



CONTEMPORARY CHALLENGES

IN MANAGEMENT AND ECONOMY
IN THE AREA OF COVID-19

Edited by
Marcin Suder and Maciej Woźniak



WYDAWNICTWA AGH

KRAKOW 2023

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Introduction

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The enterprises have had to face the very turbulent and uncertain circumstances in the last years. The COVID-19 pandemic was one of the most important challenges, which required uncommon managerial skills and economic activities from entrepreneurs. Unfortunately, such black swans are very rare and unpredictable. Therefore, even the central banks and governments had to implement specific activities in order to support the economy, including the enterprises. The academic community also was forced to focus on these new challenges and take them into consideration in the research. In connection to this, there is a need to analyze all these new issues and to present the findings in one publication.

The monograph is divided into three main parts. The first one concerns the methodological aspects, which regard contemporary issues in management and economy. This part of the monograph starts with the chapter about the discourse analysis as a research method. This issue seems to be ignored or marginalized in the management sciences. It is quite rarely used both in theory and in practice. In connection to this, it was essential to explain the meaning of discourse analysis and provide the recommendations for improvement in this research area.

In the second chapter, the agile management as an important strategic approach to companies and organizations is discussed. The question was of particularly importance in the pandemic circumstances. Therefore, the new agile approach called digital stractics is proposed.

The third chapter concerns the relationship between the financial inclusion and inclusive economic growth. This issue is more and more important in the macroeconomic research area. However, the impact of the financial inclusion on the growth of GDP, poverty, income inequality is inconclusive as there is a shortage of research in this field.

In the second part of the monograph the empirical evidences of the innovation processes are discussed. Therefore, in the fourth chapter, the attractiveness of such innovative tool as the games and business simulations in the teaching process are assessed. The findings are based on the survey filled by students which compared these tools with other methods.

Furthermore, the recommendations for the development of the games and simulations in the teaching processes are provided, too.

In the fifth chapter a proposal of selected methodological aspects for improving both individual as well as team innovations in the companies are presented. Moreover, these aspects are considered along with the measurements of the innovation level in Poland. It enables to deliver the interesting institutional recommendations, which should be taken into consideration.

The sixth chapter regards the digitalization of the individual energy metering as a innovative approach to the liberalized and decarbonizing energy market. The authors reveal that the real-time consumption data in order to apply a machine learning-based automated reasoning is expected by both the individuals and the organizations. Moreover, they prove the numerically superior to the offline ways of supervising and operating the energy consumption.

In the seventh chapter the innovativeness as a component and development factor of the knowledge-based economy is presented. Moreover, the systematization of the innovation barriers as well as the suggestions for the principles of the government policy is provided. It has been proved, however, that not only the policy guidelines, the value and structure of financing but also behavioral factors have impact on the innovativeness.

The last part of the monograph concerns the impact of COVID-19 on the companies. In the seventh chapter the organizational agility time during the pandemic in the Polish game industry is discussed. This industry is exceptional as lockdowns have the positive influence on the demand. The game enterprises achieved very good financial results and implemented appropriate business practices. Therefore, one may argue that they are the examples of the agile organizations.

In the ninth chapter the influence of the COVID-19 pandemic on the fitness industry in Poland is the subject of debate. Undoubtedly, this industry was hit hard because of implemented restrictions as the number of clients dropped significantly. Furthermore, the type of customers changed as there were much more men than before the pandemic.

In the tenth chapter the impact of COVID-19 on strategic decision of companies in the Polish carpentry industry is analyzed. The findings suggest a dramatic deterioration of economic condition of the companies. Moreover, they used more intensively the diversification strategy in opposition to the market penetration one.

The eleventh chapter regards the changes in the level of innovation among the countries of the European Union. The statistical analysis reveals that only France, Malta and Estonia slightly improved the innovativeness during the pandemic. In other countries this gauge deteriorated. It could urge to make necessary changes in the innovation policy.

We hope that the monograph could be seen as a valuable and interesting publication both for academics as well as entrepreneurs and decision-makers. It contributes to management and economy in various research areas. Nevertheless, we recommend continuing the undertaken scientific issues also in the post-pandemic space of time.

PART I

Methodological Aspects of Management and Economy

CHAPTER 1

Meaning of Discourse Analysis in Methodology of Management Sciences

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Summary. Discourse analysis is a research method well rooted in linguistics and in such sciences as sociology and cultural studies. Meanwhile, in management sciences, discourse analysis seems to be ignored and marginalized. At first glance, the answer to the question whether discourse analysis supports the research process in the field of management sciences may seem obvious. On the other hand, discourse analysis is relatively rarely used in scientific research and business practice. To understand the possible applications of discourse analysis, the definition of the term was first reviewed. Secondly, phenomena are discussed, the nature of which makes it possible to understand discourse analysis; special attention was paid to public relations. The article ends with a recommendation to improve the synergy effect between management and discourse analysis. Discourse analysis is a difficult and non-obvious research method derived from the humanities, but necessary when it is necessary to study what is hidden in the organization, inaccessible directly to the researcher.

Keywords: discourse, organisational culture, public relations, brand

1. Introduction

*Success in business is like riding a bike.
Either you go forward or you fall.*

Jackson Brown

It is not without reason that we begin our reflections with a thought which is both meaningful and metaphorical. Its message is simple, success is an incredible skill that helps you keep your balance, is a chance to move and follow a well-thought-out direction and stay on the market. It's a kind of way to be someone and strive to be on top (success is top) (Pycka, 1994), to be down (failure is down). The metaphorical message, which is known to cognitive

scientists (Tabakowska, 2001), allows us to take a close look at management, which has more than one name.

The first associations coming with a concept, refer to the management of something, someone. You can manage your company, human resources, time, emotions (Tabakowska, 2001). This management is not only planned, but also targeted for a specific purpose. It strives to create together with methods and techniques a management concept that will lead to the expected, intended effect. It is possible when a wider context and research methods are taken into account, which give us the field to show off and to describe the issue that interests us.

Social sciences, including management sciences, strive – as every area of life – for a kind of autonomy. This autonomy is obtained on institutional grounds, opening in higher education institutions appropriate fields of study, specialties or creating a whole – endowed with an adjective pointing to a specific discipline – the university.

Autonomy manifests itself in the search for unique research fields (cognitive, holistic) and – above all – characteristic for a given field of methods and research techniques well-established and thought-out for the needs of selected topics. Obtaining such methods is quite rarely done by developing from scratch, it is often a continuation of what someone started, but it did not develop in its entirety, to give a place to those who will return to the problem. More often we are dealing with the adaptation of methods and techniques taken from other sciences, therefore interdisciplinary in this area turns out to be useful and important because it offers many possibilities together with interesting research conclusions. An example of such adaptation is the use of observations in sociology or an experiment in psychology. Thanks to them, we can see a given phenomenon in two ways and find out that this approach is better because it facilitates the description of a problem which we analyze and evaluate.

It is no different in the management sciences, which broadly adapt the methods from the above-mentioned teachings. There is no obstacle for management science to adopt a discourse analysis derived from linguistics and widely used in sociology. All the more so because “Discourse is a key factor in the construction of social life and has a driving force in it”¹ (Duszak, Fairclough, 2008, p. 23). It means that it fits into communication and works on its course depending on the situation of the communication event. We can achieve a lot through discourse.

In connection with the above, several important questions are asked: What is discourse analysis? What do we call discourse and is it a phenomenon other than what has been studied so far? What for does the manager need discourse? (Szeluga-Romańska, 2016). What functions does the analysis of discourse in the process of managing the organization perform? What is it researching? What effects do the results of such research give to you? What management phenomena does the discourse analysis look at? What results can be obtained using this research method? Are there discourse analysis techniques that are only used in management.

On the margins of the above considerations, one should ask another question whether the analysis of discourse fits into the management sciences so much that the researcher who uses it keeps his identity as a scientist in this field, and does not become e.g. a sociologist for a moment. This is not strictly a question in the field of management methodology, but the answer to it is important due to the current scientific promotion in Poland.

¹ Authors' own translation.

In order to answer such questions, we analyzed the selected discourse literature referring to the methodology of management sciences in order to draw conclusions, which will allow us to undertake research on communicating the organization with the environment both internal and external.

2. Discourse and discourse analysis – definitions and demarcations

According to *Słownik wyrazów obcych i zwrotów obcojęzycznych z almanachem* [Dictionary of foreign words and foreign phrases with almanach] by Władysław Kopaliński, the term ‘discourse’ comes from the Latin ‘discursus’, meaning ‘to discuss’ and means conversation, discussion, and speech (Kopaliński, 2000, p. 136).

Paul Ricoeur defined discourse as an event and meaning (Ricoeur, 1989, p. 85), so understanding discourse is the interpretation of the text, the implication of its meaning (Malewska-Szałygin, 2004, p. 85). It can be said that discourse is a series of language behaviours (Grabias, 1994, p. 231). Lech Nijakowski writes that “discourse is, in brief, a text in context, and therefore not only a fixed system of signs, but also the social context of its creation, dissemination and reception” (Nijakowski, 2006).

This definition seems to be clue to understanding what discourse is and, in particular, how it differs from text or conversation.

According to Michael Foucault, “history constantly proves that discourse is only something that explains the struggles or systems of domination, but also why and what for we fight – it is the power we are trying to gain” (Foucault, 2002, p. 8). So we have an indirect reference to various organizations as systems of power. The power in itself cannot do without communication, and thus without a variety of types of messages. According to the authors of the book *Rytualny chaos. Studium dyskursu publicznego* [Ritual chaos. A study of public discourse] as a discourse we can analyze: “the entirety of messages in the social circulation, so both the area of communication in everyday life [...] and the area of the mass media” (Czyżewski et al., 1997, pp. 10–11).

After defining the discourse one should present what it is and what its analysis consists in. Tim Rapley writes that “discourse analysis is not a unified, mummified approach to studying language in use. It can be treated as a research stream flowing from many sources, a set of loosely related practices and associated theories used to analyze speech and text” (Rapley, 2010, p. 25).

Nevertheless, such a wide-ranging team of research practices has a specific goal. It is, as Lech Nijakowski writes: “reconstructing the structure of discourse. The meaning of a particular message can be fully read only when we look at it from the perspective of its place in the structure of a given discourse” (Nijakowski, 2006).

“This structure of the discourse covers all messages related to a given organization or problem. Therefore, discourse analysis deals not only with the discussion of e.g. newspaper articles, but also pictures, comic books or radio and television programs. It allows you to reconstruct broadcast meanings in all dimensions, because, e.g. receiving the content of a newspaper means not only reading the article, but also viewing graphics and photos, paying attention to titles, subtitles and bolds of text, etc.” (Nijakowski, 2006).

Two examples of how to analyze discourse can be given:

- quantitative content analysis focused on the number of occurrences of words and phrases in the speech, e.g.:
 - number of occurrences of a word category, surface of text – how much space in a newspaper is allocated to text,
 - the placement of the text, whether there is a reference to the text on the cover of the newspaper,
 - arrangement of photos,
 - airtime, font size of the title;
- qualitative content analysis that draws attention to argumentation strategies. It focuses not so much on the concepts themselves as on the relationship between them (networks of concepts) (Grzymała-Kazłowska, 2004, p. 13; Jabłońska, 2006)

These two ways are ones of many, that can be used in analyzing organizational texts. Attention should be paid to their number and variety. These are both formal internal documents, such as: regulations and ordinances, as well as informal texts of employees on internet forums (Rostek, 2010) in addition to advertisements, press texts and many more. All this shows the richness of the organizational phenomenon in humanistic research (Kostera, Nierenberg, 2016)

3. Phenomena explored by discourse analysis

Discourse is an indicator of the nature of organizational culture. If we understand the organizational culture as

Czesław Sikorski defines it as a system of patterns of thinking and acting that are fixed in the social environment of the organization and are important for the implementation of its formal goals (Sikorski, 2002, p. 4).

It can be said that discourse analysis is such a method of understanding the organization by outsiders. One can also risk the wording that employees also carry out pseudoanalysis of organizational discourse for themselves, trying to interpret it in the best way possible to achieve success. It is possible when you believe in the words that are interesting illustrated by Rhonda Byrne in the book *Sekret*. Reading it, you can feel that everything that we want to do, what is in our dreams, is possible and real in achieving what we are interested in at the moment, because: “the gravity law gives you what you think – the end, dot” (Byrne, 2007, p. 15). Undoubtedly, this is also related to how communication takes place between yourself and others in a fragmented world (Banaszek, Florkowski, 2005). It is worth taking advantage of new forms of organizational communication, namely employer branding (Kantowicz-Gdańska, 2010), once and company image management, or public relation (Adamus-Matuszyńska, 2010). Special attention should be paid to the study by Arlie Russell Hochschild titled *Zarządzanie emocjami. Komercjalizacja ludzkich uczuć* (Russel Hochschild, 2009) in which we clearly can find the connection between action and emotions, as well as life success in every field of life.

Both researchers and stakeholders of the organization (clients, contractors, etc.) try to interpret and understand all messages that flow out of the organization to obtain profit, gain a competitive advantage or strengthen alliances.

William J. McIver argues that “organizational culture is a set of social norms and value systems that stimulate the behavior of members of the institution, important from the point of view of relations meaningful for the realization of a specific purpose, and occurring in time and space between people and between people and the elements of the organisation” (Pietkiewicz, Kałużny, 1993, p. 47).

Therefore, if it is known that norms and values can be declared and actually implemented (or both), discourse analysis will show us the assignment of norms and values to one of the above-mentioned collections. The difference between these norms and values, which are only declared, and not respected, or implemented in reality, will be manifested by the difference between formal and informal messages and the activities of the organization. Attention should be paid not only to the content, but also to such elements of the message as: its context, which together with the text can create irony, as well as the ambiguities included in it.

4. Anthropology and ethnography of organizational culture

Organizational members responded to four open-ended questions about the organization’s culture at two times, six years apart. Results of a content analysis of the responses indicated that organizational values remained stable, despite extensive changes in the top leadership of the organization coupled with environmental forces that were pushing for change in the organization’s culture (Campbell, 2004, p. 47).

Mariusz Bratnicki, Roman Kryś and Jan Stachowicz are followers of the anthropological approach to organizational culture, in the name of which organizational culture is recognized as sharing meanings and symbols, rituals and cognitive schemes, constantly formed and transformed as the organization tries to balance the requirements of internal cohesion with the needs of reactions detected in the environment (Bratnicki et al., 1988, p. 67).

While the majority of organizational rituals are available at least for employees, their meaning can only be known through their in-depth analysis.

The identification of standards and values guiding the organization leads to the identification of types of organizational culture. If we consider the proposal of Charls Handy quoted by Nogalski, who distinguishes four cultural orientations (rarely existing in a pure form), which are in fact types of organizational culture:

- 1) power orientation,
- 2) orientation on the role,
- 3) task orientation,
- 4) orientation per person (Nogalski, 1998, p. 124).

It turns out that the nature of the company’s documentation – ordinances, regulations, etc. – influences not only on the focus on the role or power, also on the formal language, as well as informal – similar to the private office décor or the content of advertisements on information boards. It should be remembered that the message is not just a document, film, e-mail or voice recording. Design and spatial attributes of places are also very important – they carry information for the crew and people from outside. Here, too, discourse analysis gives a decrypt of meanings contained in the above-mentioned elements.

The components of organizational culture can be also considered in relation to the discourse, especially those elements that are hidden or ostensible. According to Edgar Schein quoted by Kostera, there are three levels of organizational culture:

- 1) visible, conscious – artefacts and cultural creations, visible patterns of behavior, symbols, ceremonies,
- 2) partially visible and conscious – norms and values, bans and ideologies, behavioral guidelines,
- 3) invisible, usually unconscious – attitude to the environment and reality, human nature and interpersonal relations, activity (Kostera, 1996, p. 75).

The artifacts, the rituals and the symbols read properly and not only through the content they communicate, but also through the organizational context, point to norms and values actually realized, not just declared. The proper deciphering of norms and values and reading them from behind the curtain of the organizational elites declarations allows to read the “organizational paradigm”, the above-mentioned unconscious level of the organizational culture. This reading has important consequences – cognitive, because it allows to know the essence of organizational and practical culture, because it enables its real change. The knowledge of the strategy of interpersonal communication (Filipiak, 2004, pp. 144–150), which avoids silence and selective expression, also helps to replace it with a holistic, cognitive view of a given topic. Magdalena Stefańska (2002), Piotr Kwiatek, Marek Zieliński (2002) and Jacek Trębecki (2002) write about this in an interesting way.

In turn, the institutional ethnography (IE), is a social ontology, pioneered by Dorothy Smith, a Canadian feminist-sociologist. Conceptualizing the discourse as social relations, which are organized by human activities and are empirically examined, IE was increasingly used by non-sociological scientists in areas such as education and health (Peacock, 2017).

Also learning about the organizational climate is simpler by analyzing discourse, especially discourse changes in the context of the changing environment. Here again, the transformation of the so-called personal documents texts (diaries, blogs, letters, e-mails) do not say everything without an organizational context – e.g., the situation of the organization on the market.

5. Brand of organization

One of the most important objects studied by management science is the organization's brand. Notes that the role of brand as more than just a marketing communications icon is increasingly obvious to leading businesses. Brand drives nearly two-thirds of customer purchases and impacts nearly every function area of the business. It stands to reason, then, that extending the equity of the brand will fuel growth while allowing the business to outpace competitors (Davis, Halligan, 2002). The concept of a brand is ambiguous and has blurred boundaries. A brand is a “trademark or brand is a name, a term, a symbol, an inscription, a pattern or combination thereof, color composition, melody or combination of all these elements used to distinguish a given product from competing products” (Altkorn, 2005, p. 128).

The brand defined in this way is a combination of symbols and signs. That is way the brand is a specific language creation and an ideal object of discourse analysis. These emotions

are so strong that Martin Lindstrom claims that brands are “perceived by man as sacrum” (Lindstrom, 2009, pp. 105–123).

Leslie de Chernatony distinguishes the following approaches to the brand concept (de Chernatony 2003, p. 45):

- As a work, the brand is a part of culture, often a symbolic product. Analyzing artistic discourse, or rather the discourse of art, gives an answer to what the brand is in the process of managing the organization. As a logo subjecting to the reading in a certain context, it is the language symbol of the organization. As an institution, in this case the brand covers the whole organization that creates it. In this case, the product or service is the same as the organization. As a value, a brand can be considered as a group of values (de Chernatony, 2003, p. 45), for example conservatism, elitism and wisdom, embodying the Rotschild Investment Bank. The advantage of such a brand’s understanding is timelessness – wisdom or individuality, they will never grow old. The disadvantage – the problem of determining the value and matching them with the values of the staff (Ollins, 2004, p. 93).
- A brand can be understood as a stenographic record – a certain number of information about a product or service (de Chernatony, 2003, pp. 38, i.e. a brand is defined as a bundle of information. We can accept seven bits of information at the same time (de Chernatony, 2003, p. 38).
- As a vision – another approach to interpreting a brand used by managers is to treat it as a kind of a lighthouse whose light shows the travelers the right direction of the road. Metaphorically it means, that a lighthouse looks like a journey to success. The role of the brand in this approach can therefore be defined as a consequence of the vision (de Chernatony, 2003, p. 38).
- As a risk limiting factor – in this approach the point is that the brand gives the consumer confidence in the usability of the product, also regarding the profitability of investments in the city.

