

RESEARCH METHODOLOGY IN MANAGEMENT SCIENCE: TRIANGULATION

Henryk Dzwigol

Abstract. The author emphasised the importance of cognitive methods and business management methods, as well as the necessity to adopt an open-minded approach that requires combining multiple approaches in the research process. In order to make the research more credible, the author suggested using triangulation of research methods, allowing to expand the scope of the studied phenomenon. The application of combined research methods also permits achieving higher quality of conducted research, as well as limiting measurement errors that may occur when just one method is used. The author pointed out that for each research process an appropriate research methodology should be selected depending on the type of research problem. It might be necessary to refine the approach, tool or method in order to strengthen the research process. The author designed a concept of a modern formula for organisational changes in an enterprise in the form of a model and verified the model against the example of selected enterprises. He made an attempt to develop a research method to be used in the implementation of basic research processes in management sciences and in the implementation of organisational changes in an enterprise. The developed research method, called "LIDER" (covering three stages), has been used by the author to identify areas of activity and to assess the readiness of change leaders to carry out organisational changes in an enterprise. The nature of the research will determine the decision as to the precise research design, creation of a research model and selection of specific research methods.

Keywords: research method, organisational change, research techniques.

JEL Classification: B40, C18, C80

Author:

Henryk Dzwigol

Silesian University of Technology, 26–28 Roosevelt St., Zabrze, Poland, 41-800

E-mail: henryk.dzwigol@poczta.fm

<https://orcid.org/0000-0002-2005-0078>

Citation: Dzwigol, H. (2022). Research Methodology in Management Science: Triangulation. *Virtual Economics*, 5(1), 78-93. [https://doi.org/10.34021/ve.2022.05.01\(5\)](https://doi.org/10.34021/ve.2022.05.01(5))

Received: October 12, 2021. Revised: November 26, 2021. Accepted: January 12, 2022.

© Author(s) 2022. Licensed under the [Creative Commons License - Attribution 4.0 International \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/)

Henryk Dzwigol

Virtual Economics, Vol. 5, No. 1, 2022

1. Introduction

In management science, it is very easy to build "new theories" that lack sufficient verification. A swift introduction of new, recommended management-related concepts and methods, as well as their rapid rejection, resulted in negative organisational changes. It would be difficult to determine the reasons why the applied methods lack effectiveness. Was the failure triggered by an inadequate method used for a management process or by its unskilful implementation? (Sudoł, 2012). Most disciplines of sciences have separate, proper and diverse cognitive methods, allowing to solve or diagnose a research problem, while the management methodology has no permanent, universal character.

Management uses methods inherent in other sciences, including psychology, sociology, statistics, econometrics, or economics, to name but a few. So, methodological aspects of different approaches were shown in the works of many researchers (Arefieva et al., 2021; Boiko et al., 2019; Bogachov et al., 2020; Dalevska et al., 2019; Drożdż et al., 2021; Dźwigol & Wolniak, 2018; Dźwigol et al. 2019a; 2019b; 2020a; 2020b; Dźwigol, 2020; Hussain et al., 2021; Kharazishvili et al. 2020; 2021; Kostyrko et al., 2021; Kotowicz et al. 2022; Kuzior et al., 2021a; 2021b; 2022; Kuzior & Kwilinski, 2022; Kwilinski et al., 2019a; 2019b; 2020a; 2020b; 2020c; 2020d; 2021; 2022a; 2022b; Kwilinski & Kuzior, 2020; Lyulyov et al., 2021a; 2021b; 2021c; Miśkiewicz, 2018; 2020; 2021; Miśkiewicz et al., 2021; 2022; Moskalenko et al., 2022a; 2022b; Polcyn et al., 2021; Prokopenko & Miśkiewicz, 2020; Saługa et al., 2020; 2021; Szczepańska-Woszczyzna & Gatnar, 2022; Tkachenko et al. 2019; Trzeciak & Jonek-Kowalska, 2021; Trzeciak et al., 2022; Yang et al., 2021). Management methodology is a reflection on the transformations that have taken place over the years in management methods that provide an insight into the state in which a company finds itself. Management methodology is constantly being enhanced by new methods characterised by varying cognitive and practical effectiveness. The constant growth of diagnostic instruments is conditioned primarily by changes in the environment (Dźwigol, 2018).

The problem lies in the overproduction of research findings and publications, being useless or not fully valuable (Sułkowski, 2010). Management science lacks an unambiguous criterion of truth and falsity (Koźmiński, 2011) Nowadays, in the management sciences, the most common division of research methods is their classification into qualitative and quantitative methods. Certain methods exhibit characteristics of qualitative as well as quantitative methods. The discipline of management sciences relies on methodology from other sciences.

Already at the stage of defining the research problem, it is difficult to select one method enabling a full and thorough diagnosis of the problem. It is necessary to apply diverse research methods providing a comprehensive answer to the problem in question. The development of cognitive methods and business management makes it imperative to adopt an open-minded approach that requires combining several approaches and methods.

In research processes, the author uses system methods and techniques, qualitative and quantitative methods (Dźwigol, 2015). The author pays particular attention to the use of

triangulation of research methods. The simultaneous application of several research methods is very beneficial for the final result. Then, one obtains a more comprehensive and reliable picture of the research problem and avoids the danger of bias or even obtaining a result that is not entirely consistent with economic or social reality (Sudol, 2012).

The author designed a concept of a modern formula of organisational changes of an enterprise in a model form and has verified the model on the example of selected enterprises. He makes an attempt to develop a research method to be used in the implementation of basic research processes in management sciences and the introduction of organisational changes.

2. Research methods and techniques

Research methods and techniques in the management sciences are aimed at finding out about rules and principles that govern organisations, and at changing the said organisations for the better. A method can be defined as a conscious and resolute way in which a researcher acts or behaves in order to achieve a defined goal. A technique, on the other hand, can be defined as an instrument, a tool used to solve appearing problems. However, from a practical point of view, it is not easy to distinguish between a method and a technique. Regardless of a researcher's decision about applying a research method or a research technique, the researcher is always obliged to implement a determined research process. A research process consists of numerous elements; the said elements should be meticulously planned on the basis of continuous choices. The said choices are to be made in consideration of the reliability and credibility of research findings (Babbie, 2005).

