

CHAPTER 1

Organizational Methodology in Process of Developing Organizational Restructuring Model on Example of Production Company

Henryk Dźwigol

Silesian University of Technology, Poland; ORCID 0000-0002-2005-0078

Summary. The primary objective of this chapter is to design a concept of a modern formula, structured as a model, for the organizational restructuring of a hard coal mining company. The author assumed the following thesis: the process of the organizational restructuring of a hard coal mining company can be presented in the form of a model introducing deep organizational changes for this type of company, with the support of the following methods: project management and control system. The author had the opportunity to apply crucial methods that seem to be privileged in management sciences. The research was conducted on 700 randomly selected leaders of changes in five restructured hard coal mines. In the research process, the author used 16 research methods and tools, which he divided into two groups: basic methods and supporting methods. The author has developed the model of organizational restructuring covering, in a comprehensive way, all the crucial areas of the mining company's activity, in which it is also possible to make some partial changes depending on one's needs. *The organizational restructuring model* enables the formulation of global strategies and functional strategies in key areas of activity of the surveyed companies. It can also be used in the restructuring processes of mining and non-mining companies. The developed model meets the assumptions of 'Industry 4.0'.

Keywords: organizational methodics, organizational restructuring model, research methods

1. Introduction

Management relates to professional activities based on the latest knowledge, expertise, the use of rational methods and behaviour-related techniques. It is a resultant of various attributes, including emotional intelligence, which are considered important for managers' behaviours, attitudes, and fortune (Korzeniowski, 2011).

Management is faced with the first great test of its competence and its most difficult task in the upcoming industrial revolution, which we call 'automatization' (Drucker, 2017).

Achieving a higher level of automation as well as higher levels of operational efficiency and productivity is a major objective of the Industry 4.0 (Ślusarczyk, 2018). The Industry 4.0 is the dawn of a new era in which the industry is becoming 'smarter and smarter' thanks to the use of the Internet of Things, intensive data exchange and predictive analysis (Lenka et al., 2017; Porter & Heppelmann, 2015). Companies from different industries are entering the Fourth Industrial Revolution (Industry 4.0) through capitalising on digitisation, which is changing the way businesses operate and affects the entire value chain within the industry (Ślusarczyk, 2018).

Permanent restructuring has been nowadays a natural consequence of the company's activity, being the basis for the development and maintenance of its competitive advantage (Borowiecki, 2007).

Improvement of the management system requires a constant analysis of numerous connections and interdependencies among processes. It is assumed that the undertaken improvement activities should be implemented in accordance with the principle saying that if the optimization of one process implies changes in other processes, the balance sheet of these undertakings must be positive. Disadvantages that weaken the effectiveness and efficiency of the organization's management are disorderly issues related to information and decision flows between its particular levels (Kowalczyk, 2011). Information flows in such systems are responsible for IT fields, which in practice are simultaneously established and organised at different levels of management by task-related teams (Dźwigoł, 2015).

Management is faced with the first great test of its competence and its most difficult task in the upcoming industrial revolution, which we call 'automatization' (Drucker, 2017). Managing a 21st-century organization implies understanding and acceptance of its changeability, complexity and multifacetedness (Dźwigoł et al., 2019a).

Restructuring may be perceived as a set of changes affecting each and every field of the enterprise's activity, preceded by a strategical diagnosis, and introduced as a response to changes shaping its environment. Restructuring is aimed at adjusting the enterprise's operating rules to the tricks of the trade binding in the environment, and at providing opportunities for achieving the desired market position (Dźwigoł, 2015). The Industry 4.0, which plays an important role in the production and service sectors and has a direct link to productivity, is of considerable importance in this transition process (Imran et al., 2018; Rübmann et al., 2015; Shrouf et al., 2014; Waschneck et al., 2016). As it was stated by Posada et al. (2015) and Roblek et al. (2016), although various functions of the Industry 4.0 are strongly linked to Internet technologies, the Industry 4.0 is also one of technical added value procedures and effective knowledge management practices. This is also confirmed by other studies (e.g., studies by Brettel et al., 2014; by Weyer et al., 2015; or by Zawadzki & Żywicki, 2016). The results of these studies prove that the Industry 4.0 has a positive impact on production, which translates into improved business performance.

As part of the systemic approach, the author proposed changes in the process of functioning of mining companies.