In addition, we deal with the recognition of a brand as a: legal instrument, a company, positioning, a personality, identity and relationship (de Chernatony, 2003, p. 48). It also involves with the Bank for the Services Exchange, which takes place in interpersonal contacts. It is often the manipulation leading to the destruction of relationships and all activities². Therefore, it seems important to shape one’s own personality and create a strong embedded identity in itself, that image, promotion, self-promotion and self-presentation will be effective and will bring success. It could also help to have a holistic view of the issue by appealing to the senses, which can strengthen being yourself. It depends on the strength of the given sense and its activation at a given moment without weakening the other receptors.

Similarly, an advertising is subject to discourse analysis. A lot of space is devoted to it and an advertising appears in various aspects. Attention is drawn to what it expresses, what kind of the information carrier it is, what it is for and what it is its message. This last is not always legible, it is often conditioned by an individual approach and understanding of the image or advertising text. Looking at the advertisement in the context of discourse

² Three parts of the Helen Fielding novel referring to the history of the Bridget Jones Journal can be used as literary examples (movie).

is an interesting mental experience and allows to extract this, what constitutes the sense and the essence of the discussed phenomenon. Expressing this through language, indicating the messages that characterize them and situating them in context is a research adventure worth launching, digging into it and ending it with descriptions and conclusions. According to Barbara Jabłońska, who writes: “[...] common features for sociologically and critical oriented analysis of discourse, which distinguishes them from the linguistic approach, is the understanding of discourse both as statements and text, attaching importance in the research process to the context in which it works and paying attention to its processuality. However, the difference in these approaches is that in critical studies, in addition to the descriptive and explanatory plane, the normative plane is added” (Jabłońska, 2006, p. 57).

The statement shows that during the discourse analysis we focus on statements, text, context and consider them, taking into account three possible approaches: description, explanation and normativity. They are closely related to the communication event and processuality (Gajda, 2010), which occupy an important place when discussing management in the area of research.

The employer brand can also be subject to discourse analysis as P. Raj Devasagayam, Cheryl L. Buff, Timothy W. Aurand, Kimberly M. Judson write: “External branding initiatives and communications can be used internally, among employees, to build positive brand associations and brand affinity. Further, implementing an internal brand community can lead to increases in the emotional buy-in of employees and ultimately could help companies increase the proportion of »champion« employees” (Devasagayam et al., 2010, p. 210).

6. Standardization of discourse tests

Management is an extremely grateful and bearable topic. A registration, a picture and a recording can be the research material. Definitely an interesting reference are memes or images that are presented on such portals as Demotyworthy. On their basis, one can show the discursive and axiological side of a given issue. Discourse tests are also conducted to check how they function and what they characterize. Such considerations are undertaken by the authors of the Qualitative analysis of discourse in social sciences (Wodak, Krzyżanowski, 2011), who propose solutions in various possible discursive paths. Certainly these are preliminary descriptions that give researchers the chance to develop in different directions, depending on the methodology adopted and the research slope, which is not always uniform, often mixed, because it uses material that requires interdisciplinary analysis. Do not be afraid of such analyzes, because they are an interesting view of management in both narrow and broader sense.

7. Conclusion

The presented point of view encourages deeper research on the example of specific references that clearly show that the discursive form of management is not only interesting, but especially the description is important for science, because it gives holistic, cognitive and pragmatic opportunities to look at what has so far been overlooked, and which, in our opinion, needs to be emphasized.

This is a type of managerial profiling, i.e. searching for a prototype, stereotype, metaphor, metonymy, cognitive models, which in terms of cognitive linguistics are the image of the discussed concept and problem and indicate the experience of the user (Lakoff, Johnson, 2010), who uses and processes, gives sense what he says creates the conceptual reality and its scope. Discourse analysis allows you to find different variables affecting events and identify their mutual influences. So far, there are no discourse analysis techniques specific to management and quality sciences, but the pre-paradigmatic nature of this scientific discipline allows the use of methods and techniques from other scientific disciplines.

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CHAPTER 2

Agile Management

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Summary. The changes caused by a pandemic have a very strong impact on many areas of activity. The long-term plans set out in the operating strategy of companies and organizations have become of little use in the new business conditions. Many companies are urgently required to develop a new strategic approach that takes account of the post-pandemic situation. The question is whether the traditional approach to strategy building and strategic management can be applied. The article analyzes strategic management in new conditions and proposes a new agile approach called digital stractics.

Keywords: strategic management, new technology, management methods

1. Introduction

Traditionally, business operations are carried out in accordance with the adopted strategy which sets the goals as well as determines how and when to achieve them. Methods of determining the organization's strategy have a fairly long history and are widely known and used. The application of new technology in management processes has resulted in a significantly shortened horizon of strategic planning and in the modified strategy development methods. It seems that taking advantage of methodological experience used while implementing IT solutions can be applied when developing the organization's strategy.

More and more often we come across the phrase “now nothing will be the same as it was before” in reference to the operation of companies or organizations, behavior patterns or various activities that have changed as a result of the COVID-19 pandemic. The need to modify existing solutions arises from the need to change the style of functioning under the pandemic conditions. Extreme situations necessitate rapid adaptation to new conditions, which often means no return to the old solutions. The environment in which we are functioning undergoes

irreversible changes, and certain processes that were previously implemented in an evolutionary manner gain significant momentum.

Due to the pandemic, broadly understood digitalization, accompanied by the implementation of ICT communication, has dominated social and economic life. Traditional operating methods have been quickly replaced by IT solutions, skipping the natural for such processes phase of preparation, training and implementation of processes that allow for normal activity. The COVID-19 pandemic obviously disrupted the functioning of companies and organizations. The need to change the existing *modus operandi* occurred almost overnight, for which most companies had not been prepared.

The radical and very rapid change caused by the anti-covid strictures has disrupted the implementation of the adopted and consistently implemented strategies. The question arises as to whether it will be possible to return to the previously established and implemented operating strategy once the restrictions disappear. In most cases, the principle will apply that “nothing will be the same as it was before”, which impels to take a new look at the adopted strategy and quickly develop a new one that will adapt the company operations to new conditions. The dynamics of change and the widespread use of new technology will force a new approach to managing the organization’s operation. What can be valuable here is the experience of teams implementing management processes in situations when new technologies are applied. It seems that knowledge gained from the development of IT project management methodologies can be quite relevant as it is there where we can see the growing popularity of agile methods (Szyjewski, 2004a; Trocki, 2017).

It seems reasonable to ask whether it is at all possible to return to traditional strategy building where well-known and widely used methods are employed; whether the existing methods of strategy building and the traditional methods of achieving objectives through planning, task division and their consistent implementation will prove effective in the new, post-pandemic conditions. If the thesis that “nothing will be the same as it was before” is justified, then it is necessary to take an entirely new look at the company organization and operations, at the adaptation to the new landscape and business environment, at seeking new methods of setting business objectives and preparing the way to achieve them. The change should concern not only the *modus operandi* resulting from the solutions adopted during the pandemic, but also a different approach to building strategies and its further implementation in practice¹.

It seems that the agile approach, which is gaining popularity and is widely used in the methodological approach to the implementation of IT projects, can also be applied to organization management.

2. Strategic management objectives and methods

Usually, the basic tool that determines the objectives and directions of companies’ and organizations’ operations is strategy which, after being developed and approved, sets out in

¹ Of great interest is the experience resulting from the pandemic period and the functioning of sales and marketing during that period published in a special issue of “ICAN Management Review” titled “Agility Begins with Sales” (ICAN, April – May 2021).

detail the tasks to be implemented over a long period of time. The construction of strategy and its consistent implementation and execution by individual agendas of the company or organization constitute strategic management.

According to Alfred Chandler's classic definition, strategic management means defining long-term goals, directions, and methods of an enterprise in the context of allocating its resources (Nasierowski, 2018, p. 13). Strategic management is also an information and decision-making process that is supported by such business operations as planning, organization, motivation and control. It is designed to help to solve problems concerning company growth and survival while taking into consideration the impact of the environment (Sołtysik, 2016, p. 224).

In general, strategic management is supposed to reduce uncertainty resulting from a long time horizon and set a course of action. By default, we assume relative stability of the business environment. Sequentially implemented stages are distinguished with possible modifications over the implementation and execution process (Romanowska, 2017). These stages consist of:

- strategic planning, where on the basis of the analysis and diagnosis of the track record as well as the present and predicted state, goals are set and ways to achieve them are decided;
- strategy implementation, which involves the decomposition of objectives into specific actions; their detailed planning; preparation of resources and conditions for action; and subsequent implementation of these actions;
- monitoring of operations and verification of compliance with the established assumptions, possibly followed by any modification necessary due to changes in the business environment; and, last but not least, adjusting deviations from the approved plan.

What is crucial for implementing the company's mission and achieving the expected acceptable market position is the phase of strategic planning and applying working methods and techniques appropriate at this stage. The analysis of the past and current company's standing, and the resulting diagnosis for the future, are critical factors deciding about its success or failure. At this stage of works on strategy, well-known and widely used methods are employed, such as:

- SWOT,
- Porter's 5 Forces,
- BCG Matrix,
- Benchmarking.

The aforementioned methods are most often used to analyze a company's strategic position and to identify its future growth prospects. Forecasting the changes can be of quantitative and qualitative character and follows the analysis of trends and the company's position in the business environment.

SWOT is one of the basic methods of strategic analysis. Its name is an acronym of strengths, weaknesses, opportunities and threats. The basic assumptions of the method were described by Harvard Business School employees in their work (Learned et al., 1965) published in the 1960s. The method quickly gained popularity in the American market, and then, after modifications and additions, it became one of the most popular methods of strategic analysis (Jackson et al., 2003).

The analysis consists of an assessment of the company's internal situation and external position in the economic market, based on available historical data as well as on the evaluators' experience and forecasts. The company's strengths are assessed, as well as what should be improved, i.e. its weaknesses. Basing on anticipated market development directions and the changes being implemented in the company, chances of success are assessed as well as the perceived or anticipated threats. The results and observations of the participants in the analysis are grouped in a matrix (Cabała et al., 2015).

It is noteworthy that decisions are based on accumulated historical data and past experience and facts that relate to the past situation. In case of a radical change in the business environment, they do not have sufficient value for developmental decisions. Currently, most often the accumulated data and experience come from the pre-pandemic period. The analyses of these data and the resulting conclusions are of little use in the post-pandemic reality, where operating conditions have changed radically and it has become necessary to radically shorten the time perspective.

Porter's 5 Forces is another method of strategic analysis that is very popular and often used in the processes of building a company's operating strategy. This method focuses on studying the business environment in which the company is operating. It assesses the company's position in relation to competitors operating in the same area of economic activity. This concept was proposed by Michael E. Porter in 1979 and focuses on determining the company's position in a given economic sector and on analyzing its competitiveness in relation to other market actors (Gierszewska, Romanowska, 2002).

Porter's model examines the impact of 5 forces on the business market as well as the company's position in this competition. These forces are as follows:

- rivalry among the existing competitors,
- bargaining power of suppliers,
- bargaining power of buyers,
- product or service substitutes, the emergence of which could threaten the balance of power,
- potential new entrants to the sector.

The positioning of a given company and the determined values of individual forces provide the basis for strategic development decisions in the future. The analysis of the economic sector in which the company operates is based on data referring to the past. The assessment of impact forces in the previously mentioned areas is therefore of historical nature and does not take into account the current situation in the sector.

The changes in the structure and the behavior of the economic market that are the consequence of the pandemic cannot be included in the assessments made today. Therefore, it is not possible to include in Porter's forces assessment the significant changes in the new business situation. Radical changes concern both the internal situation of the company as well as the company's competition and business environment. Conclusions that have been drawn on the basis of Porter's forces so assessed, and thus providing grounds for a strategy for further company operation, may significantly differ from the current situation taking place in the sector it is operating in.

The BCG matrix, applied by the Boston Consulting Group in 1969, allows for assessing the opportunities and directions of a company's development and for identifying its strategic

position. The assessment is focused on the company's products and their current evaluation, i.e. their qualification to the appropriate cell of the matrix according to their current position and market evaluation (Oblój, 1993).

Naturally, the company's products do not have a fixed position in the matrix, but depending on the product's development phase they move from one cell to the next. The current state of the product depends on its market situation which has effect on how it influences the company's situation.

Most often, products are initially placed in the cell called *stars* where new products are placed that are likely to become market hits but require large financial outlays for promotion and production. When their market position stabilizes, they may become a *milk cow* bringing substantial and stable benefits to the company. The *question mark* cell groups products that are in short supply and have a low market share. Their prospects are unclear and depend on active promotion and market developments. They can become *stars* or *dogs*. This cell contains scarce products, which do not bring the expected benefits and their market position is low. Most often in this group we find products in a declining phase of development or failed ventures of a company.

The dynamics of changes in the positioning of products in particular cells depends very strongly on the business environment and market behavior. The post-pandemic situation is so indeterminate and poorly predictable that the positioning of products in the matrix is a big unknown. Historical data from the stabilized market period are of little use and the dynamics and indeterminacy of market directions are strongly blurred and volatile.

Benchmarking is a management method that involves comparing a company with its competitors, particularly with the recognized market leaders. Comparison with competitors is supposed to encourage copying good solutions and to prevent failures. Systematic comparison and quick reaction to observed phenomena helps to avoid bad decisions, to modify one's own solutions and to outperform the competition (Martyniak, 2002; Zairi, Al-Mashari, 2005).

Benchmarking is a method to perfect processes and organizations by introducing changes resulting from the observation of competitors' performance and by creatively implementing best practices. Of course, benchmarking is multidirectional and is carried out in stages, starting with the planning stage, where we define the object of examination and choose the method of examination as well as the competitors to whom we will compare ourselves. Then we conduct research by collecting data from a certain period, which we then compare with ours, identifying the deviation and moving on to the analysis of the expected results. The next stage is integration, where the results of the comparisons allow us to define the functional objectives of our activity. In the final stage, we implement solutions and monitor the process as well as control of the effects of the implemented solutions.

The turmoil caused by the pandemic obviously affects all market participants and therefore there is no stable benchmark to which the data being compared can be related. In addition, the pandemic has led to severe market disruption and hence it is difficult to assess the market positions of the competitors selected for comparison. An unstable post-pandemic situation offers a good chance to achieve a high competitive position if appropriate and market-acceptable measures are taken that do not result from imitating previous leaders or copying solutions that have been proven effective in the past.

A cursory review of the methods used in the process of building the company's operating strategy indicates a strong reference to historical data and past experience, as well as to the course of action that prevailed in the past. Referring to the past and drawing conclusions

from historical data is justified when operating conditions are stable. However, in the situation when we agree that “nothing will be the same as it was before” the applicability of such approach is not only doubtful, but it may lead to completely false conclusions and to decisions that have no *raison d’être* in the new situation.

3. Determinants of method use in post-pandemic times

The return to business activity after the pandemic poses a new challenge for many companies that have survived the difficult period of suspended business activity and are beginning to function in new conditions, having to face the new situation in their business environment. Under what new conditions will companies operate in the post-pandemic time? Which of the existing data, operating methods, behavior patterns and operating conditions will remain unchanged or the change will be minor, and which are subject to dramatic changes and need to be completely reorganized? These key questions should form the basis for building the company’s strategy in the post-pandemic period.

Traditionally, strategic management and setting the direction of the company’s long-term activity is most often based on forecasting the expectations and behavior of the company’s customers and business environment. The expectations are formed and the forecasts are created on the basis of collected and specially acquired data about future customer behavior and future business situation. The most commonly used method of obtaining these data is a survey. The reliability of data obtained from a variety of surveys supporting the process of building a company strategy is rather questionable (Szyjewska-Bagińska, Szyjewski, 2018). The poor reliability of the data obtained by means of the survey method should be further attributed to the respondents’ most likely manner of reasoning, as most of their reactions are influenced by previous experience which may prove irrelevant in new operating conditions.

Historical data, which is used by the most popular methods of building company strategy, are of course the resource on which analyses and business decisions are founded. However, their interpretation and conclusions concerning their effect on future activities should be modified. The collected data is subject to interpretation in reference to the known business environment conditions, but this have changed radically and therefore the conclusions prior drawn must also be revised and very often completely changed.

When taking into account the poor reliability of data collected by survey methods, which results from the intentional way of answering questions, it should also be remembered that, while answering, the respondents referred to a different reality. These factors that weigh down the historical data make the collected information of relatively low value for the methods applied because these methods take the past behavior and operating conditions as the basis for future strategic decision making.

The consequence of changed style of doing business and the rapid growth of electronic communication in all areas of life in the pandemic times is the fast development and extensive use of IT means. The IT solutions, that were previously introduced cautiously and with appropriate prior training and organizational preparation, had to quickly and effectively replace the traditional methods of remote communication with all its implications. Digitization of documents and dematerialization of everything possible resulted in significant changes in behavior patterns and day-to-day business operations.

The dynamic development of ICT accompanied by progressive improvement of infrastructure are a driving force behind the modern trend oriented at advancement of information solutions which is present in diverse domains of economic and social life. The 5G networks, allowing for a meaningful and user-satisfying use of communication and high-speed data transfer, are here to stay, leading to a new style of business communication with all the consequent implications. The use of augmented reality or the Internet of Things has brought significant cultural changes that will permanently alter behavior patterns and ways of responding. Mobile technology, aided by effective video imaging, both coming along with the ever-improving ICT infrastructure, signify fundamental changes in business operations (Ostruszka, 2021).

The pandemic has made remote work the primary mode of communication for both business, social interaction and even entertainment and learning. Young people, who had already been extensively using the electronic means of communication, switched almost completely to living in the realms of the Internet during the pandemic. Basic school activities moved to the digital world and remote communication, as well as all other sports, entertainment, or social activities were done through mobile devices by means of electronic communication and powerful applications. The change of a lifestyle at such young age will have very serious implications for the future. The fact of radically re-modelled behavior and reactions of the future user cannot be ignored when deciding on future strategies.

New ICT solutions and their widespread use, both in professional, social and private life, have proven not only to completely change the organization of work and procedures, but very often to significantly reduce costs. The wider the use of new technology, the greater the savings. Of course there are necessary initial investment costs and additional effort to train staff in order to learn the details of new technological solutions, but their later use results not only in lower expenses, but also in time savings and in improved comfort of work. Accelerated implementation of ICT solutions due to the pandemic strictures proved to be very attractive and effective in economic terms. In practice, despite the gradual lifting of the anti-pandemic regulations, general interest in new ICT and the actual number of its users is growing.