The essence of the research process is formulating a research problem; the latter is needed to determine research goals, i.e. what is to be achieved as a result of the research. Defining a research problem is the starting point for developing a research concept (Bogdaniecko, 1983):

- analysing the problem in the light of the subject literature,
- identifying sources of necessary data and research methods,
- adopting necessary assumptions, hypotheses and theses.

It is necessary to apply a systemic methodology, which requires a common holistic design of activities (Rokita, 2007), which will result in the construction of an appropriate research methodology. Therefore, the research conducted in the management sciences in particular should be guided by:

- clarity,
- avoidance of vague statements and statements creating only an appearance of scientific thoroughness.

In the discipline of management sciences, historically speaking, one can distinguish four fundamental types of methods. These include: pragmatic, empirical, formal and understanding ones (Ostasz, 1999).

The first type of method was used the earliest. It may be most generally characterised as the practical solution to problems related to meta-physics. The advantage of this method was supposed to be common sense and reference to empirical reality. The value of this method is measured by the effectiveness of the changes occurring in the enterprise, which are to lead to an increase in its efficiency (Niemczyk, 2011).

Empirical research methods are proper methods for management sciences. It needs to be underlined that one should employ proper methods allowing to verify research hypotheses and answer research questions. Deductive methods and analogical reasoning, complemented with intuition should be a source of research hypotheses or a basis for formulating research questions. Carrying out research in management sciences requires more research discipline than, for example, the above-mentioned intuition (Niemczyk, 2011). Empirical methods represent the opposite of pragmatic methods. They focus on solving the problem from the side of experience, trying to create the closest to reality conditions that will allow the researcher to explore the phenomenon, the problem from the side of science. The cognitive path, in this case, is mainly induction, which introduces certain generalisations and is therefore incomplete. In management, empirical methods are represented by observation, experiment and quantitative methods of social sciences - for example, questionnaire (Sułek, 1990).

Formal methods are related to the ability of hypothetical thinking. The ability to make inferences, mathematics and statistical and logical methods play an important role here. In management science, they are reflected in numerical and probabilistic methods. The result of the application of these methods can involve practical and cognitive conclusions (Niemczyk, 2011).

Understanding methods, which refer to philosophy and humanities. Their task is to thoroughly penetrate the essence of the problem, enabling to examine it from different sides. In empirical sciences they find their place in the qualitative methodology of social sciences including methods that allow comparing organisations (Kostera, 2003), i.e. observation, interview, analysis of documentation, etc.

During the analysis of literature concerning the phenomena and problems of interest to the researcher and their solutions, the researcher must also be guided by the principle of intersubjective verifiability. According to this principle, the results of other researcher's studies should be verified and checked (Sułkowski, 2005).

Methodics can be defined as a set of ways, rules and principles regarding how a given job needs to be done. Nonetheless, one needs to ponder specific character of methodics related to management sciences. In the subject literature, one may find statements about the existence of methodological underdevelopment of management sciences, which is caused, among others, by the anti-methodological character of main trends (Koźmiński et al., 1989). Furthermore, it should be pointed out that among the methods that are used in the management sciences, it is possible to identify both methods specific to management only

and others, derived from workshops of other sciences. The borrowed methods refer primarily to learning about the organisation and management, while the management's own methods focus on shaping the organisation and management system. It should be stated that in spite of some criticism, management science and its methods lead to increased efficiency and competitiveness of enterprises. It is worth noting, however, that management methods are not and cannot be universal. These methods must change over time, just as the company does. The traditional approach does not always produce satisfactory results and, in addition, does not always contribute to improving the existing situation. In the modern approach, different types of rules, procedures and tools are developed, which make it possible to deepen, in comparison to the traditional approach, the understanding of the problem situation. In the literature on management sciences, the necessity of simultaneous use of many different methods of getting to know and shaping the organisation has been repeatedly emphasised. The literature also points out that there is a need for simultaneous use of many mutually verifying and correcting methods (Denzin, 1970).

3. Directions of development of research methods and techniques in management sciences

Scientific research is a complex process leading to the solving of a specific problem. Its outcome may take a strictly cognitive form, but it may also be implemented for specific practical purposes. Scientific work carried out in all fields consists of constant elements, which are: analysis and synthesis. The contribution of individual elements depends on the nature of the studied phenomena. Popular scientific works are not connected with the implementation of research, nor do they contribute anything new to the world of science. The assumptions made in them do not necessarily have to be backed up by research and may therefore prove to be false. Their main purpose is to disseminate what is already known. The language they use is also more accessible to the average reader. Significantly greater conceptual and linguistic freedom prevails in them than in scientific works. Scientific methods appropriate for management sciences are empirical research methods. It should be emphasised that appropriate methods must be used to verify research hypotheses and answer research questions. The source of research hypotheses or the basis for formulating research questions should be deductive methods, analogical thinking and, finally, intuition. Conducting research in the field of management sciences requires more research discipline than, for example, the aforementioned intuition (Niemczyk, 2011).

However, regardless of whether a research method or technique is used, the researcher must always follow a specific research process. The research process consists of numerous elements that should be carefully planned based on continuous choices made in order to ensure the reliability and credibility of the research results (Babbie, 2005).

The essence of the research process is formulating a research problem; the latter is needed to determine research goals, i.e. what is to be achieved as a result of the research. The formulation of the research problem is the starting point for the development of the research concept (Bogdaniecko, 1983):

- analysis of the problem in the light of the subject literature,
- determining sources of necessary data and research methods,
- adoption of necessary assumptions, hypotheses and theses.

According to the holistic approach, phenomena create comprehensible systems. Regarding an organisation as a whole is an element of systems thinking. It is thus necessary to make use of the systems methodology, which requires designing actions collaboratively (in the holistic sense) (Rokita, 2007). The ensuing results will be to establish proper research methodics.

According to the author, core studies should be preceded by pilot studies. In pilot studies, the choice of objects should be well-thought-out by the researcher. One is aware that pilot research steers the fundamental research process. Adopting wrong assumptions at this stage may result in making wrong assumptions about solving the research problem.