The aim of the study is to:

- select research methods and tools,
- design a research method,
- develop a model of organisational restructuring for a coal-mining company.

The systemic approach shows an organisation as a set of interlinked elements, which is aimed at achieving defined objectives and activities in the most optimal way possible (Grudzewski & Hejduk, 2007).

The author made an attempt to approach, in a comprehensive way, organizational restructuring in mining companies from the point of view of research analysis, its scope as well as opportunities of supporting the implementation process by using modern management methods. The author developed his own *organisational restructuring model* covering, in a complex way, the most essential areas of the activities of mining companies (marketing and sales, production, finances, human resources, organisational resources, tangible resources, information-related resources), in which it is also possible to make partial changes as required.

With the view of designing a model and its further verification, the author's research method, LIDER, was applied for identifying activity domains and assessing the change leaders' readiness to undertake organizational restructuring. It provides a link between the research, empirical and application part.

The traditional, hierarchical model of the company's organisation has, so far, been a combination of departments, which, despite a defined goal for the whole company, followed their own courses of action. Nowadays, simple, networked and orbital structures are preferred, where knowledge is regarded as an important asset. It therefore seems appropriate to provide both theoreticians (young researchers) and practitioners (managers and executives) with innovative research methods and techniques (preferably online) to facilitate the transfer of knowledge to the company, its management with the view of increasing competitiveness on the market and, for example, resulting from the implementation of a new strategy as to the development of a market economy, such as: Industry 4.0 (Dźwigoł, 2018).

The model for *organizational restructuring* allows to develop a global strategy and functional strategies for key activity domains of companies under investigation, as well as to apply it for processes of restructuring of mining and non-mining companies.

2. Research assumptions as to construction of restructuring model of organizations

Modern management should take into account the ownership and organisational forms of the company and its market behaviour. It should determine the current conditions in which the company comes to operate in a specific period (Dźwigoł, 2018).

It is necessary to distinguish key areas of the company's activity (marketing and sales, production, finances, human resources, organisational resources, tangible resources, information-related resources) and subject them to strategic diagnosis as well as develop a precise and uniform concept of the model of fundamental organisational changes, which constitute one of the elements determining positive effects of restructuring activities. Furthermore, the model should cover some process restructuring aiming at the development of an intelligent organisation.

The basic objective of the study is to *design a concept of a new formula for organisation restructuring in hard-coal mining companies, in the form of a model.*

Partial objectives are the following:

- elaborating methodics for designing new ways of organisational restructuring of hard-coal companies;
- selecting a set of tools supporting modelling processes of organisational restructuring;
- applying a systemic approach to diagnosing a company;
- designing a model of organisational restructuring of mining companies.

The application of the organisational restructuring model should favour an increase in competitiveness and efficiency of the hard coal mining company on the market, as well as ensure its ability to compete on foreign markets.

The issues presented in the chapter result from the author's research on the current course and effects of the restructuring process of hard coal mining companies (<https://www.scopus.com/>...). It allowed to formulate the main thesis, which reads as follows: *the process of organizational restructuring of hard coal mining companies can be presented in the form of a model instilling profound organizational changes for such companies, with the support of project management and controlling methods.*

Within the framework of the methodological approach, the author formulated an important research question: What organisational restructuring model should be applied to meet the requirements of the company of the future?

Designing a company of the future requires to remodel the management structure, principles of data gathering and more effective use of resources (Malara, 2006, p. 11).

3. Organizational methodics

Organizational methodics indicates what methods and techniques are used to complete specified organisational tasks (Pszczółkowski, 1988, p. 119).

The author had the opportunity to use important methods, which appear to be *privileged* in management sciences, i.e., observations carried out in natural conditions (where the author cooperated with the surveyed enterprises), and observations-interventions, which took place within the framework of transformation activities in enterprises, and the author had a direct influence on decisions made in this area.

To comprehensively examine research problems and increase the cognitive value of the overall research results, the author used quantitative and qualitative methods, i.e., the so-called *methodological triangulation* (Kostera, 2005, pp. 25–26).

In the research process within the organizational methodology, the author employed *16 research methods and tools*, which he divided into two groups:

- *basic methods*, i.e.: analysis of operational documentation, observation, interview, method of group assessment of experts, scenario method, questionnaire, statistical analysis (correlation coefficients, significance of differences between means, arithmetic means and standard deviations), taxonomic method, comparison method,
- *supporting methods*, i.e., branch cost calculation, budgeting, controlling, project management method, modified strategic scorecard, force field analysis and the author's application and linking method called 'LIDER'.