These additional benefits, that manifested themselves in a relatively short period of time, have become a permanent element of our lifestyle and our companies' day-to-day operations, disregarding our age or social status. Of course such a radical change, driven by a pandemic conditions, has not been advantageous for everyone. There are some actors on the market who, for various reasons, have failed to implement new solutions and now the environment that has already switched to modern technologies have become inaccessible for them. Digital exclusion is a social problem but rapid technological changes and radical change of lifestyle forced by the pandemic are unstoppable and therefore the creation of current strategies requires new thinking where referring to previously employed methods and data is of little use.

4. Stractics – new approach in management

Fundamental changes have occurred due to the dynamic development and spread of digitization and ICT applications. The first symptoms of the change in the approach to planning and setting courses of action could already be seen in areas where the use of new ICT

solutions and the digital economy was relatively broader. Planning periods were becoming much shorter and the response to changes in the business environment became relatively faster. Articles and statements announced by business people pointed to the rapid response to the dynamically changing business environment (ICAN, April – May 2021). Traditional approaches aimed at building an operating strategy and consistently executing it over the long period of time were proving less and less practical and prompted the implementation of agile solutions.

This trend is clearly seen in the approach to creating IT solutions (Szyjewski, 2020b). The popularity of adaptive programming methods and the development of agile methods for creating IT solutions have progressed concurrently with the dynamics of the Internet development and applications (extremeprogramming.org, (n.d.); Chabik, 2002). Traditional methodologies, called heavyweight, are being replaced by agile approaches like SCRUM (Szyjewski, 2004; Trocki, 2017). The majority of new IT solutions is developed with the use of the agile approach, which is now becoming the methodological standard for developing ICT solutions.

The popularity of agile management which has replaced traditional action planning while implementing IT solutions is due to dynamically developing technology and environment for the production of IT solutions, which resulted in turn in the need to shorten the planning periods and in numerous modifications to the already adopted long-term plans. An equivalent situation occurred in the case of companies which were introducing more and more IT solutions and, consequently, their day-to-day operations were subject to the same changes.

The COVID-19 pandemic significantly accelerated these processes and traditional development of strategies and long-term plans proved to be of little use in the rapidly changing business environment. The search for new approaches to the functioning of companies and organizations has led to the emergence of stractics (Outram, 2016). Changes resulting from the technological revolution are transforming strategy from a linear process to an interactive one in which strategy and tactics intersect to form a new construct referred to as stractics. This innovative approach is changing the traditional static approach to executing developed and written plans to a modern one that responds to current needs and behavior patterns in nearly real-time.

Traditional methods of strategy development based on historical data of doubtful reliability must be replaced with dynamically collected and processed current data that are immediately analyzed with the use of digital algorithms in order to make short-term decisions adequate to existing operating conditions. It does not exclude setting and meeting long-term goals, but their importance and effect on current business activities and operational decisions have eroded. The time horizon of plans being developed has been significantly shortened. New methods of data collection with the use of digital technologies combined with IT algorithms employed to process data and draw conclusions allow for faster and more accurate decision making.

In the new conditions of business competition, innovation has become a natural driving force. Broadly defined, innovation is often called “reinventing oneself”, which means far-reaching changes in not only the operating methods but also in procedures, planning processes and business behavior (Outram, 2016). The innovative approach to strategic planning

calls for new data, collected differently than before in order to enhance their reliability; new methods for analyzing these data, a different approach and computer aided inference; and more importantly, a shorter time horizon for plans as well as their flexibility that will allow the company to promptly respond to the dynamics of the changing business environment (Szyjewski, 2020b).

Widespread use of information technology in businesses should be focused not only on supporting structures and procedures that are essential to the functioning of the organization but also on the customer and service efficiency as well as on examining their present needs and expectations. This new look at the applied IT solutions requires a different approach to the numerous processes implemented in a conventional way. Computer support should be provided not only to algorithm-aided routine procedures but also to conceptual, growth-oriented activities performed with the use of modern hardware and technical and software solutions in order to create dynamic plans and strategies. The flexibility, agility of these plans, their relatively short time horizon, and their ability to cope with the high dynamics of change within the business environment are the basic premises of the new approach, which stem from the experience of the pandemic period.

Digital assets and ICT solutions must be integrated with the physical assets and company customers thus creating an integrated business model. IT and digitalization should not be a means in itself, but an effective tool to achieve the adopted business goals in the new information technology environment. They also necessitate a change of mindset and procedural flexibility in most job positions, in particular in the relationship between the company and its customers. New technologies should ensure customer participation, not only in the current business operation. It also should have an impact on the strategies being built through a reliable examination of customer expectations and needs. These changes are not easy to implement because they require extensive amendments that affect the whole organization and almost every employee. The new quality of work and thinking applies to every position, which is a serious limitation especially for large organizations. Hence the indication of de-concentration and favoring small task teams. A fast-paced digital environment supporting the organization's operations should be built into the company's structures.

Stractics, which intertwines strategy and tactics, combines elements of the traditional approach with the new operating environment. Thus, strategy becomes a fluid concept with multiple shifts in direction and alterations to the business model. It is no longer a long-term action plan written down into shorter periods and goals, but the direction of actions tested as to its effectiveness in short, often quarterly, cycles of assessing the results of operations and as to possible modifications or adjustments. Outram in his work (2016, pp. 123–132) proposes a four-stage cycle:

- 1) start with a bold vision,
- 2) adopt 90-day strategic goals for each team in the organization and revise them every 90 days,
- 3) refresh and revise your financial plans annually,
- 4) introduce new indicators of success.

Such a management model replicates the agile approach known from the methodologies used for implementing ICT solutions.

5. Conclusion

High-impact events that occur unexpectedly give start to accelerated change that would normally take a long, evolutionary course. The instance of such an event is the COVID-19 pandemic which has considerably accelerated the digitization process and the widespread use of ICT. With the restrictions on personal mobility and communication in place, the wide use of remote working and remote teaching as well as the IT communication tools have become the only means of maintaining social and business contacts and relationships. Business relationships and operation faced revolutionary changes, which led to the transformation of management methods.

The changes in the functioning of companies and organizations have considerably re-defined many areas of life and economy. Traditional methods of everyday functioning have been severely limited in favor of more effective solutions provided by new technology. They quickly gained popularity and are here to stay bringing important economic benefits. Fast-track universal IT education and extensive use of digital technology tools have also resulted in changes in other areas. What is more, the new way of operating have helped to verify the effectiveness of the existing business models.

What seems particularly important is the ability to forecast and determine the direction of operations, combined with flexibility and responsiveness that ensure the company's success. Strategic analysis, traditionally responsible for setting business objectives and determining the path to achieve them, has become subject to specific verification. Practice has shown that companies and organizations that were more advanced in the use of ICT solutions and took advantage of digital technology in their operations, found it easier to survive the pandemic with all its strictures. Others were forced to quickly transform their processes to the digital version, often in an emergency mode.

Traditional ways of doing things, which assume operating in a linear manner in a stretched time perspective, had to accelerate and become more flexible to keep up with the rapidly changing business environment. The proven efficiency and effectiveness of information and communication technology have led to the re-evaluation of many areas and the statement that "nothing will be the same as it was before" has become a reality. In particular, building a company's strategy in the new conditions must be modified and hence the growing popularity of a new approach called stractics which integrates strategy with tactics, thus creating conditions for companies to promptly respond to changing business conditions. Agile management, which shortens the time perspective and combines strategy with tactics, turns out to be an effective tool for managing a company in conditions of digital solutions effectively supported by ICT solutions.

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CHAPTER 3

Financial Inclusion and Its Relationship in Inclusive Economic Growth

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Summary. The purpose of this study is to discuss the relationship between financial inclusion and inclusive economic growth. Financial inclusion is the ability to gain access to relevant and affordable financial products and services applicable to their needs in transactions, payments, savings, credit, and insurance, delivered ethically and sustainably. Financial inclusion and economic growth are becoming increasingly important to national development. I will use the phenomenon of rapidly expanding financial inclusion in Asia without increasing economic growth or reducing income inequality for this study. Moreover, the impact of financial inclusion on economic development, poverty, income inequality, and financial stability is inconsistent, and there is a lack of comprehensive research. Economic development can be significantly increased through digital financial inclusion, while income disparities can be reduced and poverty can be significantly reduced based on empirical findings. The Global Index Database estimates that 50% of the adult population lacks access to formal financial services.

Keywords: economic development, financial inclusion, inclusive economic growth, poverty

1. Introduction

Access to relevant and affordable financial products and services that fulfill their needs transactions, payments, savings, credit, and insurance delivered ethically and sustainably is known as financial inclusion. National development is increasingly obsessed with understanding the link between financial inclusion and economic growth.

A transaction account allows users to store money, send payments, and receive them, an essential first step toward greater financial inclusion. The World Bank Group's Universal Financial Access 2020 endeavor is focused on ensuring that everyone worldwide can have access to a transaction account as a gateway to other financial services. Financial access makes life easier daily and supports families and businesses in setting long-term planning

and preparing for unanticipated situations. Customers are more likely to use extra financial services like financing and insurance to develop or expand their business or invest in education or health care. They can also manage risk and deal with unanticipated economic shocks as a result of becoming account holders.

A national strategy for financial inclusion has been adopted or developed in nearly half the governments that have made commitments to it since 2010. Our research demonstrates that when countries execute a national financial inclusion plan, which brings together financial regulators, telecommunications, competition, and education ministries, the pace and impact of reforms rise.

Many countries have acknowledged the importance of financial inclusion and have made it a policy priority. When countries have a healthy economic infrastructure, it is easier for them to prosper and develop economically. Financial inclusion is crucial to this process (Sarma, 2015). Different measures have been made by authorities in Asian countries to expand the number of people who have access to financial services for the first time. The relationship between financial inclusion, poverty, and income inequality has also been the topic of numerous studies, which have employed different approaches and come to different results. As with the relationship between financial inclusion and financial stability, other studies have produced conflicting results. Financial inclusion improves financial stability. According to research by Hannig and Jansen (2010), came to different conclusions about the relationship between financial inclusion and financial system stability, both of which concluded that financial inclusion had a detrimental impact on financial stability. The rise in banking services did not promote financial stability because it was not followed by a fall in borrowing prices for the lower middle class, an increase in service quality, and a lack of confidence.

For this study, the author will use the phenomenon of rapid financial inclusion growing in Asia without accompanying increases in economic growth or reductions in income inequality, as well as inconsistent findings and a lack of comprehensive research that examines the impact of financial inclusion on economic development, poverty, income inequality, and financial stability (Collard, 2007). It is anticipated that the findings of this study will aid in establishing and implementing policies that promote financial service access, which will lead to increased economic growth and reduce poverty while also distributing income more evenly.

It is possible to accomplish economic growth by relying on various economic sectors, one of which is the financial industry. One of the critical roles of the financial industry is to reduce risk, while the other three are to help save money, lower transactional costs, and promote specialization (Beck et al., 2007a). And the banking industry could offer borrowers quality financial instruments with low risk, which will speed up economic growth in the long run.

Financial inclusion and economic growth have been linked in several research. Data from Indian subnational levels to determine the effect of financial access and use in economic growth in India. They find that both have a beneficial impact on economic growth in India. Financial inclusion and communication technologies to be essential for economic development. According to Beck et al. (2007b), governments and policymakers can use access to finance as a policy instrument to boost economic growth. Increasing the availability and affordability of financial resources for all economic actors will increase economic activity and output. Data from 49 nations were used by Sarma (2015) to provide empirical evidence of a link between financial inclusion and economic development. According to the development of the financial sector has an enormous impact on economic growth. Improved banking

sector performance is vital for boosting economic growth, as evidenced by this finding. According to Law, economic progress necessitates a well-developed financial system. As a result of this research, Sarma (2015) concluded that access to banking services has a two-way causal link with economic growth, proving that financial inclusion and economic growth go hand in hand.

2. Post COVID-19

A woman wakes up in the early morning hours in a distant part of a low-income country and calls her cell phone. She's going to the local market to acquire some fresh produce, so she's taking out a modest digital loan to pay for it. During the day, she'll be selling her merchandise at her store on the outskirts of town, where she works. Customers will pay her in a variety of ways, including cash and mobile wallets. A mobile money agent at the shop next door will let her transfer the funds to her phone. With her profit in her mobile wallet, she'll be able to pay back the debt and walk away with nothing. The utility company has recently connected its payment system to the mobile money infrastructure, so she may pay for the gas she needs to cook dinner with this mobile money. This is a significant step forward in her day-to-day existence (Brune et al., 2011).

A chocolate factory machine malfunctions just weeks before the winter holiday season somewhere in the middle of a wealthy country. In the busiest period of the year, revenues will disappear if there isn't a new device. The owner scrambles to get a loan from his bank to afford to replace his broken machine. This may have spelled the end of the company a few years ago. However, he learned about an alternative lender via a mutual buddy. It took the online lender about a week to evaluate the borrower's creditworthiness, authorize the loan, and disburse the funds. Two weeks before Christmas, the machine was delivered on time and in perfect working condition. This is based on a true story that occurred in London.

There are numerous examples of how FinTech has aided financial inclusion in nations at various stages of development before the COVID-19 pandemic. Around the world, 1.7 billion individuals lack access to a bank account. In contrast, small and medium-sized businesses (SMEs) (which account for 95% of all companies) employ more than 60% of all workers, despite their inability to obtain financing. As the number of people with mobile phones and internet access increases, so do the prospects for FinTech (financial sector technical innovation).

A new opportunity has opened up for digital financial services to help financially excluded people because of the COVID-19 health issue. The "great lockdown," in which the country employed a succession of restrictive containment tactics such as lockdowns and quarantines as well as travel restrictions and other social isolation measures, was the outcome of government efforts to prevent viral spread. When it comes to reducing the distance, the growing demand for cashless and contactless transactions makes it possible for people and organizations to continue to use FinTech, particularly mobile money. Many governments have taken steps to reduce transaction fees while also increasing the amount that can be spent on digital transactions to promote the use of bitcoin (e.g., Ghana, Kenya, Myanmar, among others). These new developments may expedite the shift away from traditional financial services and toward digital ones. Because of the SARS outbreak in 2003, China has used

electronic payments and e-commerce in a digital form much more quickly than before (World Economic Forum).

Even individuals without bank accounts will be able to take advantage of tailored fiscal measures made possible by FinTech, which has already played a critical part in lowering the COVID-19's economic impact. To reach individuals and organizations more quickly and securely, FinTech reduces or eliminates the need for face-to-face interactions and cash in numerous ways. Government transfers are sent using mobile money networks in countries with limited access to banking networks. Data obtained via mobile payments allows governments to engage with informal workers outside of standard aid programs. For example, a new initiative targeting casual workers in Togo has been developed that uses mobile money and provides a top-up for female beneficiaries. Taxpayers are urged by authorities to file their forms electronically. The epidemic has hit many SMEs, including those in China, and some FinTech lenders are responding quickly to the liquidity needs of these businesses by using real-time data and online methods. Lenders who use FinTech are known as FinTech lenders. Many large and small FinTech firms offer loan repayment flexibility to borrowers who the financial crisis has harmed (e.g., India, Kenya, and United Kingdom). FinTech firms and digital banking can contribute to the expansion of e-government, but more remains to be done.

Given recent empirical findings, digital financial inclusion holds enormous promise in increasing economic development while also lowering income disparities and decreasing poverty. FinTech has made accounts, transactions, and loans more accessible to a more extensive range of people in recent years, from low-income households to small and medium-sized enterprises (SMEs). There are also opportunities in the development of digital savings, cross-border transfer solutions, and insurance (Amidžić et al., 2014). Access to credit has positive macroeconomic implications aside from improving individual prospects. According to IMF research, financial inclusion promotes growth and reduces inequality, and it has no negative impact on financial stability as long as the financial sector is effectively regulated. It also enhances macroeconomic policy efficacy, promoting growth and stability further. After the significant COVID-19 shock, these findings are critical for generating new income and employment and eliminating financial access disparities.

While the COVID-19 issue has opened up new possibilities, it has also brought to light problems that were already beginning to emerge ahead of the epidemic. For example, authorities are concerned about the dangers of financial stability posed by regulatory arbitrage, which causes economic activity to move from heavily regulated to weakly regulated. These worries are exacerbated by the potential disruption of existing business models and the ties between traditional financial institutions and loosely regulated FinTech firms. The technology itself poses hazards to banks and nonbank financial companies, such as the possibility of confidential data leaking, mainly through cyber assaults. New money laundering and terrorism finance concerns may be posed to financial service providers. Cybersecurity concerns and unethical lending practices by institutions with lax regulations, according to regulators, might undermine public confidence. During and after COVID-19, the financial technology landscape and rules may change, altering the risk-reward equation.

These dangers could be exacerbated if people lack financial and digital skills. Economic consequences may significantly impact microfinance institutions' operations and clientele, putting financial inclusion at risk. Microfinance institutions may also be straining to operate digitally during the COVID-19 situation.

As a result, a large number of FinTech firms are in their infancy and have never been through a recession, let alone the most significant global shock in decades. A crucial test of the FinTech sector's resiliency will be the COVID-19 crisis. To begin with, smaller FinTech firms will be hit harder by stricter funding conditions than larger ones. FinTech fundraising activity stagnated in the first quarter of 2020, resulting in the worst first quarter for FinTech funding since 2017, as investors drew back investments, according to preliminary data. If the lack of capital causes smaller FinTech firms to be acquired by larger ones or go out of business, the market concentration in the FinTech sector could increase shortly. As a result of the economic crisis, revenues for FinTech payment companies would decline. This is especially true in areas like hotels, restaurants, airlines, and even retail. And lastly, because many small borrowers are the ones who the current financial crisis will hit the hardest, loan quality may plummet due to FinTech lending.

3. Contemporary dilemmas of entrepreneurship

Entrepreneurs give our economy one of, if not the biggest, boosts. They don't just take the risk for the sake of the business; they do so to create jobs and enrich our society. Only when a society rewards and fosters entrepreneurial activity can it be prosperous because entrepreneurs and their actions are, in fact, the crucial component for success, prosperity, growth, and opportunity in any given economy. It's not easy being an entrepreneur; there are dangers and ups and downs to contend with. In the recent decade, entrepreneurship has grown and developed, changing the laws of entrepreneurship once more due to this growth and development. Not all entrepreneurs must indeed be equally educated, but this does not mean that they must be geniuses or have an active idea before starting a business. Instead, just like any other business owner, they must set clear objectives and goals. Universities appear to be unable to grasp the concept that preparing students with real-world experience is far more beneficial than simply teaching them business administration with a slant. However, I shall clarify what an entrepreneur is, their ideals, and their traits in this piece.

The term "motivation paralysis" refers to a state in which one feels unsure of what to do next. Having a clear idea of where you want to go might help entrepreneurs stay on track. If you're not sure about something, talk to someone who does. This may be a business coach, members of a Vistage group, or anybody else who can give you a new perspective on your work. Even while some business owners may be embarrassed to ask for help, this attitude is wrong. Nobody knows everything, and it's impossible to know everything.

