it. Divisions operate relatively autonomously, while maintaining a small horizontal flow of information. The information is distributed according to the work path resulting from the organizational structure. The working environment is strongly bureaucratic. There are numerous procedures in the company taken from a German mother company, whose organization is treated as a model in relation to Polish factories.

In the enterprise, there is a noticeable division into office and production employees, who vary in degrees of qualification, level of remuneration, and the degree of granting various employee privileges. The company has adopted the assumptions of a new strategy related to Industry 4.0. Implementations are made according to modern systems for enterprise and communication management, as well as attempts to formulate projects in the field of big data, aimed at processing employee data. These projects are implemented in cooperation between the communication and IT departments. The projects are evaluated by the board in terms of the criteria related to the degree of compliance with legal requirements, economic efficiency, adding value and compliance with the strategy including modern technological trends. The decision-making cycle is long, including many involved opinion-giving units in Poland as well as the German side.

The main communication problems of the company

The communication department in factories has struggled for about a year with the problem of insufficient communication directed to employees. It manifested itself as a distortion of corporate communication and misuse of information to manipulate selected groups of employees. Unfavorable to the management, trade unions used privileged access to corporate information in order to create their own information message to employees, eg.; information from the board was passed along with an unfavorable comment. In the face of problems in the labor market related to the inadequate number of low-skilled production employees and the difficulties in recruiting them, the company may struggle with difficulties in maintaining production continuity. This problem was so significant that the search for solutions outside the company was started among suppliers of modern IT solutions for communication. It turned out that the majority of solutions offered concerned the customized licenses of generally available communicators offered by leading IT companies. They concerned the implementation of IT solutions within the corporate communication process itself, and thus met the requirements of Industry 3.0 - not 4.0.

In order to deepen the knowledge of communication needs within the factories, workshops were conducted with representatives of the main employee groups. Therefore, the strategy of in-depth *insight*, typical for Industry 4.0, was used. The workshops were carried out by an external company with knowledge in software development. This led to the creation of an atmosphere in which employees talked about current problems without worries. The result of the study was to indicate additional problems. The following problems were indicated in Table 1.

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Table 1: List of problems indicated in the company

Problem	Characteristic of a problem
Limited access to information of production workers.	The problem is related to the introduction of an electronic work time accounting system, which does not include time for internal communication. The production worker is not able to log into corporate systems while working on the production line. During the breaks, the possibility of collecting information via traditional channels such as reading posters and announcements is limited. After finishing work, the employee is transported by a company bus, so there is no time to look for information
Digital exclusion of selected employee groups	The research revealed that only employees employed under a regular contract of employment had access to corporate systems related to HR and communication services. Other employees, for example employed in the form of their own business or through outsourcing companies, perceived the access restriction very negatively as a treatment in the lower category.
Distortion of transmitted information	The distortions concerned various professional groups, even office workers had problems finding the information they needed in numerous office systems and relied on verbal data. This information becomes significantly different from the original message. Communication resembled a "Chinese whispers" game popular among children.
Low efficiency of information flow	The time of providing information to shift workers was very long and could even be up to 3-4 working days
Long communication path	The average communication path in the factory included seven structural levels. Sometimes the

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	information was not clear and there was a misinterpretation of its content.
Staff frustration due to difficulties in finding information on HR services	Production workers have faced numerous problems related to being unaware of communication processes. For example, they were not sure if their sick leave had reached HR and who to contact in this case. The failure of the payout schedule was also a problem
No possibility to provide feedback	The large number of messages transmitted was unclear to employees, which caused dissatisfaction. The production worker could not practically pass on his opinion or ask for information in the communication process
Long time for communication in working teams	Communication was passed in a traditional way at employee meetings. It took a lot of time to discuss and wasted time which should be used for production
Unwillingness to log into multiple systems	The necessity of logging in to many available corporate applications is considered by employees to be an unnecessary waste of time
Low flexibility of communication channels	Adaptation of the corporate system to current needs was related to the implementation of a multi-month IT change. In the communication channels, outdated information was transmitted and problems with adjusting the content to the user were recorded
Confusion related to the multiplicity of communication channels in the company	The company used both traditional and electronic channels. It was difficult for the employee to find out which system played the superior role.

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Communication strategy undertaken

The strategy taken by the communication department in the company was in line with the Industry 4.0 assumptions and boiled down to four main areas, described in Table 2.

Table 2: Strategic assumptions in implementation of new communication solutions

Group of strategic assumptions	Characteristic
Network communication	The solution is to implement a communication network platform to provide information to the entire enterprise. A solution was suggested in the SaaS model, to which all employees of the group may have access
Digital communication	The implemented platform is a mobile application. Each employee can download the application on his private phone. Access to the application is voluntary - it is to help the employee and not to interfere. The application is extremely easy to use and contains only the necessary content defined in the workshop cycle.
Information in real time for users	Information in the communication application is transmitted on a regular basis and messages about changes in the content of individual areas appear on the user's phone
Flexible communication	Communication is personalized and can be freely shaped for selected groups of employees. Changes in the application are not time-consuming. Adaptations are implemented within one day. Reports on user activity and the level of acceptance of posted content are collected (the number of messages downloaded is measured, there is the possibility of giving "likes"). On this basis, the message is adapted.