In order to avoid confusion with an erroneously devised data collection tool, a pilot study should be carried out. The pilot studies, otherwise known as preliminary studies, are carried out prior to the basic (core) studies when a problem, process, phenomenon or mechanism specific to a given community, location, object or society is scarcely studied – that is, very little is known about it. Such research is often conducted on a small scale and constitutes the first contact with the analysed reality. The pilot study allows gathering preliminary knowledge about the studied phenomenon. The main purpose of such study is to collect information (implicitly incomplete, because only core studies allow collecting all the necessary data to verify the theses adopted in the work) to verify the chosen direction, formulate assumptions for the work, or check the correctness of the developed questionnaire – in the case of surveys. Pilot studies also serve to check the usefulness of the adopted research methods and tools to investigate a given problem (Nowak, 2007). By conducting preliminary research, the researcher gains confirmation or negation of the previously accepted connections between the studied phenomena.

Furthermore, a pilot study also allows for the selection of the information collected. This results in the rejection of information that is irrelevant to the problem under investigation or that is not present in the environment or population. Apart from checking the correctness of the developed questionnaire, it is also possible to obtain knowledge about the duration of basic research or a reliable random sample size.

A pilot study appears to be necessary if (Rószkiewicz, 2002):

- the field of study is being explored for the first time,
- completely new methods and tools are used in research,
- it is likely that the assumptions made in the studies cannot be maintained.

In contemporary management sciences, an important role is played by the calls for methodological eclecticism (Sułkowski, 2005), within which research methods are divided into inductive and deductive methods (Matejun, 2011). In management, moreover, there are no

unambiguous or definitive conclusions and firm findings that can be posed as immovable universal laws. Each analysed phenomenon or problem is unique, and may have several solutions, additionally losing its validity quickly (Koźmiński, 2004). Therefore, in conducting scientific research, especially in the field of management sciences, one should be guided by clarity, and should avoid statements that are vague and create only an appearance of scientific thoroughness (Koźmiński, 2004). The researcher must be guided by the principle of intersubjective verifiability. According to this principle, the results of other researchers' studies should be verified and checked (Sułkowski, 2005).

4. Research methodics in the process of designing organisational changes model, with the application of the „LIDER” method, developed by the author

The essence of the exemplary research process is to investigate the determinants of changes in the organisational system. In the research process, an attempt should be made to comprehensively capture the problem from the point of view of the scope of research analysis and the possibility of supporting the implementation process by applying certain management methods.

The research was conducted using quantitative and qualitative methods. In order to make the research more credible, in the author's opinion, triangulation of research methods should be applied, allowing to broaden the scope of the studied phenomenon. The use of combined research methods also allows to achieve a higher quality of research, as well as to limit measurement errors that may occur when just one method is employed.

Among the methods used in practice for research in management based on observation of facts and the classification used in the general methodology of inductive sciences, it is good when the author has the opportunity to use two extremely important methods, namely:

- observation carried out under natural conditions, where the researcher cooperates with the enterprises being examined,
- observations-interventions that take place within the framework of transformation activities in enterprises, and the author has a direct influence on the decisions taken in this respect.

Management theory should explain complex phenomena and be of help in improving management practice. The variety of research methods in management sciences is not detrimental, it is a resource that each discipline should value and develop. Claims that each science should use only methods developed by itself and that only one method should be considered fundamental are unjustified and unrealistic (Sudoł, 2012).

From the point of view of the methodology of elaboration of the examined problem, it was important to use the results obtained on the basis of the "LIDER" research method developed by the author, referring to the assessment of the ability to conduct changes. The developed

"LIDER" research method was used by the author to identify areas of activity and to assess the readiness of change leaders to carry out the said changes.

Most research problems are very complex and require a systematic approach and analysis of multiple threads, often inconsistent with the scope of research. The combining of various theories, concepts, notions and theses from different selected philosophical trends into one incoherent whole, is essential for the development of reliable principles and criteria as to the selection of components of the scientific offer to be applied in practice.

In the case of the study of changes in the organisational system, enterprises of the same activity profile were accepted as research objects, which made it possible to compare their areas both in terms of identifying the actual research problem and the ability to solve it. Experts and representative research groups were not used in this research; in the author's opinion, there is no need for it, as this is pilot research confirming the researcher's belief in the sense of investigating a given problem. The research paid special attention to the characteristics of individual areas of activity within the organisational system and their comparability.

In order to identify a research object, it is necessary to carry out a preliminary measurement and assessment of the studied phenomenon, using, for example: the intuitive method of "comparisons", which involves comparing such quantities that have the so-called value of comparability. It means that as a result of these comparisons, one can draw conclusions that are important from the point of view of the evaluation of the studied phenomenon (Dycz, 2000).

In this process, depending on the nature of the research problem, one should also pay attention to the taxonomic methods of evaluation, especially useful when the features of the system subject to evaluation are not measurable. Therefore, it is necessary to estimate them (Steinhaus, 1950).

In fundamental research, the author pays special attention to the determination of the sample size and the use of heuristic methods in the research process. The starting point, and at the same time the main reason for any marketing research is to determine the sample size. How to select the sample is one of the most important decisions that a researcher planning an empirical study must make. The accuracy of the obtained research results will depend on how representative the sample is (Brzeziński, 1996). Since each study satisfies a different decision-making need, no two studies are identical. Each stage requires different methods of procedure specific to that stage. Procedure for determining necessary sample size (Greń, 1984).

$$nb = \frac{N}{1 + \frac{4d^2(N-1)}{Z^2\alpha}} \quad (1)$$

where N – population size, d – admissible fraction ratio error; assumed fraction ratio– 1, hence z = 1.64, Z – normal distribution, α – significance level,

Heuristic methods may boast a strong scientific basis and a rich and long tradition. These methods use judgments and opinions of both experts (professionals) and non-professionals who are involved in the process of solving a specific research problem, consisting of searching for facts and connections between them, proposing solutions or expressing subjective opinions and judgments.

The discussed methods draw on the achievements of the discipline, the subject of which is the processes of creative thinking – heuristics. It defines recommendations, the use of which enables more effective problem-solving. A heuristic approach to a problem should be understood as stimulating imagination, fantasy and intuition, and focusing on creative aspects of the solved problem (Orzeł, 2005).