Because you're so busy with the daily grind, you don't have time to consider your next move. This means you're working on your business rather than on it. Even early in the life of your company, this position is unavoidable at some point in the process. Working long hours, being short-staffed, and dealing with frequent problems like inadequate money and few professional network connections can lead to burnout. Entrepreneurs are notoriously bad at delegating duties, especially early on, but you may need to do it if you want to free up time for long-term thinking.

To expand a firm, you'll nearly always need to have money on hand. It's here that the majority of entrepreneurs hit a roadblock. While the general public views entrepreneurs as reckless riverboat gamblers who aren't afraid to take on debt in exchange for the possibility

of paying it back (and making even more). The truth is that many of them don't have the stomach (or don't believe they have the stomach) to take on additional debt. A scarcity of information frequently aggravates that issue. There are several financial possibilities available to entrepreneurs, depending on their risk appetite.

It doesn't mean you won't have disagreements with your business partners, even if they are all family members, close friends, or respected business professionals. You may be the only one in the partnership that desires rapid progress, or you may be the opposite. You may also say that there are as many differing viewpoints on what to do as partners. Whatever the case may be, you must come to some sort of agreement before you can proceed.

Things are going well, so why not take advantage of the current situation rather than obsess over how to improve things further? Although the "don't worry, be happy" mentality has merit, there are only a few instances where leaving things alone makes sense. However, the majority of the time, you must plan a few steps. To paraphrase a well-known saying, "If you're not progressing, you're going backwards." If things continue as they are, you may feel stress-free for a while. However, as soon as issues arise, your stress level will skyrocket. As a result, thinking about the next step must always be at the forefront of one's thoughts when working from a position of power.

Which of these predicaments most closely resembles your life right now? Keep in mind that your trouble may have a combination of two or more of these dilemmas. It doesn't matter what the situation is; problems won't go away on their own if they're neglected. You must have a strong sense of ownership in your company if you want it to succeed. Certain flaws can indeed be the death knell for a company, but the five problems listed above should not be on that list. These are serious issues, but they can be overcome. Just keep in mind that you're not on your own. It's not a sign of weakness to ask for aid; on the contrary, it shows strength. Admitting you need support is a sign of a strong person, and overcoming adversity makes that person even more substantial.

4. Science business: role of universities in transfer of knowledge and shaping entrepreneurship

International and national policies have been implemented during the last two decades to boost regional competitiveness, and universities have played an essential role in many of these programs. Universities are acknowledged as knowledge-intensive institutions and environments that encourage the development of human capital, innovation, and entrepreneurship when their contributions to education, advanced research, and knowledge networking are considered. To be on the safe side, universities nowadays include in their mission not only a generalized knowledge transfer but also a promotion of business thinking and entrepreneurial culture and the creation of institutions as well as venture capital, all of which contribute to the growth of regional entrepreneurial ecosystems.

The current article aims to evaluate the contribution of Greek universities to the promotion of regional entrepreneurial ecosystems, make a comparative evaluation of them and strengthen the role of Greek universities in regional entrepreneurial ecosystems by looking at the development of entrepreneurship in teaching and learning through the various actions of the innovation and entrepreneurship units of Greek universities between 2011 and 2015.

It begins with a study of entrepreneurial ecosystem theories and the role of universities in regional development. This study aims to record greek universities' innovation roles by collecting and processing data on those institutions' innovative activities, using the case of the innovation and entrepreneurship units as a case study. Third, policy ideas for the national and regional levels of government are developed based on the research findings. To put it another way, entrepreneurship is the process of turning a business idea into a viable firm.

Entrepreneurs are a valuable asset for any nation. They contribute to the economy by generating work opportunities. A non-profit organization called TiE (the indus entrepreneurs-www.tie.org) asserts that each entrepreneur generates 30 new jobs. In addition, they provide revenue for governments by enabling the introduction of new goods and services and by collecting taxes. They are responsible for propelling the country's economy forward.

However, only a tiny percentage of people create their enterprises (Imbroscio, 2013). This can be attributed to various factors, including bureaucratic roadblocks, poor infrastructure, insufficient finance, personal risks, and cultural differences. Furthermore, India's educational system is constrained by tight bounds, preparing pupils to enter traditional occupations rather than inspiring them to follow their passions. Also, according to a recent research, only 22% of would-be entrepreneurs have access to proper training. According to another survey, over 80% of students in wealthy countries learn a skill or a trade by the time they are fourteen. For all of these reasons, educational institutions play a more significant role in helping people develop their entrepreneurial skills.

Economic progress relies on social integration to discover sustainable answers to pressing global issues. The establishment of new firms and the alliance of key actors in the environment are all development processes that every society seeks a practical approach to generate. In the transfer of technology, information marketing, and regional economic growth, university-business relations (UBR) are playing an increasingly essential role. A topic that has arisen and is being discussed in the current global economic climate is universities installing research centers within firms (mainly focused on information technology) to carry out cooperative research initiatives. If the UBR can be institutionalized through partnership agreements, and if so, how might other universities or corporations in the research community imitate those connections that have been successful?

Since about fifteen years ago, the ecosystem approach to entrepreneurship has been found in international literature and policies. According to biology, an ecosystem is a collection of interdependent relationships between living and non-living species to preserve their natural balance at all times. The term "ecosystem" has been widely used in social sciences, which referred to an entrepreneurial ecosystem as the empirical environment of a company (La Porta et al., 1998). There isn't a single, commonly agreed-upon definition. The definitions are differentiated based on the many scales, research areas, and data that have been collected. Most reports emphasize the interaction and combination of institutions that establish standard cultural norms that support corporate activity, primarily through networks. There are "dynamic processes and acting persons at the local, institutional and cultural levels that stimulate and foster the emergence of new firms" (Berger et al., 2008).

More comprehensively stated that entrepreneurial ecosystem is composed of various factors that encourage the emergence and growth of creative start-ups while also encouraging new business owners and other stakeholders to take on high-risk ventures. As a result, his classification of the above characteristics is divided into three parts: material characteristics

(universities that train young entrepreneurs while also producing new knowledge), cultural factors (supportive cultures, outstanding successful businesses), and social aspects (talented human resources, successful local entrepreneurs offering consultation to young entrepreneurs, available investment capital, social networks between entrepreneurs, consultants, and working individuals that allow knowledge diffusion). Instead, they were created and replicated due to their interactions (Kuckertz, 2019). An entrepreneurial ecosystem can be thought of as nothing more than a geographic location. It comprises a variety of actors and environmental factors that work together to define a region's entrepreneurial performance. There is a wide range of stakeholders in the regional economy, including entrepreneurs, firms, universities, regulatory agencies, and local or regional governments. All of them can be productive when working together efficiently. Because they concentrate on the outside business environment, regional entrepreneurial ecosystems mirror other related local development concepts such as company clusters, industrial zones, innovation systems, and learning regions (Demirgüç-Kunt, Klapper, 2012).

5. Regional economy

Thanks to the growth of digital financial inclusion, increasing access to and availability of formal financial services has never been easier than it is now. Another significant influence on financial development and growth is economic freedom. As a result, there's a good case for looking at how financial freedom affects economic freedom. No empirical evidence exists in the literature, however, that these variables are linked. As a result, we investigate these connections. For emerging nations, we found that the interplay between ICT diffusion and economic freedom and financial development is beneficial to financial inclusion over the long term; this highlight how important it is to create an economic climate that encourages long-term economic growth. Our findings have important policy implications and necessitate a more comprehensive approach (Klapper et al., 2016).

Financial inclusion (FI) has been studied and found to be an essential driver of economic growth (Carretta et al., 2015). Formal financial services are available to everyone, including low-income people and micro-businesses, under the umbrella term "FI".

There are various advantages to having an inclusive financial system. However, 50% of the global adult population (or around 2 billion people) lack access to formal financial services, according to the Global Index Database 2017. More than 50 nations, according to the World Bank, are working on strategies and plans to make financial inclusion a reality.

A global socioeconomic challenge, financial inclusion (FI), will substantially impact developing countries because research has shown that FI is essential for growth and poverty reduction (Adegbite, Machethe, 2020). One of the leading causes for the lack of inclusive growth in emerging nations like India is the failure to attain greater financial inclusion. Emerging countries like India have had a unique and challenging time. Because of the differences in emerging economies, it's critical to examine dynamics in that setting.

Structural variables and policy-related factors have been highlighted in the research as essential drivers of FI across nations. While structural considerations mainly determine the cost of providing financial services to the general public, policy-related issues are critical in building an environment that promotes financial inclusion for the people at large. Information

and communication technology (ICT) infrastructure is a major structural component. Increased access to finance is one of the many benefits of general information and communications technology (ICT). One of the ways information and communication technology (ICT) promotes economic growth is through a comprehensive financial system.

6. Digital business strategy

Digital financial inclusion is a developing trend that makes it easier for anyone to access and use regulated financial institutions like banks and credit unions. Economic independence also has a significant impact on financial security increase in size and scope. Considering the impact of economic freedom on financial inclusion is thus a sound idea. However, there is no evidence in the literature to support the existence of links between these variables. As a result, we looked into these connections. It turns out that the interplay between ICT dissemination and economic freedom and financial development has a beneficial long-term impact on the participation of the poor in the global economy, underscoring the significance of building an economic climate that encourages long-term economic growth. The study's conclusions have important ramifications for monetary policy, and they advocate for a more comprehensive strategy (Boukhatem, 2016).

7. Future of digital business innovations

Researchers and practitioners are currently focused on digital transformation as a critical strategic issue (Bouncken et al., 2019). When viewed from a high perspective, digital transformation denotes fundamental economic and technological shifts taking place in society and across industries due to the widespread adoption of digital tools.

When viewed from a company's perspective, digital transformation is a comprehensive business transformation (Bouncken et al., 2019). For this transformation to take place, significant changes must be made across the whole organization, from the service processes and products to the operations to the leadership and structure to the company's overall business model and strategy (Bouncken et al., 2019). Mobile, social media, analytics, the internet of things, the cloud, and platforms have all contributed to changes at these levels. It is hoped that the implementation of these technologies would lead to significant improvements in the customer experience, increased operational efficiency, improved firm performance, and new value propositions.

Digital transformation can be described by four different qualities, as illustrated here: the target entity, scope, means, and intended consequence of the modification itself. First, the term "target entity" refers to the unit of analysis affected by digital transformation. Secondly, the term scope refers to the size of the changes occurring inside the unit under study. In other words, means relate to the innovations causing these shifts in the environment. The predicted outcomes of the considered modifications are represented by the expected result, the last of the four terms. Because these outcomes are always intended to benefit an organization, achieving them is a crucial objective of digital transformation.

To better understand digital transformation in businesses, it will look at it from two different angles in this thesis due to the wide range of possible target entities, scopes, means, and

intended outcomes. The first perspective focuses on companies from a variety of industries. Also assessing changes in the area of firm strategy brought about by various digital technologies, with an eye toward more extraordinary firm performance as an expected outcome.

Each of these viewpoints has specific research topics to explore. Even though digital transformation is occurring across a wide range of businesses, it may significantly impact particular industries than others. The financial services industry is one of the most vulnerable when it comes to digital transformation since it is being disrupted and even put at risk of going extinct. This industry faces several issues as part of the digital transformation (Gomber et al., 2017). Customers' changing demands for digitally savvy products and services and the entry of newborn-digital players from outside the traditional sectors that alienate financial services firms' customers are all part of the challenge. Due to these issues, financial services organizations' ability to create value is in danger (Asian Development Bank, 2014).

Financial technology (also known as FinTech) is the primary driver of the potentially life-threatening developments caused by digital transformation in the financial services business. Financial technology can be defined as any digital technology deployed to increase a financial service's efficiency, convenience, and accessibility for clients in the context of financial assistance. Financial services companies are beginning to integrate financial technology into their digital financial processes to become more digitally transformed.

8. Business informatics and digital society

The term "digital society" refers to a society that has adopted and integrated information and communication technology (ICTs) in their daily lives, including at work, school, and play. There is no precedent for the volume and speed at which digital breakthroughs are altering today's society, economy, and industry. Innumerable opportunities exist due to mobile and cloud technologies, Big Data, and the Internet of Things, which drive growth, improve citizen lives and increase efficiency in a wide range of industries, including health care, transportation, energy, agriculture, manufacturing, and public administration. They can also help policymakers make better judgments and include citizens in the governance process. The internet holds enormous potential because of its widespread use in terms of democracy, cultural diversity, and human rights like freedom of expression and access to information. We need to learn about how these changes affect people in the real world, such as how quickly they are happening and how they affect people's daily lives, and how they affect the government, science, education, etc., businesses. Computer science and business management are combined in the Business Informatics discipline to achieve this goal. To help industry managers embrace new areas of information technology in their managerial roles will help groove future computer science workers into their current and future jobs.

The workshop allows us to get together with our peers and share what we've learned with them. This course's emphasis on making decisions and making choices has shifted my focus. Understanding a company's strengths, weaknesses, opportunities, and threats is no easy feat. A SWOT analysis is performed on every organization before a decision is taken. To analyze that information, such firms need to monitor their environment for strengths, weaknesses, opportunities, and dangers.

Informatics, information technology, and management principles are all rolled into one field called business informatics. Medicine, business administration, and management all benefit from the usage of informatics. When it comes to selecting raw materials, informatics can help companies make better judgments about the quality of their raw materials, the capitalization of their human resources, and the solution of problems. Additionally, it can be applied in various other contexts, such as game theory in business. Business informatics is used to assist in learning in an organization, whether it is individual learning or organizational learning. There are two ways to communicate within a company: vertically or horizontally. Communication is essential for an organization's efficiency. It was accomplished admirably with the aid of technology. The employment of case tools and other forms of informatics aid in discovering new methods and merchandise.

One of a company's most important responsibilities is keeping records. Keeping records has two purposes: one is for future reference, and the other is for evidence. Documents need to be accurate and readily available at all times. Without the use of informatics, this could be difficult for the management. Informatics is favored over all other systems in terms of accessibility as well. Managers are responsible for arranging as a matter of course. Firms nowadays aren't just amorphous; they've also become far too complicated to grasp. As a result, the company's management has requested the services of an informatics expert. Making a decision is one of the most challenging aspects of running a business or investing in the stock market. It's not always simple to pick one option over another. In addition, decision-makers entrenched interests make it difficult for them to make choices. As a result, business informatics will be required.

Many human rights have been threatened by the growing use of information and communication technology (ICTs). These issues range from privacy concerns and the misuse of personal data to cybercrime risks and large-scale surveillance activities. They are diverse. A consequence of this is that every European citizen will have their human rights trampled upon at some point in time. With the support of international organizations like the United Nations and the European Council, LIBRe believes it is crucial to ensure human rights are protected. Also, it promoted cyberspace in the same way and intensity as in real life, despite the specific challenges posed by the increased use of digital technologies. Our team's mission is to find the optimal balance between cyber security issues and human rights observances. In the digital society, data protection, and digital rights, we conduct research that combines legal study with social analysis to build a socio-legal approach to information management that benefits the community.

9. Virtual enterprise

To survive and grow as a company in today's globalized world, companies must constantly seek new entry methods with quality products and services at competitive prices, which leads to a decrease in innovation cycles over time, constant shifts within a particular industry, and greater cooperation between companies. Because of advances in information and communications technology (ICT), businesses no longer have geographical or socio-cultural limits and operate on the worldwide market. They have also dimensional their resources on the global market. As a rule, firms are forming strategic alliances to attain a common aim.

With technological advancements, businesses are becoming a more critical link in the value chain since they help them reach their objectives while also providing various forms of profit. To get to modernity, however, the actual corporation is the stage where operations are transferred towards a global information society of the future. In light of the ongoing digitization of information and new communication channels, the virtual firm or organization web is becoming increasingly apparent (Ahamed, Mallick, 2019).

A virtual business is a short-term partnership of unaffiliated enterprises. It linked information technology to take advantage of market changes. Each partner brings a unique set of skills, knowledge, and experience to bear on the project. A virtual business dissolves when its goal is met, or a new market opportunity arises. "Virtual enterprise," according to Molina et al. (2007) is "a temporary network. In which skills, infrastructure and business processes are divided to fulfill unique market requirements." A virtual company is a network segment that may be reconfigured with its administration, productive resources, and production targets.

Any groups or companies which may decide to build their virtual community, such as a platform that allows them to share information about the members of their organization. The company may also address its customers via the internet, transforming this business into a virtual one. Suppliers-producers-customers is a typical value chain for such a virtual business. To meet the needs of both investors who want to put a product on the market with a short production cycle and low cost and organizations with manufacturing activity, the creation of virtual enterprises arose. Participants in the virtual enterprise structure can take advantage of this potential to capitalize on maximum production capacity.

While it takes physical capital to start a traditional firm, developing a virtual organization begins with an opportunity in the market and involves more resources than the company presently has in its mesh. Overall, a virtual company has the structure, operational functions, and logistics of a traditional company but appears functional. It considers the system on the "nuclei" of the virtual organization. To provide products and services, traditional businesses combine all of their functions into a single entity, which has the advantage of centralizing all resources and activities (making it easier to optimize the flow of operations). Allowing them to integrate results better, monitor activities, and meet short- and long-term goals.

There are disadvantages to conventional enterprises, such as the need for massive capital investment to integrate all activities into a single organization and internal barriers between departments. Overall, customers are more satisfied, which leads to higher costs for serving them and selling products. This necessitates the implementation of a customer relationship management system to meet their needs, both in terms of the product and service offerings' quality and a greater focus on the customer.

Outsourcing or subcontracting specific production processes can be more cost-effective than restructuring and re-engineering, which would result in additional expenses the company may not be able to afford. As a result, finding partners with whom to execute an association agreement just to take advantage of newly appearing market prospects or to materialize or integrate into a virtual company is an alternative considered.

It's important to note that virtual organizations do not herald the demise of traditional ones; instead, they represent a convergence of business processes, people, and technology that's more connected than ever before. Suppose a virtual organization is to be effective and efficient. In that case, it must make extensive use of the internet and intranet, communication

technologies (such as email and teleconferences), groupware programs, and virtual personnel with computer skills. Generally, all partners are treated equally in a virtual company. However, there may be instances where the coordinator, usually the starter, plays a significant influence in final decision-making.

10. Trade, global market, monetary economics and finance

Financial inclusion, also known as the development of economic systems, financial services, or financial products to give adults in society easier access, has piqued the interest of academics, policymakers, and regulators in recent years in emerging nations. Increasing the financial network within a country's borders is made possible by financial inclusion. Economic growth and development are predicted to increase as a result of inclusion. Financial inclusion has been identified as a formal aim by several countries (Sahay et al., 2015) to help them grow and prosper economically.