Moreover, the assumptions of the process of organizational restructuring modelling were developed, as well as the research methodology enabling the construction of the model of organizational restructuring, with the use of supporting tools, i.e., project management methods and controlling methods. The directions of activities modelling the process of organizational restructuring in the areas of activity such as: marketing and sales, production, human resources, and information resources were proposed as the key areas of activity of a mining company.

The research procedure to construct an organisational restructuring model for a mining company was based on concepts of management sciences, including a systemic analysis of the company and support for project management, and controlling methods (Dźwigoł & Wolniak, 2018).

The process of identifying the key elements of the organisational restructuring model has been based on a systemic approach, according to which such companies can be disaggregated into the following, closely related key areas of activity. The selection of the indicated areas of activity was finally confirmed by the research conducted by the author.

The author's own research, carried out by him, is a contribution to the development of the research method, related, among others, to:

- critical analysis of management literature, in particular:
 - general models relating to the management and design of organisations,
 - functioning of mining companies according to strategic concepts,
 - models for restructuring mining companies according to strategic concepts,
 - analysis of organisational changes with the use of the formula of management tetrahedron,
 - modern system-related stages of enterprise improvement,
 - management tools which support changes,
- identification of the areas of activity of the hard coal mining company and the ability of the change leaders to carry out the organizational restructuring process,
- scenarios aimed at determining the scope and depth of organizational restructuring according to change leaders,
- analysis of the process of restructuring changes in the hard coal mining industry in 22 countries of the world (Dźwigoł, 2003).

The developed research methodology consists of the following steps:

1. *Determination of the subject matter and purpose of the research* – selection and definition of a hard coal mining company, as well as determination of the purposefulness of research related to the construction of a model for organisational restructuring, creating conditions for initiating innovative activities, improving management efficiency, and strengthening the competitiveness of this type of companies.
2. *Internal diagnosis* – recognition and identification of internal conditions of a hard coal mining company, as an entity operating in a specific context: organisational, production-, ownership-, employee-related, financial, etc., enabling a preliminary systemic approach to the analysis of a hard coal mining company by indicating its key areas of activity.
3. *External diagnosis* – identification of conditions for mining industry activity with regard to the external context of the activity of a hard coal mining company related, among others, to political, social, environmental and other conditions; the importance of hard coal for the energy security of the country, current government restructuring programmes – which ultimately define the boundary conditions for the construction of a model of organisational restructuring (Dźwigoł et al., 2019b).

4. *Identification of problems in the scope of the subject and objectives* – based on a summary of the results of internal and external diagnosis aimed at identifying the specific character of the activity of a hard coal mining company in relation to the problems of organizational restructuring.
5. *Searching for partial solutions* – analysis of contemporary approaches to restructuring issues through detailed recognition of theoretical achievements in the field of concepts, models and tools supporting restructuring (including organizational theory, strategic analysis, restructuring models, project management method and controlling method).
6. *Development and characteristics of the model understood as methods, concepts, and assumptions* – it consists of the following stages:
 - development of general assumptions and key assumptions of the model,
 - verification of the areas of activity identified, at the stage of ‘*internal diagnosis*’, as key elements of the model by means of surveys and scenario methodology;
 - a list of key elements of the model together with the definition of relations between them and the introduction of supporting tools such as: project management method and controlling method,
 - presentation of activities in the field of modelling of organizational restructuring in selected key elements of the model (marketing and sales, production, human resources, information resources), including the use of force field analyses,
 - detailed characteristics of the possibilities of using tools supporting the organizational restructuring process (methods of project management and controlling), including defining the stages of their implementation, defining the methods of project evaluation (strategic scorecard), identifying the effects resulting from the implementation of the project management method, presenting budgeting methods and problems related to controlling implementation.
7. *Model verification* – testing the usefulness of the model for management purposes through its application in the process of organizational restructuring in a selected hard coal mine.

4. Structuring model of organizational restructuring

The term ‘model’ is usually understood as a simplified representation of a complex object. Building a model may aim at learning about the existing complex situation, i.e., structure, functioning and development. It should include a deeper understanding of economic and social realities. In order for the modelling result to have a scientific value, it must be verified by means of simulation (Sudoł, 2007).