At this point, it should be pointed out that the role of heuristic methods in enterprise management, with particular reference to decision-making, is extensive and well-established. The method of group expert assessment is most often used in decision-making. Related to this is operational risk management, which is one of the elements of enterprise management. Operational risk should be understood as “the risk of loss resulting from inadequate or failed processes, people and systems or from external events.” (Mun, 2004).

5. The application of the "LIDER" research method to organisational change management

An example of research methodology in the area of organisational changes in an enterprise. A concept of a modern formula for organisational changes in an enterprise was designed in the form of a model and the model was verified on the example of selected enterprises. The objective can be divided into two parts, i.e.:

- designing a modern formula for organisational changes in an enterprise.
- verifying the model on the example of selected enterprises.

Tasks to be completed during the construction of the model:

- developing a methodology for designing a modern formula of organisational changes in an enterprise,
- selecting tools to support the process of modelling organisational changes,
- applying the systemic approach to enterprise diagnosis,
- constructing a model of organisational changes in an enterprise,
- verifying the model on the example of a selected enterprise.

Research methods and techniques. The simultaneous application of several research methods is highly beneficial as far as the final result is concerned. Thus, a more comprehensive view of the research problem is obtained and the danger of bias or even of a result that is not fully in line with economic and social reality is avoided.

The researcher should contribute to the development of the research method, which may consist of his/her own research related to e.g.: critical analysis of literature in the field of management sciences.

Empirical research should be followed in this case by a diagnosis of the environment and the sector or industry represented by the research object, as well as verification of the functionality of the developed solutions for management purposes on the example of a selected organisation.

The developed research methodology may consist of the following stages, i.e.:

- determination of the research object and research goal - selecting and defining the research object, as well as determination of the research expediency referring to the construction, e.g.: a model in the scope of research area,
- internal diagnosis – recognition and identification of the internal conditions of the research object,
- external diagnosis – identification of conditions for activities run by the research object in the environment,
- identification of problems with regard to the subject and objectives - on the basis of compiling the results of internal and external diagnosis aimed at recognising the specific nature of the activities of the research object,
- search for partial solutions – analysis of contemporary approaches to the issues of the researched area through detailed recognition of theoretical achievements,
- construction and description of e.g.: a model construed as a research method (Dźwigoł, 2007).

The company activity should be based on short-term enterprises, recreating themselves in other forms from accumulated capital, making use of external resources and activities performed by persons from the company's environment and not from the inside of the company in question (Dźwigoł, 2014). The development of a model of the enterprise of the future, possessing the ability to learn, to be creative, to manage with the use of lean organisational structures, is triggered by the new economic reality. Coping with the changes of tomorrow is conditioned by the readiness to undertake the construction of new ways of perceiving the future of management (Brzeziński, 2001).

As a result of the conducted research and the synthesis of the said research, the key areas of companies' activity 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.

From the point of view of the methodology of developing the model of organisational changes, it was important to use the results obtained on the basis of the "LIDER" research method developed by the author and relating to the assessment of the company's ability to carry out organisational changes.

The „LIDER” research method initiates the development of a new organisational 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 organisation. The conducted research was aimed at assessing the activity of employees participating in the restructuring processes of coal mining companies, particularly the middle management staff.

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

- two types of survey 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 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 organisational restructuring in individual companies. While constructing the overall concept of the company’s organisational change model, the results of research relating to the general analysis of the change process according to the company’s problem areas were taken into account, as well as the results obtained in the questionnaire survey relating to the perception of this process and the ability to carry it out. The "LIDER" research method is presented in Fig. 1.

The „LIDER” research method – assumptions. According to the author, the research methodology developed at the beginning did not provide a guarantee for effective practical implementation of the change process in the surveyed enterprises. Therefore, it was necessary to develop the "LIDER" method to assess:

- the enterprise’s ability to conduct changes;
- the credibility of the adopted direction of changes;
- applicability of the developed model or concept, etc.

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

- assess the readiness to carry out organisational changes;

- identify areas of key importance for organisational changes;
- define the scope of changes, according to the change leaders.

The "LIDER" method comprehensively tackles the problem:

- organisational changes in an enterprise;
- determines the course of further development;
- uses the intellectual potential of an enterprise to introduce changes;
- provides an information database for many management concepts;
- indicates the organisation's ability to learn.