“Financial inclusion has yet to be defined definitively. The extent to which families and small businesses may access financial services such as savings, loans, payments, remittances, and insurance,” the World Bank says. Consumers are actively and effectively using formal financial services such as deposit and savings accounts, payment services, loans, and insurance because they are freely available, according to a 2011 report by the Consultative Group on Assisting the Poor (CGAP). Individuals and organizations have a propensity to use a wide range of financial services rather than the ability to acquire financial services. Individuals and firms may use these services for their commercial or personal gain, but the term “access” is used so broadly that other metrics have been used to measure it.

This research was prompted by the emergence of a practical debate that has yet to be empirically studied and the fact that financial inclusion and economic growth are intimately linked. We employ panel data and appropriate econometric methodologies instead of cross-sectional national data, as most previous research has examined the relationship between financial inclusion and economic growth. As a result, a multidimensional index of financial inclusion can be created for comparison purposes. To collect as many observations as possible, we use the three-year average of the data. As a result, we could look into the connection between financial inclusion and global economic growth. If our findings were used, policymakers, regulators, and academics would have valid and convincing data on the impact of financial inclusion on economic growth. The degree of economic progress (for developed and developing nations), as well as financial inclusion, might have an impact on the relationship, as well. As a result, the research sample is separated based on income and financial inclusion, allowing for a better understanding of the link between financial inclusion and economic growth.

11. Sustainable development of enterprises

Varied people have different interpretations of what it means to be sustainable. The attitudes and judgments associated with the concept of sustainability range from the conviction

that environmental conservation and sustainable ways of living and doing business are the essential issues facing the globe today to the belief that sustainability is a fad.

Sustainable development, as the name suggests, seeks to strike a balance between serving the needs of the present while also taking into account the requirements of future generations. It considers nature's needs while also acknowledging man's desire to contribute to the advancement of various parts of the planet. Another essential aspect of sustainable development is that it recognizes that growth and action must be inclusive and environmentally sound to reduce poverty and bring about shared prosperity for the entire global population. Using resources efficiently while preparing precisely for the achievement of immediate and long-term goals for people, the earth, and future generations is the purpose of sustainable development. Sustainable development is now required not only for human existence but also for protecting humanity's future.

To be sustainable, one must conserve energy and resources over the long term rather than continually depleting them to meet the moment's demands. Urbanization degrades the environment because industries continue to exploit natural resources incessantly. New technologies, businesses, and the environment must be created while harming nothing to achieve sustainable growth. Environmental degradation caused by rising population, economic development, and deforestation has put human life in jeopardy. As the number of automobiles and industries grows, pollution from greenhouse gases like carbon dioxide and methane wreaks havoc on the planet's climate. As a result of the increased emissions of greenhouse gases, ice caps worldwide have begun to melt, causing the sea level to rise. Sustainably developing a country requires action from both the government and the people.

By focusing on sustainable development, we can make the world a better place now while not compromising the opportunities for future generations. First and foremost, we must protect our planet's numerous natural ecosystems, all of which must be unbalanced for humanity to survive. The business sector has begun to recognize the possibility presented by the sustainability business case. Achieving success by improving the quality of human existence while remaining within the environmental carrying capacity. Businesses of all sizes have realized that they can take the lead in social and ecological issues.

Global Business Council for sustainable development states that sustainability is about filling the needs of people today without sacrificing the ability of future generations to meet their own needs. The fact is that company leaders swiftly realize that long-term workplace regulations can give their companies a competitive edge in the twenty-first century, regardless of personal convictions. As a result of this study, we hope to learn why businesses are increasingly committing themselves to sustainability strategies, their main implementation challenges, and what role human resources may play in their firms' journeys towards sustainable goals.

Environmental, social, and economic challenges have been surfacing in business and society for decades. Only recently have these challenges gained widespread public attention. People's well-being is at the center of the social component. Human inequality, social injustice, and poverty are immoral, and we have an ethical duty to do something about it. Initiatives like promoting peace, equal access to social services, eradicating extreme poverty and eliminating discrimination in the workplace fall under this pillar.

All sorts of energy and resource expenses may be reduced, pushing Western civilization to get more involved in sustainability. Because it's a widely utilized part of the workplace, companies can see right away how much money they've saved, which drives them to keep cutting costs. When it comes to its brand and reputation, it will show customers that it is environmentally conscious and accountable for its actions. This will affect its bottom line, but it will also encourage its stakeholders to establish a deeper relationship. In addition to increasing profitability and sales growth, the company's brand and reputation will be maintained. Sustainability is a business idea that encourages positive changes in the company's economy, environment, and society. To be a commercial priority, sustainability must have a business case. Greenpeace and its ilk, known for their outlandish claims about sustainable, social, and good governance practices, have a 25% stock value advantage over their less sustainable counterparts. It should be taken with a grain of salt because there is a compelling business case for these organizations to act responsibly toward the planet and its people.

12. Conclusion

In emerging nations, academia, policymakers, and regulators have stepped up efforts to foster financial inclusion by developing economic systems, financial services, or financial products for adults. Financial inclusion allows countries to expand their financial networks within their borders. It is predicted that inclusion will increase economic growth and development. Several countries have identified financial inclusion as a formal goal for growth and prosperity. Defining financial inclusion definitively is still a work in progress. Savings, loans, payments, remittances, and insurance are all financial services that are available to families and small businesses. Financial inclusion and economic growth are intimately related, which has led to this empirical study, which addresses a practical debate that has not been empirically studied. Because most previous research on financial inclusion and economic growth has used cross-sectional national data, we relied on panel data and appropriate econometric methods. Consequently, financial inclusion can be assessed on multiple dimensions and a multidimensional index developed.

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PART II

Evidences of Innovation Processes

CHAPTER 4

Attractiveness of Games and Business Simulations in Teaching Process

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Summary. This study aims to assess the attractiveness of games and business simulations in the teaching process. The presented overview concerns their application in primary and secondary schools, at universities and in business. Among the most important benefits were the development of participants' creativity and the use of games as effective tools for imparting practical knowledge. The chapter presents the results of a survey completed by 97 participants. The study showed that the use of games and business simulations is positively perceived by trainees and students, but this form of knowledge transfer must be used with awareness of its limitations relative to other forms. The last section focuses on conclusions and suggested possibilities for further development of games and simulations in the teaching process. Colloquially: does the use of business games make learning a more enjoyable and less boring process? Is the preferred option for acquiring practical knowledge the choice of a book or attending a lecture, or would participants prefer game- and simulation-based learning?

Keywords: business games, simulation games, educational games, gamification, artificial intelligence

1. Attempt at defining business game and business simulation game

Game is a term that incorporates various activities and forms of playing, characterized by the application of specific rules. Business games or business-oriented games focus on management, social relations, law and finances (Ceschi et al., 2014). Participation in games allows players to gain the necessary abilities for conducting business or leading a team, including communication skills and enhanced creativity (Cavalcanti Rosa et al., 2019). Most often, these games require the presence of a coach or other person who would moderate the gameplay while being attentive to all the players. Such person serves the role of an arbiter as well as a teacher. They demonstrate the rules and ensure the appropriate

flow of the gameplay. The presence of a third party allows players to focus solely on the play instead of monitoring whether the rules are being followed. An alternative approach includes games with clear rules, in which the players must read a manual beforehand. These usually come in the form of board games or games utilizing simple items, such as cards, game boards or dice.

A simulation is an attempt at recreating a real-life phenomenon. It allows for a certain simplification of the situation to better understand the pattern of behavior. We may consider simulations as experimenting on an arranged model (White, Ingalls, 2009), in which the model constitutes a specific representation of reality. A well-designed model should constitute the middle ground between simplicity and realism (Maria, 1997) while preserving the rules we observe in reality. Business simulation games constitute a combination of simulations and business games. A business game, therefore, is a broader term than a business simulation game (Birknerová, 2010). We can define the latter as a game played in a prearranged system designed to reflect reality to a certain degree. Players must adapt to the conditions in the simulation to achieve the best possible results. Such games may be much more convoluted than business games because the sole utilization of a system can render the rules more elaborate and the relations more complex. Usually, computer programs responsible for the simulation aspect are used for playing. Some simple business simulation games are released in the form of board games, but the rules have to be straightforward enough for the players to follow them without the help of electronics.

2. Business and simulation games in education

Business games and business simulation games are tools utilized at every step of education: in primary and secondary schools, at universities and even during business training which points to their universality. Needless to say, games designed for younger people are relatively less complex than those for professionally active people. Nonetheless, by choosing appropriate themes and techniques, it is possible to make a game suitable for people of any age and stage of education. The overview prepared for this chapter is based primarily on Polish education. Games are used as means for introducing students to economics, business, and communication as early as elementary school (Leśniewska, 2017). Learning through games and playing is beneficial for acquiring new skills, although mostly soft ones, in a friendly atmosphere (Hernik, Jaworska, 2018). The immense popularity of video games (Mendes et al., 2022), as well as board games (Sousa, Bernardo, 2019), can make them a more often considered tool for teaching various skills, including communication and business (Noemí, Máximo, 2014). Research on the application of games in developing cooperation and social skills shows positive results (Öztürk, Korkmaz, 2020). In educational establishments, extracurricular workshops are organized. Owing to the *Ferie z Ekonomią* programme aimed at 7th- and 8th-grade students, young people from over 50 schools participated in courses on the introduction to economics and rules governing business activities. Business games and other practical exercises were applied as means of teaching there. In establishments such as the Center for Good Education, young people create their own educational games with a focus on entrepreneurship and

communication¹. It proves that they consider games an appropriate method for sharing knowledge and spending leisure time.

The secondary school curriculum includes a subject called Introduction to Entrepreneurship, during which students acquire knowledge from the fields of basic economics, the market, running a business and communication. Teachers often use business and simulation games to convey practical knowledge and make students actively participate in classes (Tracz, Rachwał, 2008). As part of the subject, students compete in various business simulation games, such as *Ja Titan* or *Szkolna Internetowa Gra Gieldowa*. A game called *This War of Mine* was established as official educational material by the Polish Government. In addition to the undisputable ethic values, the game is also a simulator in which players must carefully manage available resources and take risks on multiple occasions.

At higher education institutions, business games and business simulation games are also utilized in courses as means of conveying practical knowledge. A valid and notable aspect of games and simulations is that they allow students to independently acquire knowledge and draw conclusions from their own mistakes (Gaweł, 2016) without incurring a risk. They engage students notably more than other teaching methods (Smiderle et al., 2020). In SGH Warsaw School of Economics, there is a separate course called Business Simulation Game² dedicated to teaching students in one extensive simulation about running a company. At Kozminski University in Warsaw, the Division of Simulation Games and Gamification was established, which organizes classes on the implementation of simulation and games in training and education³. Some subjects at Kozminski University have their material based primarily on the utilization of simulation games during classes, such as strategic decision games. Frameworks are also created and developed, which make it possible to conduct classes based on business simulation in tertiary education (Öztürk, Korkmaz, 2020).

Preparing games or simulations with suitable complexity makes it possible for the participants to gain practical skills (Cohen, Rhenman, 1961), including those connected with management and communication (Rzońca, 2011). Participation in games, in turn, allows players to interact with each other in a natural manner (Routledge, 2016). For that reason, business and simulation games are used in courses dedicated to professionally active businesspeople. There are companies on the market that provide paid courses and materials based on games and simulations, such as *Pracownia Gier*, *Businessgames* or *Cesim: Business Simulation Games*. A wide variety of options makes it possible to choose the most beneficial tool for acquiring skills such as:

- management and leadership (Zulfiqar et al., 2019),
- teamwork (Ceschi et al., 2014),
- managing resources,
- product development (Pacheco-Velazquez, 2015),
- strategic management (Wolfe, 1997).

¹ <https://cdw.edu.pl/biznesowa-animacyjna-gra-planszowa/> [22.11.2022].

² https://usosweb.sgh.waw.pl/kontroler.php?_action=katalog2/przedmioty/pokazPrzedmiot&kod=130830-P [20.11.2022].

³ <https://www.kozminski.edu.pl/pl/jednostki/centrum-gier-symulacyjnych-i-grywalizacji> [20.11.2022].

Simulation games also assist in developing creative, lateral thinking (Moffat et al., 2017). Available products include contact games, board games, as well as online games which use communication platforms (usually verbal team games) and full-fledged computer games. Thanks to the advancements in technology, games and simulations are effectively used in multinational teams, as it occurs in corporations such as The Coca-Cola Company or AstraZeneca⁴.

A vital element of simulation games is the faithful reconstruction of the environment they are supposed to simulate. For that reason, business and simulation games available on popular gaming platforms *Origin* and *Steam* often utilize artificial intelligence. Its principal function is managing the simulation to which the players must adapt. Although such games serve primarily as sources of entertainment, they can also teach players various abilities. Artificial intelligence can sometimes be quite simple and responsible only for particular events, as in old games like *Tropico* or *RollerCoaster Tycoon*. In contemporary simulation games such as *Rogue AI Simulator*, artificial intelligence may be used to manage the whole gameplay. It points to the possibility of using AI-based and machine-learning-based solutions for developing advanced simulations from different fields that would also serve as learning tools (Opel et al., 2019), including management and business.

3. Assessing attractiveness of business games and business simulation games

This chapter aims at assessing the appeal of business games and business simulations (G) in comparison with other available methods of acquiring knowledge in the fields of business and social communication. Other methods include:

- oral means of conveying knowledge (O), which include lectures and talks,
- written means of conveying knowledge (W), which include books and research papers.

The study was conducted in the form of an online survey in which 97 people participated. The survey was submitted to students attending the Faculty of Management at AGH University of Krakow and people professionally active in the fields of business and communication.

The demographics section of the survey consisted of three questions, while the questionnaire about preferred methods of acquiring knowledge had four questions. In the second section, participants answered the following questions:

- Which method do you find the most beneficial for acquiring theoretical knowledge? (Q1),
- Which method do you find the most beneficial for acquiring practical knowledge and experience? (Q2),
- Which one of the following methods do you consider the most entertaining? (Q3),
- Would you be more willing to attend a course or training if practical exercises based on games or simulations were part of the schedule? (Q4).

For clarity, the data was presented both in percentage and numerical values.

⁴ <https://www.businessgames.com/> [21.11.2022].

The answers to question one are presented in Table 1. The study shows that a significant number of respondents (48.5%) considered written forms the best method of acquiring theoretical knowledge. It points to the conclusion that books and publications have the most credibility as far as facts are concerned. Percentage of people who consider games and simulations a valuable source in that regard amounts to only 18.6%. Such reception of this form may denote that games and simulations are not focused enough on presenting the theoretical background reliably. On the other hand, they are perceived as the most entertaining option by the participants of the survey (75.3%) as well as the best method for conveying practical knowledge (85.6%). A small fraction of surveyed people considered oral (11.1%) and written (13.4%) methods the most enjoyable.

Table 1. Assessing the appeal of business games and business simulation games, questions Q1–Q3

Question number	Oral (O)		Written (W)		Games (G)	
	respondents	[%]	respondents	[%]	respondents	[%]
Q1	32	33	47	48.5	18	18.6
Q2	8	8.2	6	6.2	83	85.6
Q3	11	11.1	13	13.4	73	75.3

The vast majority of surveyed people (92.8%) declared they would at least be more willing to attend a course or training if games and simulations were part of them. Only a small percentage of the participants (7.2%) either consider it neutral or evaluate it negatively. Therefore, the study demonstrated that incorporating games and simulations into training or a course increases its attractiveness. Table 2 presents the answers to the second question of the survey.

Table 2. Assessing the appeal of business games and business simulation games, question Q4

Rating									
1		2		3		4		5	
respondents	[%]	respondents	[%]	respondents	[%]	respondents	[%]	respondents	[%]
1	1	1	1	5	5.2	25	25.8	65	67

Additionally, there are significant differences between groups when we consider the occupation. Professionally active people declared comparable interest in oral form (43.2%), written form (43.2%) and games (40.5%) in terms of theoretical knowledge. Among school and university students, as well as employed students, the preferred form of acquiring theoretical knowledge was written sources (50.9% on average), while games and simulations were the least favoured method (22% on average). Table 3 presents the answers to the third question.

Table 3. The most beneficial method for acquiring theoretical knowledge – with regard to the occupation

Occupation	Oral (O)		Written (W)		Games (G)		Total
	respondents	[%]	respondents	[%]	respondents	[%]	
Employed	16	43.2	16	43.2	5	40.5	37
Employed and studying	7	25.9	14	51.9	6	22.2	27
Studying	9	28.1	16	50.0	7	21.9	32

By categorizing participants based on their educational background, we could also observe a difference in answers to Q1. 53.6% of those with higher education declared that written forms constitute the best method of acquiring knowledge. Games and simulations were indicated only by six people (10.7%). Participants with secondary education also chose the written form most often, but in this group, oral forms and games were equally popular (30%). As far as Q2 and Q4 are concerned, no significant differences were observed in the above categories. The answers to the fourth question are presented in Table 4.

Table 4. The most beneficial method for acquiring theoretical knowledge – with regard to the educational background

Education	Oral (O)		Written (W)		Games (G)		Total
	respondents	[%]	respondents	[%]	respondents	[%]	
Secondary	12	30.0	16	40.0	12	30.0	40
Tertiary	20	35.7	30	53.6	6	10.7	56

4. Conclusions

The study demonstrated that business games and simulations are considered more congenial in comparison with written and oral forms of conveying knowledge. Regardless of their educational background, the majority of the survey participants declared business games and simulations not only to be the most appealing but also the most beneficial for gaining practical abilities. They are lacking, however, in terms of conveying theoretical knowledge. The participants stated that they would be more willing to attend courses which incorporate business games and simulations. Since trainings and courses should provide trainees with both knowledge and the ability to utilize it, it would be reasonable to combine as many different teaching methods as possible. Games and simulations could eventually become versatile tools if, in addition to their already appreciated appeal and practical knowledge application, the presentation of the theoretical background was improved. To achieve that, the developers of computer games and simulations could, for instance, implement particular fragments of

books and other publications in the form of a lexicon or a concise wiki. As far as stationary or contact games are concerned, the necessary knowledge could be attached in the form of a manual or a folder, so that every participant has access to it. Business games and simulations are promising for teaching business and communication skills, but they must be carefully prepared and polished in terms of factual accuracy so that players can acquire a complete set of competencies in addition to the entertainment from playing.

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CHAPTER 5

Methodological Aspects of Innovation of Project and Production Businesses

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Summary. In this chapter the authors present a proposal of selected aspects of methodology for improving individual and team innovation in enterprises. Methodological aspects were reasoned with measurements of the level of innovation by GUS and its causes in Poland. The reasons for the low level of innovation are justified by historical roots, as the seven main points formulated by PTI in 1980, similarly to the 21 postulates of “Solidarity”, accurately reflect the main reasons for Poland’s backwardness in development and, unfortunately, most of them are still valid. These reasons require action on the part of the Polish state, but they should also be used in bottom-up activities of each enterprise after minor interpretation corrections. The chapter focuses on industrial enterprises, because the realities of creativity of engineers and technicians are different from workers in other sectors of the economy. An important determinant of creativity in industrial enterprises with aspirations to design their products and production processes is the set of instruments, in particular CAD/CAM/CAE. Three methodological proposals guarantee a faster and more effective way to creativity and innovativeness of enterprises, although their implementation requires a lot of effort on the part of both employees and their employers. At the same time, they are a prerequisite for acquiring the ability to make strategic innovations in the enterprise. The developed methodological solutions have been tested in practice and constitute an institutional recommendation.