Designing the organizational model of the company of the future forces every employee, all task forces, and the entire organization to create themselves. Enterprises of the future should ensure a change in the approach and way of thinking, from the one embedded in the realities of the past century, to the new way of thinking about the future reality. The enterprise’s activity should be based on short-term undertakings, which are often recreated from accumulated capital in another form, using foreign resources and work carried out by entities from the environment rather than from within the enterprise (Dźwigoł, 2014).

As a result of the conducted research and the synthesis of the said research, the key areas of activity of mining companies were distinguished, taking into account the assumptions for the model.

The selected areas of activity were examined using the 'LIDER' research method developed by the author. Furthermore, tools supporting the modelling phases were selected.

The use of results obtained based on the 'LIDER' research method, developed by the author, and referring to the assessment of the hard coal mining companies' ability to carry out organizational changes, was of significant importance from the point of view of the methodology as to development of the organisational restructuring model. The developed research method 'LIDER' (of three stages) was used by the author to identify areas of activity and assess the readiness of change leaders to carry out organizational restructuring.

The 'LIDER' research method initiates the development of a new organizational model that allows to get to know the organization, determine methods of solving operational problems in a practical way, all that with the view of building an intelligent organization.

The conducted research was aimed at assessing the activity of employees participating in the restructuring processes of hard coal mining companies, particularly the middle management staff.

The method enriched the traditional way of conducting interviews with three basic elements:

- two types of questionnaires were developed with a differentiated approach to the survey of executive and managerial staff,
- the author's own system of scaling the issues which were subject to research analysis from the point of view of staff involvement in the restructuring process was developed,
- an innovative way of interpreting the research was developed from the point of view of psychometric features of both employees fully engaged in restructuring processes and passive employees in the face of changes.

The developed 'LIDER' research method is a part of the proposed model, which allows to:

- assess the readiness to carry out organisational restructuring processes,
- identify areas of key importance for organisational restructuring,
- define the scope of restructuring, according to the change leaders.

The use of the 'LIDER' research method in the proposed model allows to take into account specific conditions in the process of organizational restructuring in individual mining companies.

The applied research methods, based on the author's own research, refer to the thesis, assuming that the leaders of changes, employed in hard coal mining companies, are capable of initiating and implementing the main assumptions of the restructuring process, with particular emphasis on organisational restructuring.

In order to select a representative coal mine, the author carried out a preliminary measurement and assessment of the phenomenon under study, using an intuitive 'comparison' method. The method in question consists of comparing such quantities that have the so-called value of comparability. It means that, following these comparisons, some conclusions can be drawn that are relevant to the assessment of the phenomenon under investigation (Dycz, 2000).

The author also made use of taxonomic evaluation methods which are particularly useful when the properties of the system subject to evaluation are not measurable. It is therefore necessary to estimate them¹.

Figure 1 shows a comprehensive graphic presentation of the organizational restructuring model (ORM) of a hard coal mining company.