L I D E R

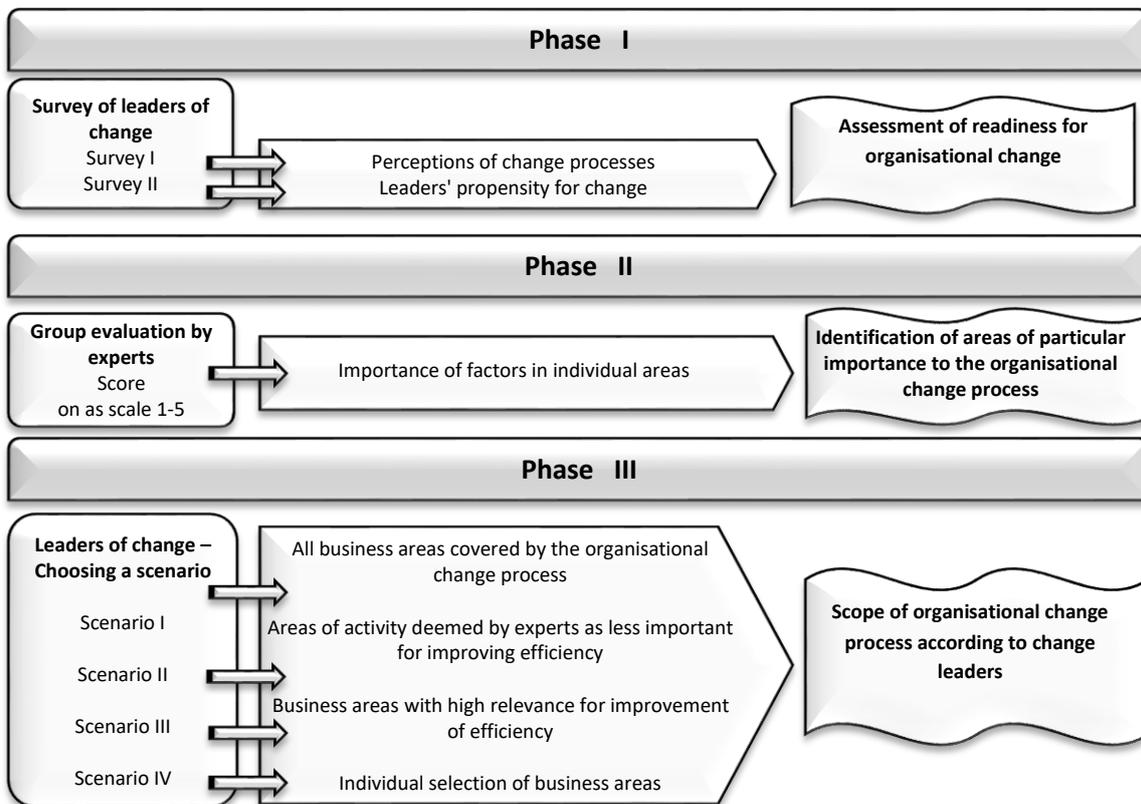


Figure 1. The „LIDER” research method (Dźwigol, 2007).

The use of the “LIDER” research method in the proposed model allows taking into account specific conditions in the process of changes to particular research objects. If the research process results in a developed model, then the object of modelling should be characterised. The subject of modelling includes the following steps:

- formulating general and key assumptions of the model,

- verifying the areas of activity identified at the stage of "internal diagnosis" as key elements of the model, by means of surveys and the scenario method,
- listing key elements of the model together with defining relations between them and introducing supporting tools,
- presenting activities in the field of modelling the process of change e.g.: in selected key elements of the model, including the use of force field analysis,
- characterising in detail the possibilities to use tools supporting the modelling process of change.

The "LIDER" method refers to the importance of soft organisational elements which are closely related to the concept of the management tetrahedron (strategy, structure, decision-making processes, organisational culture).

6. Conclusions

New problems arising in economic reality have turned companies into a completely new research subject, triggering the need for knowledge of processes and the conditions of transformation and development thereof, tools and methods of management in times of "new economy" (Borowiecki et al., 2010).

The nature of the research will determine the decision on the precise design of the research, the creation of a research model and the choice of specific research methods. It is worth mentioning that the research procedure presented in this paper is not an ideal answer on how to operationalize phenomena in management sciences, i.e. how to convert data to the level of variables ready for further statistical analysis. Some limitations of the proposed methodology can be pointed out at this point. The basic limitation concerns the research sample. Due to difficulties in reaching a large group of enterprises that could constitute a representative research sample, the research is usually conducted on a random sample. Another limitation may concern the research tool and the obtained measures. The use of e.g.: a questionnaire survey results in obtaining numbers that reflect managerial approaches and views. In this respect, it is difficult to discuss the measurement of a given phenomenon - what is studied is rather the level of a given phenomenon in a given group of organisations.

However, the author would like to draw attention to a certain complexity of hypothesis verification in management and quality sciences. In management science, it is not possible to establish commonly valid and universal laws, because these laws are determined by people. If the order defined today does not suit people, they change it (Bolesta-Kukułka, 2003).

Berger and Lukmann (2003) – note that "Social order is not part of the nature of things and cannot be derived from the laws of nature. The changeability of the world is an important barrier to the formulation of laws in the management sciences."

In management, there are no unequivocal or definitive conclusions and firm conclusions that can be interpreted as indelible universal laws. There are no such laws in management and there must not be. This is because each phenomenon or problem analysed is unique, and may have several solutions, additionally rapidly becoming obsolete (Koźmiński et al., 2004). Knowledge in management sciences has a non-universal, approximate and uncertain character (Sułkowski, 2005). W. Ossowska, L. Kołakowski and T. Kotarbiński claim "The way of interpreting social and historical phenomena depends, in fact, on the whole conceptual apparatus that we use, depends on the adopted system of classifying facts and other circumstances regarding which a general agreement never exists (Kołakowski, 2004).

The objectivity of hypotheses in management science is highly challenging. Therefore, there are significant limitations in applying the principle of intersubjective verifiability in the management sciences. The researcher should demonstrate the ability to combine quantitative and qualitative methods in the research process to increase the information base needed to verify hypotheses.

Some of the limitations indicated imply the use of triangulation of research methods involving a combination of quantitative and qualitative methods. At the dissertation stage, however, this is difficult and should be properly justified.