Keywords: innovativeness in Polish industry, methodological aspects, innovative creativity of employees

1. Introduction

The authors of this chapter have dedicated more than 30 years of work to applications of information technology in education and practice of social and economic life. Undoubtedly, the use of information technology still means innovation, and the whole process of creating information systems and their implementation requires creativity, not only individual from employees but also from the entire community.

Recently, innovativeness has reached the rank of innovation policy in some countries, as well as in the EU. Therefore, public statistics, also in Poland, carries out measurements of innovation in services and industrial companies. The period 2010–2021 of the studies carried out by the authors was focused on innovation of engineering and technical workers and innovation of project and production businesses located in the Pomorskie Voivodship.

The aim of this study is to highlight the methodological aspects related to the improvement of industrial innovation, because the authors concluded that they constitute a necessary condition for taking up directly related topics, i.e.:

- contemporary dilemmas of entrepreneurship,
- use of ICT in transforming the organization,
- virtual enterprise,
- digital business strategy,
- the future of digital innovation in business,
- business computing and digital society.

2. Diagnosis of state of innovation and research results

The state of innovativeness of Polish enterprises has been monitored and the data have been published by Statistics Poland (GUS). The methodology of this monitoring is standardized by the OECD and Eurostat. It refers to:

- innovation activities of companies,
- economic aspects of innovation activities,
- cooperation in innovation activities, such as technology transfer and intellectual property protection.

Monitoring is focused on enterprises which are active in innovation and are innovative in the following areas: product innovations, process innovations and other innovations. The situation of innovative enterprises in 2011–2019 in Poland is shown in Figure 1.

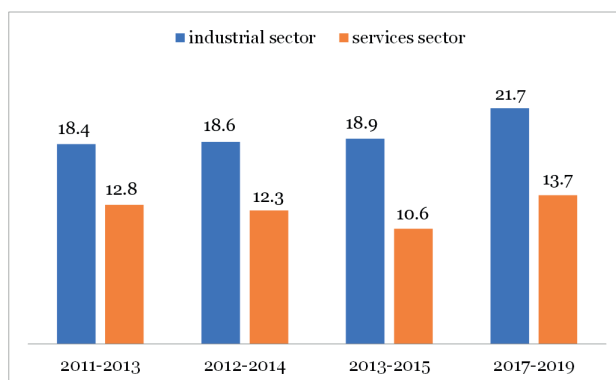


Fig. 1. The percentage of innovation-active enterprises in Poland in 2011–2019

Source: own research based on GUS (2015, 2016, 2020b)

Unfortunately, the percentage of innovation-active enterprises in Poland is very low and even lower is the percentage of innovative enterprises, which in the years 2017–2019 amounted to 18.9% of industrial enterprises and 11.9% of services enterprises – out of the total number of such businesses. There is a large variation between voivodships, e.g. innovative activity of industrial enterprises in the Pomorskie Voivodship (where the authors conducted research).

A situation of industrial enterprises in 2008–2019, product innovations which are typical for them (indicating minor importance of these innovations for the market) are shown in Figure 2.

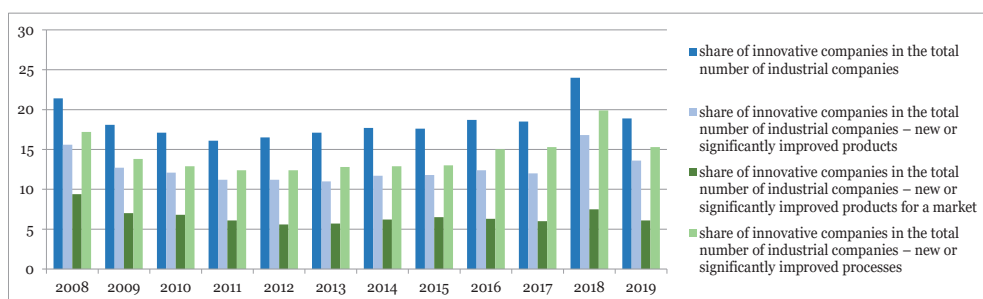


Fig. 2. Percentage of innovative, industrial companies in Poland in the years 2008–2019

Source: own research based on GUS (2015, 2016, 2020b, p. 18)

In the ranking of EU countries, in the case of introducing product innovations by industrial enterprises, four levels of the indicator were distinguished (i.e. 40.0–50.8; 30.0–39.9; 20.0–29.9; 12.5–19.9) and, unfortunately, Polish enterprises are at the lowest level (GUS, 2020b, p. 48). The share of net revenues from sales of new or significantly improved products launched to the market in terms of the total sales revenue in 2019 amounted to 9.3% for industrial companies. The largest share of revenues from sales of new or significantly improved products in total revenues was reached by industrial enterprises (12.1%) which employed 250 people and more. The percentage of industrial companies which made expenditures on innovative activities in 2019 amounted to 14.4%. It should be emphasized that the lowest expenditure in the area of innovative activities within industrial enterprises was made on staff training directly related to the introduction of product or process innovations.

The first author’s diagnosis of the state of innovation in 2012–2013 was carried out by the authors as part of the project “Road to professional excellence” and its synthesis was published in the article (Sala, Tańska, 2013a). As a result of the analysis of experiences of the British government and self-government, which referred to moderating and stimulating innovation of businesses in the UK, authors took part in the development of the model dedicated to the companies from the Pomorskie Voivodship. The authors have published an essence of the model in the article (Sala, Tańska, 2015) exposing its initiating part connected with the transfer of ICT knowledge and the first edition of the model implementation. This implementing clarification has been focused on the technical and engineering staff, and the

choice of ICT tools has been addressed to integrated computer systems CAD/CAM/CAE. The elaboration of a model is a methodology for reaching the versatility, professional project and production flexibility, which consists of three paths (Fig. 3):

- 1) for engineering and technical staff,
- 2) for project and production businesses,
- 3) for strategic innovation partnerships.

In Figure 3 the path 2 is presented, for which the path 1 is a necessary condition, what has been explained in the article (Sala, Tańska, 2015).

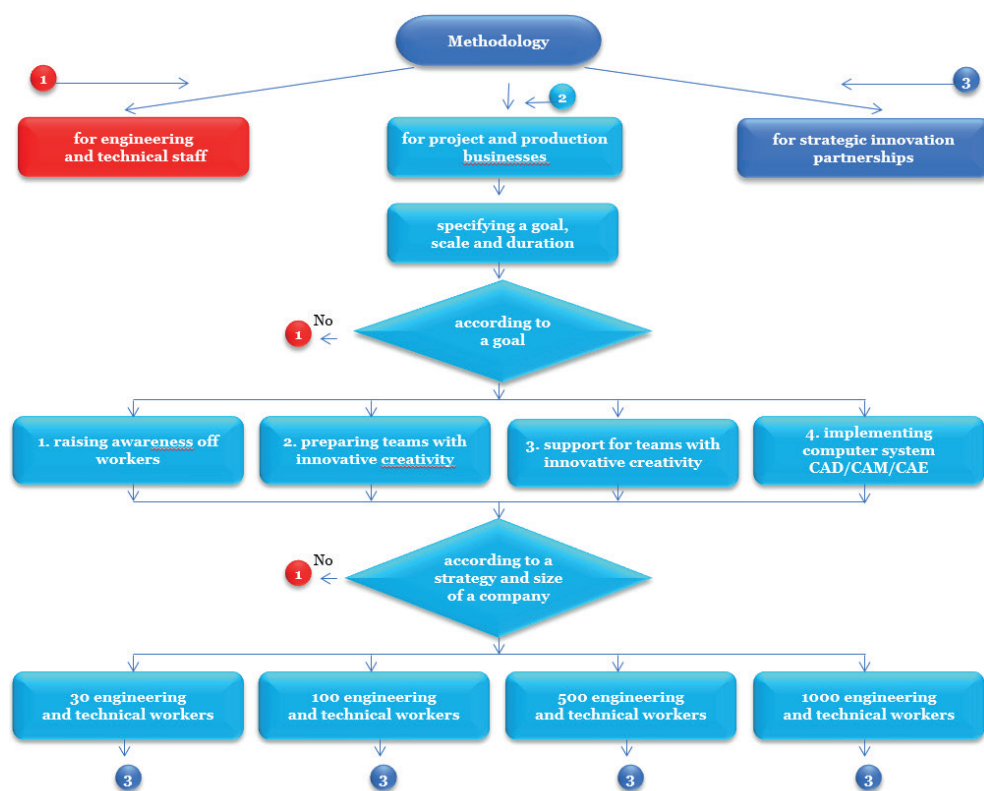


Fig. 3. Methodology of reaching the versatility, professional project and production flexibility to obtain the ability to make strategic innovation

The main objective of methodology is to acquire the individual and institutional ability of making strategic innovation by the employees and the company through the implementation of the path no. 3 shown in Figure 3. The path no. 3 is an adaptation of the British model of innovation which has been carried out for over 35 years, under which approximately 1000 strategic innovations were moderated and stimulated annually after the year 2000. However, in the case of Polish enterprises the execution of path no. 3 would not be effective without

taking a necessary condition in the form of path no. 2. The purpose of taking into account methodological differences between the British and Polish companies has its historical roots, and a lack of understanding them will lead to incidental, not permanent, understanding of the innovativeness of Polish enterprises.

3. Historical roots of a lack of understanding

In order to verify the methodological assumptions, it is worth considering the causes of the current state and determining how deeply these causes are rooted in the culture of socio-economic life. To do this, one should diagnose the past by taking into account sufficiently distant future. It can be assumed that the proper reference point is the year 1980, in which professional awareness of IT specialists in Poland was strongly visible and their activities to stop the chaos were integrated. The most emphasized and consequent manifestation of this phenomenon is the creation and activity of the professional association of the Polskie Towarzystwo Informatyczne (PTI) [Polish Information Technology Society], which celebrated 35 years of its existence in 2016. It can be assumed that the following main theses formulated by the founders of the PTI can be a reference point for identifying the initial state:

- 1) a lack of rational attitude of authorities towards computer sciences and its applications in all sectors of economic and social life;
- 2) allowing the extreme underdevelopment of computer services in software development, as well as assistance and consulting, which is an important factor contributing to the low efficiency of using computer sciences in Poland;
- 3) Polish society is uninformed about the real possibilities and the benefits of using computer sciences;
- 4) it is necessary to maintain a high level of basic research in computer sciences, so that it keeps up with the world-class developments in this field;
- 5) education of specialists at universities should be developed and the saturation of information techniques at all educational programs of higher education ought to be increased;
- 6) one should strive for the gradual introduction of computer sciences into secondary schools by providing opportunities for using computer sciences (hardware and software) in the teaching process;
- 7) specialists are not rewarded well enough and their salaries do not reflect the amount of work needed to acquire and maintain the qualifications or the value of qualified computer scientists on global labour markets.

Seven main points formulated by PTI in 1980, like the 21 demands of “Solidarity”, accurately reflect the major causes of underdevelopment in Poland, and unfortunately most of them are still valid. The thesis no. 3 should also comprise the need of informing Polish society of the real risks connected with using computer sciences. However, in the comment to the thesis no. 6 it should be emphasized that this one can only be considered as completed together with the second part of the thesis no. 5, because secondary schools (as well as primary schools) and all the educational programs of higher education have been saturated with information technology, but unfortunately, in the authors’ opinions the execution requires the qualitative verification. Thus, over 40 years, only one and a half of the PTI theses can

be regarded as completed (Szyjewski, 2016). Other causes of underdevelopment and their consequences have deepened.

The timeliness of thesis no. 7 and the first part of the thesis no. 5 is underlined in (Iszkowski, 2016, p. 11), (Greniewski, 2016, p. 16; Kisielnicki, 2016, p. 36) and others. They note, among others:

- lack of official and proper recognition of the profession of computer scientist and computer engineer, through entry in the polish classification of professions and specializations (*Obwieszczenie...*, 2018), which makes it difficult to manage professional IT staff;
- the challenge is to overcome the barriers that will allow the effective and efficient use of information technology;
- significant barriers are problems: economic, legal, technical, and the inefficiency of our Polish educational system in educating appropriately qualified personnel; lack of them means not taking advantage of the possibilities offered by modern computer science.

4. Methodology and institutional basis for implementation

In Polish, the word “methodology” has more than 60 synonyms and dictionary (synonim.net, 2016) distinguishes four main groups of the meaning of synonyms “methodology”: as a remedy, as a part of the procedure, as a course of action, as arts and crafts. In the context of methodology aimed at reaching versatility and professional project and production flexibility (see Fig. 3) its meaning is best reflected by synonyms from the group “as a remedy”, though synonyms from the group “as a course of action” are useful as well. There are also many definitions of methodics, and it should be definitely distinguished from methodology. Colloquially speaking, it is assumed that methodology focuses on the answer to the question “What to do?”, whereas methodics focuses on finding the answer to the question How it should be done?

Therefore, it can be assumed that the developed methodology can be a remedy to problems caused by the lack of completion of the obligations of the Polish state from the 1970s and their effects and abandonments ongoing to this day. On the synthetic diagram presented in Figure 3 the path no. 1 is a prerequisite for the success of the initial implementation of this methodology in each company. It is necessary to overcome the shortcomings resulting from theses no. 3, 5 and 6, provided that the company has the correct proportion of solutions regarding also theses no. 2, 4 and 7. Path no. 1 of methodology has been positively tested on a group of 60 employees of the Pomeranian project and production businesses and has been applied successfully since 2014. Path no. 1 of the methodology had been developed with public funds. It is recommended by the KIW (Krajowa Instytucja Wspomagająca) and is subject to a free license, which is operated by Organizacja Międzyzakładowa NSZZ “Solidarność” in Gdansk Shipyard. It should be stressed that without a transfer of tool knowledge from ICT there is no appropriate basis for innovation activity.

The implementation of the path no. 2 of methodology shown in Figure 3 can be started only after the completion of the condition on the path no. 1, at least for key engineering and technical staff in a company. The path no. 2 has been verified and validated, it has been tested in several project and production businesses. First, a company must define the purpose, scale and duration of reaching the versatility and professional project and production flexibility.

The methodology distinguishes four different specific objectives:

- 1) raising the awareness of employees,
- 2) preparing teams with innovative creativity,
- 3) supporting teams with innovative creativity,
- 4) implementing a computer system CAD/CAM/CAE.

These objectives can be pursued simultaneously or sequentially, depending on the scale and duration of the systematic effort of achieving a higher level of innovation in the industrial enterprise. The shorter time is needed to prepare a selected group of employees, e.g. 30% of the crew, but much more favourable is to involve all employees in an implemented methodology. Goals no. 1 and 3 were tested in practice. After determining the purpose, scale and duration actions should be elaborated in accordance with the strategy and size of a company. Unfortunately, a significant obstacle to SME enterprises is the lack of plans and strategies. Making up for this increases the costs of coming to permanent innovation and prolongs the time of its reach. The research shows that companies employing over 250 employees cope better in terms of the innovation activity (in 2017–2019 product or process innovations were introduced by 47.0% of industrial companies and by 24.4% of services companies), but even they have a lot to improve so that innovation activity was not limited to the purchase of new solutions, but was based on the achievements of their own employees. Thus, the implementation of methodology should be a particular challenge for small and medium-sized enterprises, which should not delay its implementation because in the years 2017–2019 the innovative activity was undertaken only by 7.7% of industrial companies employing 10–49 people.

Finally, after reaching a certain level of preparation for internal innovation an enterprise can start the implementation of the path no. 3 for strategic innovation partnerships. Thus, it is important to follow the order of implementation of paths no. 1, 2, 3, and to anticipate a gradual return to the previous paths depending on the situation.

Undoubtedly, without the institutional foundations (Sala, Tańska, 2013b) the implementation of methodology will not be possible. It is worth noting that modern management is carried out in the following conditions: extremely high complexity of actions, turbulent environment, globalization, increasing competitiveness. This situation requires a project approach in the implementation of innovative processes and development will not be possible without the use of: modern management methods, high organizational culture, the use of ultramodern technology and modern information technology, such as BI systems and knowledge base. It is worth assuming that the real challenge are activities aimed at reversing the trend of increasing the difference between organizations using modern IT solutions and organizations that do not have them (Sala, Tańska, 2014a; 2014b).

5. Conclusion

The proposal of selected aspects of the methodology is dedicated primarily to the previously revised target audience, i.e. staff occupying engineering and technical positions and employed by industrial enterprises, in particular SMEs. In part, they constitute the implementation of ICT knowledge transfer model, presented more thoroughly in (Sala, Tańska, 2015) and oriented mainly on the effectiveness of the path no. 1 (for employees), and so on

individual creativity. On the other hand, path no. 2 of methodology, synthetically presented in Figure 3, is oriented mainly on the creativity of a team (for project and production businesses).

Both methodological proposals guarantee a faster and more effective way to creativity and innovation of enterprises, although their implementation requires a lot of effort from both employees and their employers. Concurrently, they are a necessary condition to acquire the ability to make strategic innovations in the enterprise (path no. 3).

Seven socio-economic (macroeconomic) PTI's theses of 1980, which require action from the Polish state, due to their timeliness can be used in the bottom-up activities of any company after the introduction of the following minor editing and interpretation adjustments:

- 1) rational approach of a company's managers towards using information technology in all its departments;
- 2) raising the level of computer services in software, assistance and consulting in order to improve the low efficiency of using information technology in a company;
- 3) informing all employees about company's real capabilities and benefits of IT application;
- 4) monitoring research regarding an application of information technology in enterprises selected sections of PKD and introducing periodic benchmarking to keep up with the leading companies in this field in the world (GUS, 2020a);
- 5) investing in education of already employed IT specialists and other employees of a company;
- 6) striving for a gradual implementation of solutions for internal communication process, exchange of experiences and learning in the enterprise;
- 7) paying attention to the decent financial rewarding of specialists, as at present salaries do not reflect the amount of work needed to acquire and maintain qualifications, or value of a qualified computer scientist on global labour markets.

The authors can assure that enterprise management, taking into account the methodology and the above seven theses, will undoubtedly improve the innovativeness of enterprises and lead to the ability to undertake strategic innovations, which was tested in industrial enterprises of the Pomorskie Voivodship.