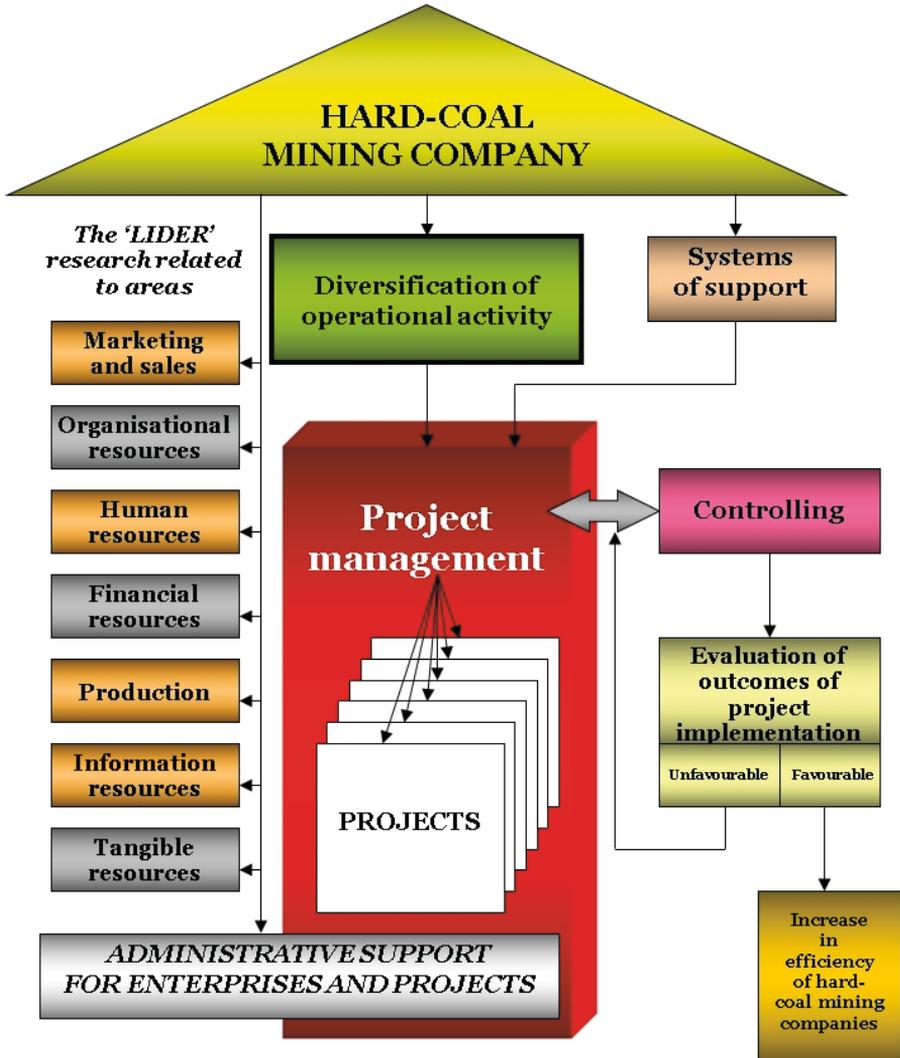


Fig. 1. Model of organizational restructuring for coal-mining company

Source: (Dźwigół, 2007, p. 210)

¹ Taxonomic method – designed over 1949/50 in Wrocław, Poland, by the team of prof. Hugo Steinhaus. It was called ‘The Wrocław Taxonomy’.

The 'LIDER' research method orientates the construction of a modern holistic, challenge-posing enterprise, where the objectives can be implemented, if it balances the conflict between the entrusted duties in terms of profitability and the achievement of customer satisfaction. According to the author, a strategy is a set of interactions on key areas of an organization's activity to obtain value for clients and value for the organization. The author attaches particular importance in the restructuring process to the organizational culture, which is created through behaviours, norms, beliefs, and values shared by the members of the organization, and its foundation is based on values. They are defined as a set of principles, considered by members of an organisation, as particularly important ones, to be respected and protected (Rokita, 2005).

The value created by an enterprise is an expression of the relationship between the satisfaction of customers' needs and the resources that must be used to satisfy those needs (Konkol, 2005).

In the modelling of the organisational restructuring process, key success factors in selected areas were also distinguished, which significantly affect the scope and success of the planned changes. Several key areas of the model were distinguished based on research results, which indicate that in the current socio-economic conditions the most important areas of organisational restructuring in the case of a hard coal mining company include marketing and sales area, production area, human resources area, information resources area.

The applied methods of project management and controlling enable the translation of the concept and strategy of organisational restructuring of a mining company into operational activities, e.g., in the form of restructuring-related change programmes.

The model of organisational restructuring includes support systems (Steering Committee) necessary for the implementation of individual projects in the enterprise and cooperation with the environment. The rank and nature of support systems will depend on the type of the implemented project.

The presented model, due to its systemic approach covering a wide range of areas of activity of a mining company and a comprehensive set of tools supporting the conduct of the organizational restructuring process, becomes universal. This feature results directly from the possibility of selective selection of areas and tools of organisational restructuring depending on the socio-economic situation in which the mining company operates.

An important feature of the organisational restructuring model is its universality of use and applicability, which has been confirmed by the development and implementation of this model by the author in non-mining companies.