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Implementation of the communication tool

The implementation of the communication solution was performed by a Polish software house. The development work consisted of software development in accordance with the Scrum methodology, and the business-functional model was compatible with Canvas. The employees of the communication department actively participated in creating a framework of software which simulated the operation of the application. The framework model was the subject of many workshops carried out in factories. Therefore, it was fully adapted to the needs of the corporation. The framework became the basis for further programming work. Although the application was implemented in the SaaS model, it was written from the beginning only for the needs of the group. The software implementation process differed from the standard patterns. Figure 1 shows the scheme of the implemented solution.
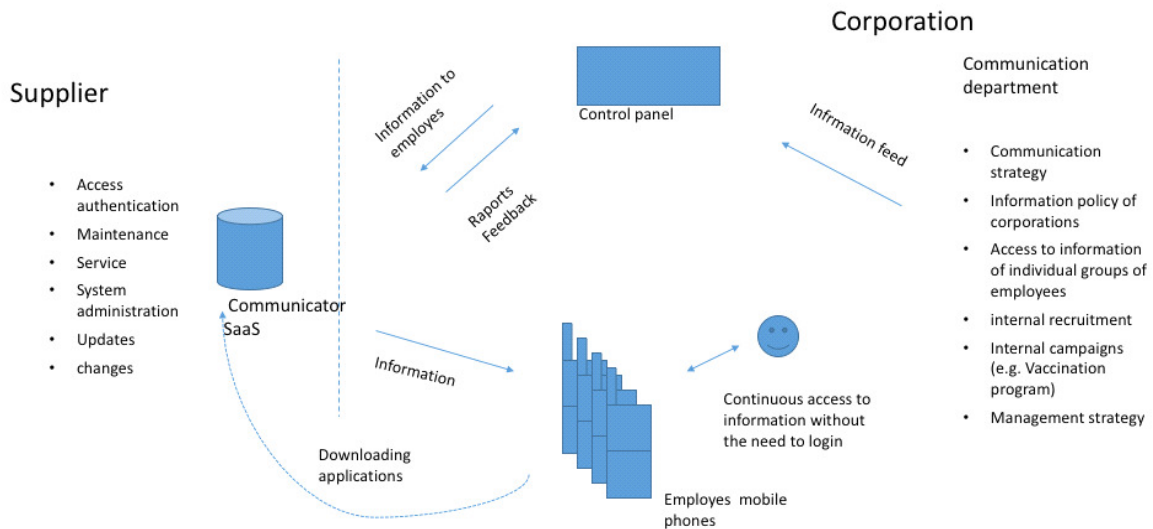
Fig. 1: Diagram of the implemented communication solution

The solution presented in Figure 1 meets the following communication assumptions within Industry 4.0, presented in Table 3.

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Table 3: Communication assumptions within Industry 4.0

Communication assumptions within Industry 4.0	Characteristic
Digital thrust	The presented communication solution is secured by access using the daily generation of access codes, which are authenticated in the corporate database. The user basically does not transmit his own sensitive data; he is rather focused on their receipt. Application installation is voluntary and can be uninstalled at any time. This creates a sense of security and trust among potential users
Digital relations	The submitted solutions meet all the requirements related to the creation and maintenance of digital relations. Communication is fully electronic. The user uses self-serving processes and decides by himself whether and how he wants to participate in communication. Communication is also carried out in real time mode, which allows the employee to be actively involved in the relationship
Self- organization	The created system combines applications of the group and employees via a virtual platform. The platform ensures collaboration between each actor within the communication process.
Cloud and big data technology communication tools	An ICT solution is implemented in the SaaS model. Information is collected and analyzed. The first step of socio-cyber-physical system is created.

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The main benefits that have been achieved after implementing the solutions

After implementing the solution, the following benefits were achieved:

- More and better-informed employees.

Obtaining the flow of information in a simple linear structure (despite the developed hierarchy). Building an employee-friendly organizational culture

- Adaptation of the method of providing information to the needs of employees strengthens the sense of stability and order, and thus the importance of communication from the board grows
- The opportunity to participate in the communication process increases the sense of "efficient power" of employees and may contribute to an increase in their involvement.
- The organization and transparency of the employee information system increases motivation and a sense of respect among staff.
- Savings of $20,000 per month, resulting from shorter communication times and reduced costs of traditional channels that are currently less used.

Summary

The business case discussed in the article presents the method of transformation of the communication process adopted in the enterprise in accordance with the assumptions of the Fourth Industrial Revolution. A description of the individual stages of implementation of an advanced communication platform based on ICT technology allows characterizing the changes that occur in the field of communication of a company operating in the conditions of Industry 4.0.

The goal set in the article was implemented with the use of literature analysis and business case analysis.

The article defines the concept of the Fourth Industrial Revolution and indicates the role of communication in enterprises applying its assumptions. In the last part of the article, using the method of case analysis, selected industry-specific communication strategies for Industry 4.0 were compiled with the assumptions for the implementation of a communication platform in a car factory in Poland.

Undertaken research activities largely limited the confidentiality of corporate data of the examined enterprise, as well as the limited possibility of conducting research in a functioning production environment.

Business management in the conditions of Industry 4.0 is an interesting topic for undertaking further scientific research while promoting cooperation between research centers and industry.

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