References

- Arefieva, O., Polous, O., Arefiev, S., Tytykalo, V., & Kwilinski, A. (2021). Managing sustainable development by human capital reproduction in the system of company's organizational behavior. *IOP Conference Series: Earth and Environmental Science*, 628(1), 012039.
- Boiko, V., Kwilinski, A., Misiuk, M., & Boiko, L. (2019). Competitive advantages of wholesale markets of agricultural products as a type of entrepreneurial activity: the experience of Ukraine and Poland. *Economic Annals-XXI*, 175(1-2), 68-72. <https://doi.org/10.21003/ea.V175-12>
- Bolesta-Kukułka, K. (2003). *Decyzje menedżerskie*. Warszawa, Polska: PWE.
- Berger, P., & Lukmann, T. (1983). *Spółeczne tworzenie rzeczywistości*. Warszawa, Polska: PIW.
- Babbie, E. (2005). *Badania społeczne w praktyce*. Warszawa, Polska: Wydawnictwo Naukowe PWN.
- Bogachov, S., Kwilinski, A., Miethlich, B., Bartosova, V., & Gurnak, A. (2020). Artificial intelligence components and fuzzy regulators in entrepreneurship development. *Entrepreneurship and Sustainability Issues*, 8(2), 487-499. [https://doi.org/10.9770/jesi.2020.8.2\(29\)](https://doi.org/10.9770/jesi.2020.8.2(29))
- Bogdaniecko, J. (1983). *Podstawy badań naukowych*. Warszawa, Polska: Szkoła Główna Planowania i Statystyki.
- Borowiecki, R., & Czekaj, J. (2010). *Zarządzanie zasobami informacyjnymi w warunkach nowej gospodarki*. Warszawa, Polska: Difin.
- Brzezinski, J. (1996). *Metodologia badań psychologicznych*. PWN, Warszawa.
- Brzeziński, M. (2001). *Zarządzanie innowacjami technicznymi i organizacyjnymi*. Warszawa, Polska: Difin.
- Cooke, R.B. (2003). *Probabilistic risk analysis: foundations and methods*. Cambridge, UK: Cambridge University Press (CUP).
- Dalevska, N., Khobta, V., Kwilinski, A., & Kravchenko, S. (2019). A model for estimating social and economic indicators of sustainable development. *Entrepreneurship and Sustainability Issues*, 6(4), 1839-1860. [https://doi.org/10.9770/jesi.2019.6.4\(21\)](https://doi.org/10.9770/jesi.2019.6.4(21))
- Denzin, N. (1970). *The Research Act: Theoretical Introduction to Sociological Methods*. Chicago: Aldine.
- Drożdż, W., Kinelski, G., Czarnecka, M., Wójcik-Jurkiewicz, M., Maroušková, A., & Zych, G. (2021). Determinants of Decarbonization—How to Realize Sustainable and Low Carbon Cities? *Energies*, 14(9), 2640. <https://doi.org/10.3390/en14092640>
- Dycz, T. (2000). *Analiza finansowa*. Wrocław, Polska: Akademia Ekonomiczna.
- Dźwigoł, H. (2007). *Model restrukturyzacji organizacyjnej przedsiębiorstwa górnictwa węgla kamiennego*. Warszawa, Polska: Difin.
- Dźwigoł, H. (2013). Metodologia badawcza w naukach o zarządzaniu na przykładzie wybranych metod. *Zeszyty Naukowe. Organizacja i Zarządzanie*, 63, 85-110.
- Dźwigoł H. (2014). *Unternehmens Management im 21. Jahrhundert*. Germany: Edition Winterwerk Borsdorf.
- Dźwigoł, H. (2015). Założenia do budowy metodyki badawczej. *Zeszyty Naukowe. Organizacja i Zarządzanie*, 78, 99-116.
- Dźwigoł, H. (2018). *Współczesne procesy badawcze w naukach o zarządzaniu. Uwarunkowania metodyczne i metodologiczne*. Warszawa, Polska: Wydawnictwo Naukowe PWN.
- Dźwigoł, H., & Wolniak, R. (2018). Controlling in the Management Process of a Chemical Industry Production Company. *Przemysł Chemiczny*, 97(7), 1114–1116. <https://doi.org/10.15199/62.2018.7.15>
- Dźwigoł, H., Dźwigoł-Barosz, M., Zhyvko, Z., Miśkiewicz, R., & Pushak, H. (2019a). Evaluation of the energy security as a component of national security of the country. *Journal of Security and Sustainability Issues*, 8(3), 307–317.
- Dzwigoł, H., Aleinikova, O., Umanska, Y., Shmygol, N., & Pushak, Y. (2019b). An Entrepreneurship Model for Assessing the Investment Attractiveness of Regions. *Journal of Entrepreneurship Education*, 22(1S), 1-7.
- Dzwigoł, H. (2020). Methodological and Empirical Platform of Triangulation in Strategic Management. *Academy of Strategic Management Journal*, 19(4), 1-8.
- Dzwigoł, H., Dzwigoł-Barosz, M., Miśkiewicz, R., & Kwilinski, A. (2020a). Manager competency assessment model in the conditions of industry 4.0. *Entrepreneurship and Sustainability Issues*, 7(4), 2630–2644.
- Dzwigoł, H., Dzwigoł-Barosz, M., Kwilinski, A. (2020b). Formation of global competitive enterprise environment based on industry 4.0 concept. *International Journal of Entrepreneurship*, 24(1), 1-5.
- Greń, J. (1984). *Statystyka matematyczna. Modele i zadania*. Warszawa, Polska: PWN.
- Hussain, H.I., Haseeb, M., Kamarudin, F., Dacko-Pikiewicz, Z., & Szczepańska-Woszczyna, K. (2021). The role of globalization, economic growth and natural resources on the ecological footprint in Thailand: Evidence from nonlinear causal estimations. *Processes*, 9(7), 1103. <https://doi.org/10.3390/pr9071103>