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CHAPTER 6

Digitalisation of Individual Energy Metering with Smart Metering and Machine Learning as Enabler to Liberalised, Decarbonising Energy Market

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Summary. During the decarbonization and liberalization of the energy market the roles and possibilities for individuals change. Distributed renewable power generation and new types of tariffs are strongly dependent on and limited by the actions of regulatory bodies and network operators. The hypothesis for role of digitalization in enabling the wider participation of individuals in the energy market include the impact of smart meters, IoT and Industry 4.0 on the economically advantageous integration with the market is examined. However, the knowledge is vague about the impact of the smart meters and real-time data on the availability of the energy utilization efficiency or internal processes fit to the market conditions. Here we show that the real-time energy consumption data concentrated in order to apply machine learning (ML) based automated reasoning is expected by the individuals and organizations. We found that the real-time energy consumption data is perceived by interviewed entities as the most important and valuable asset in transforming their presence on energy market into the way allowing them to stay competitive and benefit from the liberalization and decarbonization. For the technical processes we found that the real-time, low latency consumption data processing promotes expertise and diagnostic knowledge.

Keywords: energy market, prosumer

1. Introductory overview of European energy market during decarbonization, liberalization and digitalization

Decarbonization, liberalization, and digitalization are most important factors influencing development of the energy market in Europe. Decarbonization refers to the process of reducing greenhouse gas emissions, with the goal of mitigating the negative impact on the climate change (Angelidou et al., 2022). It involves minimising the use of fossil fuels and

transitioning towards cleaner, low-carbon renewable energy sources. Decarbonization plays significant role in EUs commitment to meeting climate goals (Papadis, Tsatsaronis, 2020). Liberalization refers to the process of opening up the energy market to competition on different organizational and technical levels (Ringel, 2003). Liberalization of the energy market is aiming at increased competition and lowering prices for consumers. However, as discovered it has also led to some challenges, especially in the area of equal access to reliable and affordable energy. Digitalization refers to the use of digital technologies to improve the efficiency and effectiveness of the energy system and market. Digital devices (such as smart meters) play important role in improving the accuracy and reliability of energy data. The use of digital means will facilitate the trading and sharing of energy on the market. The availability of digital technologies in the energy sector is increasing but adoption speed is crucial for the whole sector development.

Decarbonization, liberalization, and digitalization are important factors shaping the energy market in Europe both separately and in interacting complex ways.

Digital technologies affect the efficiency and effectiveness of the energy market, leading to easier ways for consumers to access low-carbon energy sources and to make informed choices regarding their energy use. The policies that encourage the use of cleaner, low-carbon energy sources, can ignite the adoption of digital technologies enabling the integration of renewable energy sources into the grid. Efforts to reduce carbon emissions, directly impact implementation of policies that focus on the use of cleaner, low-carbon energy sources which are expected to become more competitive than fossil-fuel based sources. Competition between energy suppliers fueled by liberalization can encourage the adoption of low-carbon energy sources and the adoption of digital technologies as ways to differentiate offerings and attract markets. At the same time, digitalization will make it easier for consumers to access and compare different energy products, leading to increased competition.

In a liberalized energy market, prices are determined by electricity supply and demand balance, rather than being set in advance by a regulatory body. This can create incentives for companies to produce and sell electricity at the lowest possible price, to stay competitive. On the other hand liberalization opens up the possibility to a weak regulatory oversight, which can result in over-concentration, higher prices and reduced access to energy for some consumers. To counter fight some of the risks of energy market liberalization the tariffs are introduced to contracts with individuals. Usually, electricity tariffs are set by government regulatory bodies in coordination with utility companies, and are used to cover the anticipated costs of producing or distributing electricity.

The EU has set a number of targets for the transformation of energy systems towards greater use of renewable energy (Zell-Ziegler et al., 2021). These targets include:

- the 2020 target has been largely achieved, with the share of renewables in the energy mix reaching 17% in 2019;
- the 2030 target of achieving a 32% share of renewable energy in the energy mix by 2030 and reducing greenhouse gas emissions by at least 40% below 1990 levels;
- the 2050 long-term goal of achieving a carbon-neutral energy system by 2050, requiring increase in the use of renewable energy sources, possible use of nuclear power and carbon capture and storage.

Taking into account more global context, under the Paris Agreement signed by nearly every country in the world, the main goal is to limit global warming, and to pursue efforts to limit the temperature increase.

Decarbonization can be measured and settled on the liberalized energy market in a number of ways. One common approach is to use greenhouse gas emissions reporting and measurement systems, such as the EU Emissions Trading System (ETS). Under the ETS, entities emitting greenhouse gases are required to report their emissions and purchase allowances for each emitted carbon dioxide tonne equivalent. Another way is to use and trade renewable energy certificates, representing the environmental features of given energy supply.

2. Large scale renewable energy sources

Some of the available renewable energy technologies satisfy the historical top-down model of energy market focusing on the role of large scale energy producers. Those include hydropower, hydrogen, and nuclear power. From the technical point of view such technologies can easily replace the coal or gas fired power plants delivering similar reliability and capacity. Unfortunately, significant and long-term development process is required prior to deployment of any of them, not to mention potential resistance from the local communities. Additionally there are concerns over the environmental impact of hydropower or nuclear sites.

Hydropower is a form of renewable energy based on the energy of moving water. Positive impact of hydropower on energy market includes generation of electricity from renewable sources, potential to store energy, contributing to the grid stability and last but not least the flexibility of operation allowing for quick adjustment to current energy system or market circumstances. On the other hand there is an expectation of substantial environmental impact of large hydropower on the environment, including the destruction of habitats and the disruption of natural water systems. Additionally, hydropower is characterized by high upfront costs connected to significant infrastructure investments and limited available locations.

Hydrogen power refers to the use of hydrogen as a fuel to generate electricity, implementing hydrogen fuel cells or the process of hydrogen burning in a turbine. Due to its role of the renewable energy source for electricity generation hydrogen being produced from a variety of renewable energy sources, including biomass, plays integrating role in the energy supply chains. Hydrogen can be used to store excess energy from the energy system such as generated from solar or wind, and help to balance the grid. Furthermore, hydrogen can be used as a fuel for transportation sector. However, currently the role of hydrogen on the energy market is limited due to the scarce transport and storage infrastructure.

The use of nuclear energy to generate electricity has the potential to play a number of important roles on the energy market. This carbon-free electricity generation technology can provide reliable base load power supply and does not produce greenhouse gases during generation. However, there are also important drawbacks of nuclear power including the safety, waste disposal, and the construction and operation costs wakening significant public opposition to the construction of new nuclear power plants. As shown after the Fukushima disaster the total cost of recovery from a single disaster can discard total gains from the technology application on the national level.

3. Current market players

The energy market is a complex organizational construct emerging from long-term continuous technological advancement. This is why often the national economy growth was depicted as limited by the availability of energy and power. During the century long development some main functionalities and actors have been established and regulated to fulfill the promise of steady foundation for economical growth, specifically: reliability, safety and accessibility in both technical and economical terms. That includes the very special roles of some actors present on the current energy market such as transmission system operator (TSO), distribution system operator (DSO), independent metering operator (IMO), energy providers, brokers and aggregators, and above all the energy market regulatory bodies (Kerscher, Arboleya, 2022).

A TSO is an entity responsible for the operation, maintenance, and expansion of the transmission grid (Golombek et al., 2022; Schmitt et al., 2022). The role of the TSO is to ensure reliability and efficiency of electricity transmission. The TSO is an independent third party, expected to be not affiliated with any specific energy supplier. Such requirement helps to ensure impartiality and fairness in access to the energy market. Responsibilities of a TSO include:

- operating and maintaining the transmission grid,
- planning and implementing the expansion of the transmission grid,
- coordination with other TSOs, locally and internationally,
- facilitation the integration of renewable energy sources.

The DSO is responsible for the operation, maintenance, and development of the electricity distribution network (Botelho et al., 2022). Distribution infrastructure is used to deliver electricity from the transmission grid to the end consumers. The DSO is responsible for ensuring the reliability, safety, efficiency, and the capacity of electricity distribution network. The DSO also plays a coordinating and operational role in integrating distributed low scale renewable energy sources into the grid, and in providing the supply for electric vehicle (EV) charging infrastructure.

An independent metering operator (IMO) is a company responsible for the installation, maintenance, and communicating with electricity and gas meters in a liberalized energy market. The IMO responsibility is to ensure the accuracy and reliability of meter readings, crucial for billing process, thus for proper functioning of the energy market. IMO may also play important role in the development and implementation of new technologies and processes related to metering. In some cases IMO function is assigned and executed internally by the DSO or its subsidiaries.

An energy provider is a general term describing entities that orchestrate processes ending with selling electricity, gas, or other forms of energy to consumers. Energy providers operate on liberalized market, thus consumers have the ability to freely choose and change their energy provider (TPA), e.g. based on price, renewable energy share, customer service, billing and payment options, or contract terms. Energy providers may sell energy directly to consumers or through intermediaries such as energy brokers or aggregators. Energy brokers do not produce or distribute energy themselves, but rather act as an intermediary and facilitate the purchase and sale of energy. An energy aggregator is an entity that orchestrates multiple energy consumers or generators to negotiate and purchase energy as a group to gain better prices and collectively manage risk.

4. Wholesale energy market during decarbonization

Wholesale energy market operates as a platform for the buying and selling of electricity and other energy products (Bagheri, Jadid, 2022). The wholesale market is typically divided into two main segments: the spot and the forward market. The spot market is dedicated to immediate purchase and sale of electricity, while the forward market is aiming at transactions covering electricity delivery at a later date. Transactions in the forward market can be based on a variety of contract types, including futures contracts, options, and forward contracts.

On the wholesale energy market there are several types of contracts available such as physical contracts for delivery of electricity from a generator to a consumer, financial contracts providing for the financial settlement of a trade, without the physical delivery usually used to manage price risk or to speculate on future market prices, and capacity contracts – a payment to a generator in exchange for the power availability.

Recently, the EU wholesale energy market has undergone a number of changes including the introduction of green certificates and feed-in tariffs, that are designed to support the development of renewable energy generation.

Unfortunately, direct access for individuals and small scale entities to the whole market is almost impossible enforcing different forms of mass participation.

A number of barriers preventing individual consumers and micro generators from participating in the wholesale energy market, including financial, technical, regulatory and market structure. Individual consumers and micro generators may not have required financial resources to participate in the wholesale market. This can relate to the cost of purchasing the necessary equipment and infrastructure, as well as the cost of participating in the market itself (such as paying fees to market operators or intermediaries). Additionally, individuals may lack the technical expertise or resources needed to participate in the wholesale market: a lack of knowledge about how the market works, a lack of access to the necessary technical infrastructure. On the other hand, regulatory barriers that prevent them from participating in the wholesale market can include rules and regulations that are designed to protect the integrity of the market processes. Finally, the wholesale market may also present barriers related to the large scale of incumbents.

5. Change on energy market imposed by renewable distributed power generation

Large scale energy producers and distribution system operators cooperate with the energy transmission system (Radi et al., 2022). The development of the transmission system was described by the copper plate concept bearing the idea that the transmission system should be able to transmit electricity with minimal losses, as if it were a copper plate with no resistance. This concept is used to guide the design and operation of the transmission system in order to maximize efficiency and reduce losses. To ensure efficiency and safety of energy transmission the voltage of the transmission system must be maintained within a certain range. Similarly, to ensure the stability and reliability of the grid the frequency of the transmission system must be controlled. The technical regulation of the transmission system is typically the responsibility of the TSO. The goals of technical regulation in the transmission system

are to maintain the stability and reliability of operation, and ensure the safety and efficiency of operation.

Those goals can be achieved by executing multilayer control system:

- primary regulation involving the use of fast-acting control, automatic generation control (AGC) or automatic load frequency control (ALFC) to balance the energy supply and demand in real-time;
- secondary regulation is used to fine-tune the balance between supply and demand applying slower-acting control mechanisms such as energy storage systems or demand response structures;
- tertiary regulation aiming at optimization of the use of resources and managing longer-term imbalances between supply and demand with use of market-based mechanisms or scheduling.

Facing current renewable power generation technology growth the TSOs responsibilities are enhanced with the integration of renewable energy sources. The weather conditions and climate dynamics is building strong space correlations ranging to 200–300 km, which puts additional task of equalizing resulting imbalances across countries and the whole continent (Shaner et al., 2018).

Despite such advancements, the technical regulation systems typically used to regulate the transmission system may not be directly applicable to the distribution network. This is because the distribution network historically had a different set of responsibilities and challenges compared to the transmission systems. Furthermore, the technological and functional debt of the distribution systems increases as more and more distributed renewable energy sources become available.

6. Downstream operational model of distribution network

The historical function of the distribution network was to distribute electricity from the transmission system to end users, rather than to maintain the stability and reliability of the whole power system. As a result, current technical control systems used in the distribution network may be focused on more local issues, such as managing the flow of electricity within a specific region or ensuring the safety and reliability of the distribution network (Botelho et al., 2022). Additionally, there may be regulatory barriers or restrictions that prevent DSOs from implementing new network services or from upgrading the distribution network. Besides, such endeavor can be technically challenging and requiring scarce competences and expertise. In response, DSOs may choose to stay focused on maintaining the existing network over implementing new network services or upgrading the substance.

Many distribution networks in Europe were built decades or even centuries ago, before modern technologies such as the Internet of Things (IoT) and Industry 4.0 appeared. These networks may not have been designed with digitalization in mind and may require significant upgrades to be able to take advantage of new technologies. The traditional top-down model of energy distribution process, where a designated utility company is responsible for generating and distributing electricity to consumers, may not be helpful in the adoption of

modern technologies. Lack of necessary infrastructure or systems in place to coordinate the demand control in a systematic way, cuts off benefits and blocks access to the market for new players.

The adoption of modern technologies such as the IoT and Industry 4.0 could potentially change the role of DSOs in a number of ways. These technologies could enable more precise and efficient demand control, and help to optimize the use of resources thus reduce costs. Additionally, such move could help to improve the reliability and resilience of the distribution grid, as well as enable the integration of more renewable energy sources. On the contrary, such moves could potentially dismantle the current role of DSOs thus require significant effort in reshaping regulatory frameworks, and business models.

The lack of digitalization of “last-mile” energy distribution infrastructure is a serious threat and can potentially impede the development of a prosumer-oriented renewable energy market. Scarcity of the necessary infrastructure in place could limit the ability of prosumers to sell excess electricity to the grid, which is one of the key benefits of being a prosumer. Risking the inefficient use of resources induced by lack of smart meters and advanced data analytics, it may be difficult for DSOs to optimize the resources and effectively manage the flow of energy in the grid, undermining the competitiveness of the renewable energy market. Without digitalization, it may be difficult for prosumers to access information about their energy usage and generation or the performance of implemented business arrangements. Furthermore poor visibility and transparency, pillars of peer-to-peer economy, can make it harder for prosumers to make informed decisions and may discourage participation in the renewable energy market.

In the following chapters the role of digitalization in enabling the wider participation of individuals in the energy market is examined including the impact of smart meters, IoT and Industry 4.0 on the with focus on integration with the existing and emerging energy markets.

7. Distribution network upgrade needs

Usually existing energy distribution networks may not be fully prepared for bidirectional traffic when facing renewable energy generation. The distribution network may need to be upgraded in order to handle the increased or reversed flow of energy. This could include the installation of new transformers, switchgear, and other equipment. Furthermore, supporting technologies such as energy storage systems might be necessary to handle bidirectional operation in the distribution network. Energy storage systems are suitable to smooth out fluctuations in the local flow of electricity (Weckesser et al., 2021). In addition, formation of local or micro grids can help to increase the resilience and reliability of the larger distribution networks when facing the overloads or power flow volatility. On the contractual level financial instruments, such as feed-in tariffs and net metering, are used to encourage the adoption of distributed renewable energy sources and to support bidirectional operation of the distribution network (Manso-Burgos et al., 2021). Another aspect slowing down the transformation is the outdated regulatory framework designed primarily to protect the integrity of the grid in only presence of centralized power generation, where the openness for integration of distributed renewable generation should be in place (Walker, Kwon, 2021).

8. Fossil vs renewable energy as product

The fossil energy has radically different product definition and business model than modern renewable sources. The switch from old model of operations to the new markets can be both capital and time demanding process, exposing to the new risks, thus involving strong inertia from well established businesses.

The current state of fossil-fueled electricity as a product is characterized in wide market adoption and well-established product definition. However, fossil fuels as non-renewable resources, will eventually run out. That factor combined with greenhouse gases emission contributes to anticipated cost increase.

9. Photovoltaics and wind power scaling problems

Photovoltaics (PV), or the generation of electricity from wind power (WP) does not scale in the same way that some other forms of electricity generation do. This means that as the size of a PV or WP farm increases, the per-unit investment cost does not decrease at the same rate as it would with other forms of generation.

There are several reasons why the investment cost of a PV farm grows linearly with its size:

- The cost of installing a PV farm is largely fixed, regardless of the size of the farm.
- The cost of acquiring land to build a PV farm is not directly related to the size of the farm, and it may increase as the size of the farm increases.
- PV and WP are intermittent sources of electricity, which means that the amount of electricity generated by a PV or WP farm can vary significantly over time. This can make it more challenging to optimize the use of resources and may increase the overall investment cost. In comparison, other forms of electricity generation, such as fossil-fueled power plants, may scale more efficiently because the cost of the fuel may decrease on a per-unit basis.

10. Smart grid role in energy market liberalization

Smart grids enable more efficient and effective management of the electricity grid (Kazmi et al., 2021). They use sensors and IoT devices to monitor and control the flow of electricity in the grid, allowing for more efficient distribution of energy and better management of demand. In addition, smart grids can help to reduce the cost of energy by enabling more efficient use of energy resources and effective use of different energy sources thus reducing the need for expensive infrastructure upgrades. In turn this can facilitate affordability of energy for consumers and create more business opportunities for energy providers.

Smart meters are used to measure and record electricity, gas, or water usage in real time (Lazzari et al., 2022). They bring important functionalities, as they allow consumers to more easily monitor their energy usage and evaluate their consumer decisions such as choice of a provider that best meets their needs. Real-time data on energy usage promotes informed decisions about when and how to use energy. Thus, helps to reduce energy consumption and to lower energy bills. Consequently such informed behavior can facilitate the integration of renewable energy sources into the grid, and reduce reliance on conventional fuels.

According to the European Network of Transmission System Operators for Electricity (ENTSO-E), the deployment of smart meters in Europe has reached over half of households and small businesses. The development of smart meters in Europe has been driven by the EU's smart meter rollout initiative. In consequence, as of 2021, over 90% of households and small businesses in Italy have been equipped with smart meters, but the deployment rate in other European countries is slower.

On the customer side there is a complementary technological revolution induced by the IoT. One way that IoT can facilitate energy market development is by enabling the utilization of smart grids. In addition to smart grid benefits, IoT devices and smart appliances can help consumers reduce their energy consumption by optimizing the way energy is used to provide accurate comfort, ventilation, heating or domestic hot water production, among the number of other domestic services.