The organizational restructuring model can be equipped with tools enabling the creation and management of such processes. These tools include modern systemic stages of company's improvement and tools supporting the change. Equally important in this context are elements of the Industry 4.0, such as the Big Data, Internet of Things or Smart Factory, which play a positive role in promoting the deployment of information technology (IT) and thus contribute to the sustainability of the company. According to the research carried out by Haseeb et al. (2019, pp. 17–18) on the role of the Industry 4.0 in promoting sustainable business performance in Thai SMEs, the Industry 4.0 is key to the growth of sustainable business performance among these companies. In addition, the Industry 4.0 elements such as Big Data, Internet of Things and Smart Factory help implement new technologies, thereby increasing business efficiency. However, as the authors rightly point out, in order to implement the new

technology and benefit from the Industry 4.0, the structure and process of the organisation must be supportive, otherwise it will cause limitations in this respect and will have a negative impact on sustainable business performance.

In today's business world, organizational goals are becoming more and more complex. Work organisation is evolving towards autonomy and the creation of flexible forms of work (Bağ, 2009). One may give an example of the production activity, which should be based on the conviction that all production units consistently meet the process standards applied at a given time. Customers and their requirements determine the actions taken by the whole production system (Grudzewski et al., 2010; Hamrol, 2016; Krzakiewicz & Cyfert, 2017).

5. Conclusions

The use of the organizational restructuring model (ORM, according to the author's concept), strengthened by system stages of company's improvement, with the use of project management and controlling methods, provides the basis for the development of the company towards a marketing orientation).

The proposed model of organisational restructuring presents a different perspective on the restructuring process of hard coal mining companies, taking into account not only the change of organisation and management, but also rational management of the deposit. An important feature of this model is to ensure a new approach to the processes of organizational restructuring in enterprises, but above all to equip it with attributes related to the universality of its use and applicability.

The organisational restructuring model is an instrument for continuous improvement of the hard coal mining company, among others, through flexible selection of areas of activity subject to organisational restructuring together with management support systems. An important role is played here by the area of information resources, the effective use of which is beneficial to the identification of opportunities and threats, implementation of strategic management methodology, while introducing elements of managers' work with information. It is one of the essential conditions for the success of the mission, the objectives of the company, and also creating a significant element of its intangible resources.

The project management method and the controlling method, from the organisational point of view, constitute a component combining elements distinguished in the organizational restructuring model of a hard coal mining company, by means of horizontal links, binding the areas of the company's activity into one whole.

The introduction of the *model of organisational restructuring* (ORM) of a hard coal mining company undoubtedly requires further research aimed at updating the diagnosis in the highlighted areas of activity. The aim of this type of research will be to indicate in which areas the organizational restructuring processes should be undertaken first and how to select tools and techniques supporting such changes.

Changes in the global economy force us to develop a business model, which will result in an effective, flexible company, capable of making continuous changes to improve its competitiveness. It is impossible to introduce changes in a company without a prior diagnosis of its areas of activity.

As a result of the conducted research and management practice, the following conclusions have been formulated:

- diagnosis is the starting point for the formulation of the organisation's development strategy,
- diagnosis should be made by interdisciplinary teams made up of competent professionals and experienced practitioners who not only come from the specialists of the company in question but also from other areas,
- when diagnosing the organizational system, we must know well the structure and system of connections between individual areas of activity. To identify strengths and weaknesses, we need standards that we can relate to,
- a new systemic approach to enterprise research has been indicated as a set of areas of activity interconnected by relations, cause-and-effect relations of a positive and negative nature, which are aimed at achieving specific objectives and tasks in the best possible way.

It should be stressed that a proper diagnosis does not solve the problem. The essence is the reaction to the outcome of the diagnosis. *An example is the approach of the American and Japanese workers. When an American worker, while completing his/her task, stumbles on a nut with too large an opening, he throws it away to the basket with faulty nuts and reaches for another nut. After some time, the contents of the basket and the amount of losses are calculated, and when their cost exceeds the acceptable standard, a technical engineer will intervene and deal with the problem according to the division of responsibilities resulting from the organizational system. However, when a Japanese employee states that the nuts are too large, the losses are obvious. On the same day, he and his colleagues agree on countermeasures, and the next day another worker observes the process to find out what is causing this state of affairs. If he does not manage to find the cause by himself, he once again holds a meeting with his colleagues and if they find out that it is a machine error, then they call the engineer (Drucker, 2017).* This example shows that the diagnosis is very important in the process of introducing changes, but their effectiveness is determined by the reaction to this diagnosis.