- Kharazishvili, Y., Kwilinski, A., Grishnova, O., & Dzwigol, H. (2020). Social safety of society for developing countries to meet sustainable development standards: Indicators, level, strategic benchmarks (with calculations based on the case study of Ukraine). *Sustainability*, 12(21), 8953. <https://doi.org/10.3390/su12218953>
- Kharazishvili, Y., Kwilinski, A., Sukhodolia, O., Dzwigol, H., Bobro, D., & Kotowicz, J. (2021). The systemic approach for estimating and strategizing energy security: The case of Ukraine. *Energies*, 14(8), 2126. <https://doi.org/10.3390/en14082126>
- Kostera, M. (2003). *Antropologia organizacji. Metodologia badań terenowych*. Warszawa, Polska: PWN.
- Koźmiński, K.A. (2011). *Reaktywacja*. Warszawa, Polska: Poltext.
- Koźmiński, A.K., & Obłój, K. (1989). *Zarys teorii równowagi organizacyjnej*. Warszawa, Polska: PWE.
- Koźmiński, K.A. (2004). *Zarządzanie w warunkach niepewności. Poradnik dla zaawansowanych*. Warszawa, Polska: Wydawnictwo Naukowe PWN.
- Kośakowski, L. (2004). *Wśród znajomych*. Kraków, Polska: Znak.
- Kostyrko, R., Kosova, T., Kostyrko, L., Zaitseva, L., & Melnychenko, O. (2021). Ukrainian Market of Electrical Energy: Reforming, Financing, Innovative Investment, Efficiency Analysis, and Audit. *Energies*, 14(16), 5080. <https://doi.org/10.3390/en14165080>
- Kotowicz, J., Węcel, D., Kwilinski, A., & Brzęczek, M. (2022). Efficiency of the power-to-gas-to-liquid-to-power system based on green methanol. *Applied Energy*, 314, 118933. <https://doi.org/10.1016/j.apenergy.2022.118933>
- Kuzior, A., Kwilinski, A., & Hrozny, I. (2021a). The Factorial-Reflexive Approach to Diagnosing the Executors' and Contractors' Attitude to Achieving the Objectives by Energy Supplying Companies. *Energies*, 14(9), 2572. <https://doi.org/10.3390/en14092572>
- Kuzior, A., Lyulyov, O., Pimonenko, T., Kwilinski, A., & Krawczyk, D. (2021b). Post-Industrial Tourism as a Driver of Sustainable Development. *Sustainability*, 13(15), 8145. <https://doi.org/10.3390/su13158145>
- Kuzior, A., & Kwilinski, A. (2022). Cognitive Technologies and Artificial Intelligence in Social Perception. *Management Systems in Production Engineering*, 30(2), 109-115. <https://doi.org/10.2478/mspe-2022-0014>
- Kuzior, A., Grebski, W., Kwilinski, A., Krawczyk, D., & Grebski, M. E. (2022). Revitalization of Post-Industrial Facilities in Economic and Socio-Cultural Perspectives—A Comparative Study between Poland and the USA. *Sustainability*, 14(17), 11011. <https://doi.org/10.3390/su141711011>
- Kwilinski, A., Ruzhytskyi, I., Patlachuk, V., Patlachuk, O., & Kaminska, B. (2019a). Environmental Taxes as a Condition of Business Responsibility in the Conditions of Sustainable Development. *Journal of Legal, Ethical and Regulatory Issues*, 22(Special Issue 2), 1-6.
- Kwilinski, A., Tkachenko, V., & Kuzior, A. (2019b). Transparent Cognitive Technologies to Ensure Sustainable Society Development. *Journal of Security and Sustainability Issues*, 9(2), 561–570.
- Kwilinski, A., & Kuzior, A. (2020). Cognitive Technologies in the Management and Formation of Directions of the Priority Development of Industrial Enterprises. *Management Systems in Production Engineering*, 28(2), 133–138. <https://doi.org/10.2478/mspe-2020-0020>
- Kwilinski, A., Dzwigol, H., & Dementyev, V. (2020a). Model of entrepreneurship financial activity of the transnational company based on intellectual technology. *International Journal of Entrepreneurship*, 24(1 Special Issue), 1–5.
- Kwilinski, A., Slatvitskaya, I., Dugar, T., Khodakivska, L., Derevyanko, B. (2020b). Main effects of mergers and acquisitions in international enterprise activities. *International Journal of Entrepreneurship*, 24(1 Special Issue), 1–8.
- Kwilinski, A., Zaloznova, Y., Trushkina, N., & Rynkevych, N. (2020c). Organizational and methodological support for Ukrainian coal enterprises marketing activity improvement. *E3S Web of Conferences*, 168, 00031. <https://doi.org/10.1051/e3sconf/202016800031>
- Kwilinski, A., Dielini, M., Mazuryk, O., Filippov, V., & Kitseliuk, V. (2020d). System Constructs for the Investment Security of a Country. *Journal of Security and Sustainability Issues*, 10(1), 345–358.
- Kwilinski, A., Litvin, V., Kamchatova, E., Polusmiak, J., & Mironova, D. (2021). Information support of the entrepreneurship model complex with the application of cloud technologies. *International Journal of Entrepreneurship*, 25(1), 1–8.
- Kwilinski, A., Dalevska, N., & Dementyev, V.V. (2022a). Metatheoretical Issues of the Evolution of the International Political Economy. *Journal of Risk and Financial Management*, 15(3), 124. <https://doi.org/10.3390/jrfm15030124>
- Kwilinski, A., Lyulyov, O., Dzwigol, H., Vakulenko, I., & Pimonenko, T. (2022b). Integrative Smart Grids' Assessment System. *Energies*, 15(2), 545. <https://doi.org/10.3390/en15020545>
- Kwilinski, A., Lyulyov, O., Pimonenko, T., Dzwigol, H., Abazov, R., & Pudryk, D. (2022c). International Migration Drivers: Economic, Environmental, Social, and Political Effects. *Sustainability*, 14(11), 6413. <https://doi.org/10.3390/su14116413>
- Lyulyov, O., Pimonenko, T., Kwilinski, A., & Us, Y. (2021a). The heterogeneous effect of democracy, economic and political globalisation on renewable energy. *E3S Web of Conferences*, 250, 03006. <https://doi.org/10.1051/e3sconf/202125003006>
- Lyulyov, O., Vakulenko, I., Pimonenko, T., Kwilinski, A., Dzwigol, H., & Dzwigol-Barosz, M. (2021b). Comprehensive Assessment of Smart Grids: Is There a Universal Approach? *Energies*, 14(12), 3497. <https://doi.org/10.3390/en14123497>
- Lyulyov, O., Pimonenko, T., Kwilinski, A., Dzwigol, H., Dzwigol-Barosz, M., Pavlyk, V., & Barosz, P. (2021c). The Impact of the Government Policy on the Energy Efficient Gap: The Evidence from Ukraine. *Energies*, 14(2), 373. <https://doi.org/10.3390/en14020373>
- Mun, J. (2004). *Applied Risk Analysis: Moving Beyond Uncertainty in Business*. Hoboken, New Jersey, USA: John Wiley & Sons.
- Matejun, M. (2011). Metoda badania przypadków w naukach o zarządzaniu. *Ekonomika i Organizacja Przedsiębiorstwa*, 10, 93-102.

- Miśkiewicz, R. (2018). The importance of knowledge transfer on the energy market. *Polityka Energetyczna*, 21(2), 49–62. <https://doi.org/10.24425/122774>
- Miskiewicz, R. (2020). Efficiency of electricity production technology from post-process gas heat: Ecological, economic and social benefits. *Energies*, 13(22), 6106. <https://doi.org/10.3390/en13226106>
- Miśkiewicz, R. (2021). The Impact of Innovation and Information Technology on Greenhouse Gas Emissions: A Case of the Visegrád Countries. *Journal of Risk and Financial Management*, 14(2), 59. <https://doi.org/10.3390/jrfm14020059>
- Miśkiewicz, R., Rzepka, A., Borowiecki, R., & Olesiński, Z. (2021). Energy Efficiency in the Industry 4.0 Era: Attributes of Teal Organisations. *Energies*, 14(20), 6776. <https://doi.org/10.3390/en14206776>
- Miśkiewicz, R., Matan, K., & Karnowski, J. (2022). The Role of Crypto Trading in the Economy, Renewable Energy Consumption and Ecological Degradation. *Energies*, 15(10), 3805. <https://doi.org/10.3390/en15103805>
- Moskalenko, B., Lyulyov, O., & Pimonenko, T. (2022a). The Investment Attractiveness of Countries: Coupling Between Core Dimensions. *Forum Scientiae Oeconomia*, 10(2), 153-172. https://doi.org/10.23762/FSO_VOL10_NO2_8
- Moskalenko, B., Lyulyov, O., Pimonenko, T., Kwilinski, A., & Dzwigol, H. (2022b). Investment Attractiveness of the Country: Social, Ecological, Economic Dimension. *International Journal of Environment and Pollution* 2022, 69(1-2), 80-98. <https://doi.org/10.1504/IJEP.2021.125192>
- Niemczyk, J. (2011). Metodologia nauk o zarządzaniu. In W. Chakon (Ed.), *Podstawy metodologii badań w naukach o zarządzaniu* (pp. 88-101). Warszawa, Polska: Wolters Kluwer business.
- Nowak, S. (2007). *Metodologia badań społecznych*. Warszawa, Polska: Wydawnictwo Naukowe PWN.
- Orzeł, J. (2005). Rola metod heurystycznych, w tym grupowej oceny ekspertów, oraz prawdopodobieństwa subiektywnego w zarządzaniu ryzykiem operacyjnym. *Bank i Kredyt*, 5, 4-9.
- Ostasz, L. (1999). *Homo methodicus. Między filozofią, humanistyką i naukami ścisłymi*. Olsztyn, Polska: Uniwersytet Warmińsko-Mazurski.
- Polcyn, J., Us, Y., Lyulyov, O., Pimonenko, T., & Kwilinski, A. (2021). Factors Influencing the Renewable Energy Consumption in Selected European Countries. *Energies*, 15(1), 108. <https://doi.org/10.3390/en15010108>
- Prokopenko, O., & Miśkiewicz, R. (2020). Perception of “green shipping” in the contemporary conditions. *Entrepreneurship and Sustainability Issues*, 8(2), 269–284. [https://doi.org/10.9770/jesi.2020.8.2\(16\)](https://doi.org/10.9770/jesi.2020.8.2(16))
- Rokita, J. (2007). Charakterystyczne cechy nauk o zarządzaniu. In J. Rokita (Ed.), *Współczesne kierunki nauk o zarządzaniu. Księga jubileuszowa z okazji 50-lecia pracy naukowej i dydaktycznej Profesora Jerzego Rokity* (pp. 41-53). Katowice, Polska: Górnośląska Wyższa Szkoła Handlowa w Katowicach.
- Rószkiewicz, M. (2002). *Metody ilościowe w badaniach marketingowych*. Warszawa, Polska: Wydawnictwo Naukowe PWN.
- Saługa, P.W., Szczepańska-Woszczyzna, K., Miśkiewicz, R., & Chład, M. (2020). Cost of equity of coal-fired power generation projects in Poland: Its importance for the management of decision-making process. *Energies*, 13(18), 4833. <https://doi.org/10.3390/en13184833>
- Saługa, P.W., Zamasz, K., Dacko-Pikiewicz, Z., Szczepańska-Woszczyzna, K., & Malec, M. (2021). Risk-adjusted discount rate and its components for onshore wind farms at the feasibility stage. *Energies*, 14(20), 6840. <https://doi.org/10.3390/en14206840>
- Steinhaus, H. (1950). *Metoda taksonomiczna*. Wrocław, Polska: Taksonomia Wroclawska.
- Sudoł, S. (2012). *Nauki o zarządzaniu*. Warszawa, Polska: Polskie Wydawnictwo Ekonomiczne.
- Sułkowski, Ł. (2005). *Epistemologia w naukach o zarządzaniu*. Warszawa, Polska: Polskie Wydawnictwo Ekonomiczne.
- Sułkowski, Ł. (2010). Etos nauk o zarządzaniu. In H. Jagoda and L. Lichtarski (Eds.), *Kierunki i dylematy rozwoju nauk i praktyki zarządzania przedsiębiorstwem* (pp. 93-114). Wrocław, Polska: Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu.
- Sułkowski, Ł. (2005). Utopia zarządzania. *Przegląd Organizacji*, 11, 7-9.
- Sułek, A.W. (1990). *Terenie, w archiwum i w laboratorium. Studia nad warsztatem socjologa*. Warszawa, Polska: Instytut Socjologii, Uniwersytet Warszawski.
- Szczepańska-Woszczyzna, K., & Gatnar, S. (2022). Key Competences of Research and Development Project Managers in High Technology Sector. *Forum Scientiae Oeconomia*, 10(3), 107-130. https://doi.org/10.23762/FSO_VOL10_NO3_6
- Tkachenko, V., Kwilinski, A., Klymchuk, M., & Tkachenko, I. (2019). The Economic-Mathematical Development of Buildings Construction Model Optimization on the Basis of Digital Economy. *Management Systems in Production Engineering*, 27(2), 119–123. <https://doi.org/10.1515/mspe-2019-0020>
- Trzeciak, M., & Jonek-Kowalska, I. (2021). Monitoring and Control in Program Management as Effectiveness Drivers in Polish Energy Sector. Diagnosis and Directions of Improvement. *Energies*, 14(15), 4661. <https://doi.org/10.3390/en14154661>
- Trzeciak, M., Kopec, T. P., & Kwilinski, A. (2022). Constructs of Project Programme Management Supporting Open Innovation at the Strategic Level of the Organisation. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 58. <https://doi.org/10.3390/joitmc8010058>
- Yang, C., Kwilinski, A., Chygryn, O., Lyulyov, O., & Pimonenko, T. (2021). The green competitiveness of enterprises: Justifying the quality criteria of digital marketing communication channels. *Sustainability*, 13(24), 13679. <https://doi.org/10.3390/su132413679>