The companies of the future must be based more on innovative solutions for their operations, their production system, and their management. Their activity should be based on short-term undertakings, which are often revived from accumulated capital in another form, using foreign resources and work carried out by entities from the environment rather than from within the enterprise.

References

- Bąk E., 2009. *Nietypowe formy zatrudnienia na rynku pracy*. C.H. Beck, Warszawa.
- Borowiecki R., 2007. *Restrukturyzacja jako narzędzie strategii zarządzania we współczesnym przedsiębiorstwie*. "Prace Naukowe/Akademia Ekonomiczna w Katowicach", tom *Dynamika zarządzania organizacjami. Paradygmaty – Metody – Zastosowania. Księga pamiątkowa* wydana z okazji 50-lecia pracynaukowej prof. zw. dr hab. Jerzego Rokity, pp. 251–267.
- Brettel M., Friederichsen N., Keller M., Rosenberg M., 2014. *How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective*. "International Journal of Mechanical, Industrial Science and Engineering", vol. 8, pp. 37–44.

- Drucker P.F., 2017. *Praktyka zarządzania. Najslynniejsza książka o zarządzaniu*. “Światowe Bestsellery Biznesowe”, Wydawnictwo MT Biznes, Warszawa.
- Dycz T., 2000. *Analiza finansowa*. Wydawnictwo Akademii Ekonomicznej im. Oskara Langego, Wrocław.
- Dźwigoł H., 2003. *Procesy zmian w światowym górnictwie i elektroenergetyce*. Instytut Promocji Małych i Średnich Przedsiębiorstw „Promotor”, Katowice.
- Dźwigoł H., 2007. *Model restrukturyzacji organizacyjnej przedsiębiorstwa górnictwa węgla kamiennego*. Difin, Warszawa.
- Dźwigoł H., 2014. *Unternehmensmanagement im 21. Jahrhundert*. Edition Winterwork, Borsdorf.
- Dźwigoł H., 2015. *Business Management*. Alpha Science International Ltd., Oxford, UK.
- Dźwigoł H., 2018. *Scientific research methodology in management sciences*. “Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie”, z. 118.
- Dźwigoł H., Wolniak R., 2018. *Controlling w procesie zarządzania chemicznym przedsiębiorstwem produkcyjnym* [Controlling in the management process of a chemical industry production company]. “Przemysł Chemiczny”, vol. 97(7), pp. 1114–1116; <https://doi.org/10.15199/62.2018.7.15>.
- Dźwigoł H., Aleinikova O., Umanska Y., Shmygol N., Pushak Y., 2019a. *An Entrepreneurship Model for Assessing the Investment Attractiveness of Regions*. “Journal of Entrepreneurship Education”, vol. 22, Special Issue.
- Dźwigoł H., Dźwigoł-Barosz M., Zhyvko Z., Miśkiewicz R., Pushak H., 2019b. *Evaluation of the energy security as a component of national security of the country*. “Journal of Security and Sustainability Issues”, vol. 8(3), pp. 307–317.
- Grudzewski W.M., Hejduk I., 2007. *Współczesne kierunki rozwoju nauk o zarządzaniu* [Contemporary development trends in management science]. [In:] W.M. Grudzewski (red.), *Rozwój funkcjonowanie przedsiębiorstw w warunkach globalnej gospodarki światowej*. Wyższa Szkoła Zarządzania Marketingowego i Języków Obcych, Katowice.
- Grudzewski W.M., Hejduk K.H., Sankowska A., Wańtuchowicz M., 2010. *Sustainability w biznesie czyli przedsiębiorstwo przyszłości. Zmiany paradygmatów i koncepcji zarządzania*. Poltext, Warszawa.
- Hamrol A., 2016. *Strategie i praktyki sprawnego działania. Lean, six sigma i inne*. Wydawnictwo Naukowe PWN, Warszawa.
- Haseeb M., Hussain H.I., Ślusarczyk B., Jermittiparsert K., 2019. *Industry 4.0: A solution towards technology challenges of sustainable business performance*. “Social Sciences”, vol. 8(5), 154.
<https://www.scopus.com/authid/detail.uri?authorId=57207952997> [2.07.2018].
- Imran M., Waseem H., Adnan H., 2018. *Influence of Industry 4.0 on the Production and Service Sectors in Pakistan: Evidence from Textile and Logistics Industries*. “Social Sciences”, vol. 7(12), pp. 246–267.
- Konkol P.K., 2005. *Zarządzanie wartością, zmiana paradygmatu zarządzania – przejście od kosztu do wartości*. [In:] J. Lewandowski (red.), *Zarządzanie organizacjami gospodarczymi. Koncepcje i metody*. Tom I. Wydawnictwo Politechniki Łódzkiej, Łódź, pp. 423–431.
- Korzeniowski F.L., 2011. *Podstawy zarządzania organizacjami*. Difin, Warszawa.
- Kostera M., 2005. *Antropologia organizacji. Metodologia badań terenowych*. Wydawnictwo Naukowe PWN, Warszawa.

- Kowalczyk J., 2011. *Doskonalenie zarządzania organizacją w praktyce*. CeDeWu, Warszawa.
- Krzakiewicz K., Cyfert S., 2017. *Strategiczny wymiar dynamicznych zdolności polskich przedsiębiorstw*. Uniwersytet Ekonomiczny w Poznaniu, Poznań.
- Lenka S., Parida V., Wincent J., 2017. *Digitalization capabilities as enablers of value co-creation in servitizing firms*. "Psychology & Marketing", vol. 34(1), pp. 92–100.
- Malara Z., 2006. *Przedsiębiorstwo w globalnej gospodarce. Wyzwania współczesności*. Wydawnictwo Naukowe PWN, Warszawa.
- Porter M.E., Heppelmann J.E., 2015. *How smart, connected products are transforming companies*. "Harvard Business Review", vol. 93(10), October, pp. 97–114.
- Posada J., Toro C., Barandiaran I., Oyarzun D., Stricker D., de Amicis R., Pinto E.B., Eisert P., Döllner J.E., Vallarino I., 2015. *Visual Computing as a Key Enabling Technology for Industrie 4.0 and Industrial Internet*. "IEEE Computer Graphics and Applications", vol. 35(2), pp. 26–40.
- Pszczółkowski T., 1988. *Mała encyklopedia prakseologii i teorii organizacji*. Zakład Narodowy im. Ossolińskich, Wrocław.
- Roblek V., Meško M., Krapež A., 2016. *A Complex View of Industry 4.0*. SAGE Open 6; <https://doi.org/10.1177/2158244016653987>.
- Rokita J., 2005. *Zarządzanie strategiczne. Tworzenie i utrzymanie przewagi konkurencyjnej*. Polskie Wydawnictwo Ekonomiczne, Warszawa.
- Rüßmann M., Lorenz M., Gerbert P., Waldner M., Justus J., Engel P., Harnisch M., 2015. *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*. "Boston Consulting Group", vol. 9, pp. 54–89.
- Shrouf F., Ordieres J., Miragliotta G., 2014. *Smart Factories in Industry 4.0: A Review of the Concept and of Energy Management Approached in Production Based on the Internet of Things Paradigm*. Paper presented at the 2014 IEEE International Conference on Industrial Engineering and Engineering Management, Bandar Sunway, Malaysia, 2014.12.9–12.
- Sudoł S., 2007. *Badania naukowe w zakresie zarządzania*. "Prace Naukowe/Akademia Ekonomiczna w Katowicach", tom *Dynamika zarządzania organizacjami. Paradygmaty – Metody – Zastosowania. Księga pamiątkowa wydana z okazji 50-lecia pracy naukowej prof. zw. dr hab. Jerzego Rokity*, pp. 359–377.
- Ślusarczyk B., 2018. *Industry 4.0: Are we ready?*. "Polish Journal of Management Studies", vol. 17(1), pp. 232–248.
- Waschneck B., Altenmüller T., Bauernhansl T., Kyek A., 2016. *Production Scheduling in Complex Job Shops from an Industry 4.0 Perspective: A Review and Challenges in the Semiconductor Industry*. Paper presented at the SAMI@ iKNOW, Graz, Austria, 2016.11.18–19.
- Weyer S., Schmitt M., Ohmer M., Gorecky D., 2015. *Towards Industry 4.0-Standardization as the Crucial Challenge for Highly Modular, Multi-Vendor Production Systems*. "IFAC-PapersOnLine", vol. 48(3), pp. 579–584.
- Zawadzki P., Żywicki K., 2016. *Smart Product Design and Production Control for Effective Mass Customization in the Industry 4.0 Concept*. "Management and Production Engineering Review", vol. 7(3), pp. 105–112.