11. Individual participation in energy market

Most of the individuals are exposed to the energy market indirectly with the electricity tariffs, but also with different forms on renewable energy such as defined by prosumerism (Brown et al., 2020). Despite the limited liberalization of the energy market individuals can participate in energy market in increasing number of ways:

- becoming a small-scale producer of renewable energy, selling excess production back to the grid,
- purchasing electricity from a provider that relies on energy from renewable sources,
- participating in demand response programs,
- providing energy storage service to the grid with home battery systems,
- investing in energy companies or projects on stock exchange or crowdfunding platforms.

For individuals and small business the distribution network is both a technical system and an organizational structure for interacting with the energy market.

From a technical and historical perspective, the distribution network refers to the infrastructure that is used to transport electricity from the power plants but more recently from the energy transmission system to the point of consumption. This typically includes mid-voltage transmission lines, substations, and lower-voltage distribution lines.

From an organizational perspective, the distribution network is typically managed by a DSO. Besides the access to the distribution network and its services which has to be done in coordination with the DSO, there is a separate task of participating in the energy market usually involving contracting the energy supply, selling the excess energy or providing services typically contracted with the energy suppliers.

12. Electricity tariffs

Electricity tariffs are the rates that consumers pay for their electricity usage (Bairrão et al., 2022). Electricity tariffs are typically set by government regulatory bodies or utility companies, and can vary based on the time of day, the season, and the amount of electricity

used. Implementation of electricity tariffs can be valuable. They provide stability and predictability of energy prices, which can encourage consumers to act more efficiently. Electricity tariffs play an important role in the functioning of the electricity market, and can help to ensure that electricity availability.

On the contrary, electricity tariffs can be complex making it difficult for consumers to understand their bills and make informed decisions. Furthermore, they may disproportionately affect certain groups of consumers especially those with limited access to alternative energy sources, which can make them more vulnerable to high tariffs and expose them to the energy poverty (Billimoria et al., 2022).

Energy poverty refers to the inability to afford sufficient energy to meet basic needs. It can have serious consequences for health and well-being, and can disproportionately affect vulnerable or marginalized groups (Bianco et al., 2021).

To mitigate these risks, it is important for governments and regulatory bodies to carefully consider the impacts of electricity tariffs on different groups of consumers, and to put in place measures to help low-income or vulnerable households. This could include programs such as energy assistance or discounts for low-income households, or the deployment of energy-efficient technologies aiming at help to reduce energy use and costs.

13. Feed-in tariffs

Small-scale producers of renewable energy, selling excess production back to the grid can also benefit from tariffs (Maldet et al., 2022). A feed-in tariff (FIT) is a policy that requires utilities to purchase electricity from renewable energy sources at a predetermined price for a set period of time. The purpose of a feed-in tariff is to encourage the development of renewable energy producers by providing a stable and predictable return on investment. FITs are typically structured as a long-term contract between the renewable energy producer and the utility. Feed-in tariffs have played a significant role in the growth of renewable energy sources such as solar and wind power. However, they have also been the subject of controversy, as the costs of the tariffs could be passed on to all consumers.

To participate in a feed-in tariff program specific equipment is required depending on the type of renewable energy source. This is typically a bidirectional meter that can measure both the electricity consumed and the excess electricity exported to the grid. In some cases, a separate meter is required to measure only the electricity that is being produced, and another to cover the energy consumed from the grid.

Another important piece of equipment required for renewable energy production is an inverter. Inverter plays a crucial role in converting the direct current (DC) electricity that is generated by the solar panels into alternating current (AC) electricity that can be used locally, or remotely over the distribution network.

In addition to converting the electricity, the inverter may also perform other functions, such as providing data on energy production and consumption and monitoring the performance. The inverter in an individual renewable energy production system should be synchronized with the power grid to ensure that the electricity being generated is properly supplied into the grid. This is typically accomplished through a process called grid synchronization,

which involves coordinating the frequency and phase of the electricity being produced by the inverter with the grid.

14. Microgeneration on current energy market

Individual small generators can offset their carbon emissions by selling renewable energy certificates, thus creating a financial incentive for the deployment of renewable energy. Another option is to participate in net metering programs, which allow them to sell excess energy back to the grid. Net metering can create a financial incentive for small generators to produce more renewable energy, as they can earn money by selling excess energy back to the grid. Additionally, there are several other ways in which individuals would participate in the energy market, including direct peer-to-peer (P2P) energy trading granting individuals or businesses to buy and sell energy directly with each other; participation in a virtual power plant (VPP) consisting of a network of decentralized energy generation and storage units that can be coordinated as a single entity; or utilize more passive approach such as a participation in demand response programs (DSR) allowing individuals to sell their power demand flexibility as a service (Goulden et al., 2014).

Individual energy producers who generate their own electricity can choose to be connected to the grid or to operate off-grid. On-grid systems are connected to the electricity grid and can sell excess energy back to the grid. Off-grid systems are not connected to the grid and must store excess energy in batteries. Semi-off-grid systems are connected to the grid, but also have a backup power sources such as batteries or generators covering possible outages.

Beside the feed-in tariffs individuals can choose for the net metering. Net metering is a policy that allows small-scale energy generators to feed excess energy back to the grid and reuse it later in time. Netting refers to the process of balancing out the energy provided to the grid and consumed over rolling time window. In some countries that type of service might require additional fees. Potential advantages of net metering include utilizing the distribution grid as a virtual battery.

Another option to participate in small scale renewable energy production is the participation in energy community (Neska, Kowalska-Pyzalska, 2022). The purpose of a renewable energy community is to promote and facilitate the adoption of renewable energy sources locally. Renewable energy communities can be motivated by reduction of dependence on fossil fuels, promotion of power supply security, facilitating decarbonization and fighting the climate change.

15. Industry 4.0 oriented energy consumer

Industry 4.0, also known as the fourth industrial revolution, refers to the integration of digital technologies such as the internet of things (IoT), artificial intelligence (AI), and machine learning into industrial processes. Industry 4.0 levers include smart metering, real-time optimization, predictive maintenance, augmented reality, remote monitoring and control, data driven supply-demand matching, rapid experimentation and simulation, and others technologies. Industry 4.0 has the potential to transform the way that energy is produced,

distributed, and consumed, and can support the decarbonization in a number of ways (Mastrocinque et al., 2022). Smart grids can be used to optimize the flow of electricity from renewable energy sources, and energy management systems can be used to optimize the use of energy in buildings and industrial processes. Such technologies can be used to monitor and control energy systems in real-time, promoting efficiency and reliability. Combining IoT enabled devices with ML algorithms can be used to optimize operations. Furthermore these technologies can facilitate the integration of renewable energy sources into the grid providing predictions and supervision capabilities.

16. Real-time data as energy market enabler

During the series of interviews we did aim to understand the different ways in which companies and individuals experience the new ways of participation on energy market with great emphasis on the decarbonization, liberalization and digitalization. Conducting the interviews, we began with presenting the potential possibility to get involved and utilize the digital platform for peer-2-peer or energy community energy trading utilizing real-time billing and control with instant micro contracting and settlement in order to gather information about their experiences and understanding of the opportunity. After conducting the interviews we analyzed the input in order to identify common topics and patterns in the participants' responses in order to define a set of categories describing their ways of perception and preferences. The qualitative output from the phenomenographic approach allowed us to understand their experiences and preferable ways of participation.

As shown in the Table 1, there was no interest in participating in the direct energy trading as the participants did not find the trading as a viable business opportunity or a way to immediately better the energy economy. On the contrary, the access to real-time, zero lag energy consumption data was found attracting, and opening the possibilities to better integrate own business or technical processes, and enable transformative move towards Industry 4.0.

Table 1. The interview output from different entities relevant for energy market players categories

Entity	The output
Energy community	The energy community was interviewed right before their set into technical operation. The community consisted of handful of private buildings where some of them provided the PV energy and others were suited with local energy storages. The community stakeholders found the idea of peer-2-peer real-time micro transactions very interesting and opening new possibilities for enhancing the efficiency of the community operations. Later on, during the business cases analysis it became obvious that the potential benefits did not match in magnitude those from entering the distribution fee rebate program as an energy community, thus the original idea was found not economically sound. Another interesting option was to use the online system for immediate real-time billing beating the typical +1M delays expected from the DSO operated meters. That was found as a way to monitor the real-time operations end enhance the community efficiency with the in-house competence.

Table 1 cont.

Municipal utility with own renewable power generation	The municipal utility entity was not interested in direct involvement in any form of real-time transactions due to the underlying need to promote the technology among the potential partners and related risks. The organizations such as energy communities or clusters were found as better suited embodiments for coordinated rollout of such market making solutions, where the communication and integration of the efforts could be executed effectively. The only need expressed was the need for real-time, high frequency refreshed data allowing for optimizing of operation of remote processes within the same business organization.
Midsized energy selling company	The midsized energy selling company was mainly interested in the billing functionalities allowing for independence from the DSOs. The smart metering was seen as a business opportunity to enhance the product portfolio and the value chain for the customer.
Individual prosumer, consumer with power generation capacity	The individual prosumer was mainly interested in cost efficiency in utilization of currently contracted power supply. The presence of PV generation enabled the ability to maximize self-consumption. As the process involved utilizing the energy availability prediction and the demand estimation with selective demand side response, there was an identified need for more complex control system with IoT enhancements.

17. Energy related data exchange related concerns

Besides the benefits and cost efficiency of cloud based or SaaS solutions for data collection and processing, some business models expose the end users to several data related risks. Among the others there are privacy concerns, lock-in risks, and service neutrality related risks.

Privacy or data confidentiality concerns are important for both individuals and for business operations. The knowledge exploration and development of knowledge base utilized in e.g. supervision or optimization of processes is acquired from the generalizations done on the data representative for the use case, but originating from different sources. On technological level there are anonymity guarding technologies and designs implemented to fulfill the market requirements, but with varying results. Fortunately, there are regulatory frameworks and policies defining the responsibilities of all actors involved in the data related operations, and recently those initiatives become of more causative than only supervising nature, shaping long term goals. One of the most significant endeavor in this field is current Open Data initiative by the Open Data Institute.

The service neutrality related to utilities would refer to an idea that utility companies do not discriminate against or charge differently for certain types of network related services. With the digitalization utilities or other companies collecting the consumption data, might find it tempting to try to abuse their position to gain from that information without the end user consent or build anti-competitive advantage on the market.

Data lock-in risk refers to the risk that an organization becomes dependent on a platform or system for data storage, or processing, and is unable to change the vendor easily. This can apply to the energy market when an entity uses a proprietary system for managing and

analyzing data related to energy, and becomes dependent on that system for critical business operations. Inability to migrate data to a different system for any reason, or a risk of losing access to important information is a clear sign of that risk emerging.

18. Role of real-time data and ML process supervision for automated efficiency oriented knowledge base acquisition in enabling energy market participation

Typically, energy usage evaluation is based on the relation between the independent factors such as outside climate and energy used to provide functionality such as stabilized indoor climate. The dependency between causing factors and energy consumption with the technical level of relevant data selection and modeling non-linearities is still a work in progress (Fan et al., 2008; Kusiak et al., 2010; Nguyen et al., 2014; Norén, 1997) and reliable and scalable instruments for the evaluation of building energy use influenced by the complex factors is highly demanded (Bae, Chun, 2009; Dexter, 1996; Gadd, Werner, 2013; Stern et al., 2010). However in modern objects equipped with IoT and automation energy usage patterns can be more complex leading to the need for more granular in time identification of the knowledge base necessary for diagnostic reasoning.

Furthermore, the individual energy consumption scale discards all methods, but fully automated preferably with the implementation of Machine Learning (ML) (Kiluk, 2006). In such dynamic circumstances the quality of ML obtained diagnostic knowledge is prone to degradation with the time as the energy consumption process conditioning or usage patterns changes.

In the analyzed process substantial knowledge was obtained from the billing data representing energy consumption measured by the smart meters used by the energy provider on billing purposes. The collected data was densely sampled on the population covering thousands of similar processes in Scandinavia (Kiluk, 2006). During the preprocessing measurements were converted into unified common form expressing each process efficiency in utilizing supplied energy. Furthermore, the time series were transformed and aggregated into the regression coefficient vectors. In such way the numerical representation of energy efficiency granted comparability of individual processes and development of the similarity measure based on the statistical significance of each coefficient pair differences. Thus, implementation of unsupervised ML methods was possible (Kiluk, 2012) (Fig. 1).

Carefully crafted clustering methods allowed for the generalization taking into account expected distribution of objects representing processes with different and meaningful properties resulting in binary efficiency classification. Clustering process involved use of nearest-neighbor agglomeration and resulted in the partitioning of all supervised processes into sets with clear diagnostic meaning, thus provided means for automated energy efficiency classification. Furthermore, automated application of such ML processing allowed for time and cost effective generation of the series of classifications for each incoming batch of energy consumption data. Each of the results represents, a separate knowledge base (KB) (Pawlak, 1991), and the whole series depicts the evolution of such information system. Because of irreversibility of the changes originating from dissipative nature of energy conversion and

systems maintenance and degradation the observed sequence constitutes an evolution (Kiluk, 2014). The term concept drift relates only to a part of such evolution and to the resulting degradation of the ML models usability (Berghout et al., 2022; Chen et al., 2021; Fekri et al., 2021; García et al., 2023).

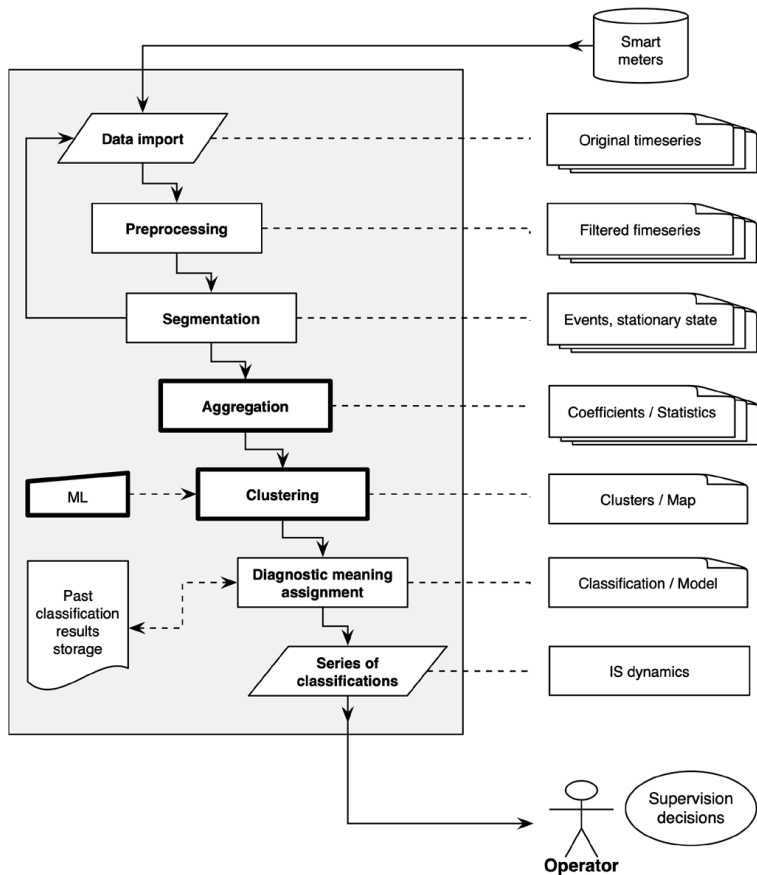


Fig. 1. Data processing and knowledge discovery process

Source: (Kiluk, 2006)

In our research we did compare the output from application of trivial static information system (IS) omitting the KB dynamics (Pawlak, 1997) with the output IS containing the dynamics of changing KB discovered using current real-time data in automated knowledge discovery process. In the presence of the nonlinearity of supervised processes, inclusion of KB dynamics allows for further enhancement of automated efficiency classification, only possible when the update process occurs frequently and with actual data feed. Thus, the possible benefits from the use of automated diagnostic knowledge discovery are two folds, one from fighting the diminishing quality of models, second from inclusion of the KB dynamics

to further enhance the efficiency classification quality. The need for accurate and quick energy efficiency evaluation and minimizing the supervision lags puts a pressure on the frequent updates of the KB in automated diagnostic reasoning systems. That is usually the case for energy related supervision due to the fact that the necessary knowledge can be gathered directly from the data (Kiluk, 2017). Besides the refresh frequency the dynamic approach leads to increased and stable IS quality across multiple prediction horizons (Fig. 2). The knowledge degradation measure of the uncertainty of IS prediction was used in the supervision process with the underlying concept of drift originated from aging of classification systems and expressed with the IS entropy (Kiluk, 2017).

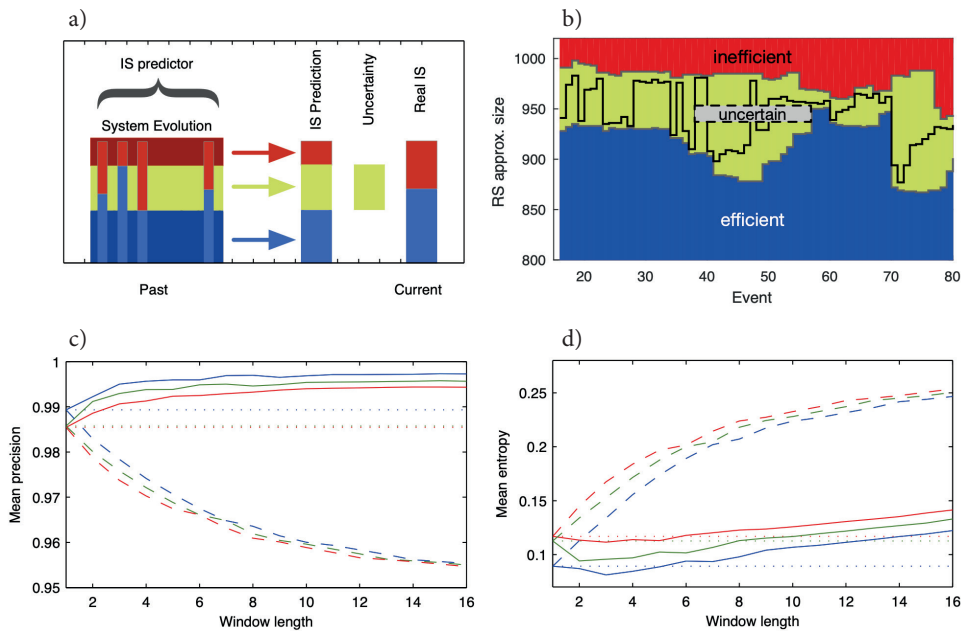


Fig. 2. IS predictor: a) predictor principle; b) uncertainty set size induced by migration from and to certain positive (blue), possible positive (yellow) and certain negative (red) predicted classes, here with window length $K = 7$; c) prediction precision for multiple approximating window lengths; d) conditional entropy. Solid line – certain predictor, dotted line – trivial predictor, dashed line – possible predictor depicting the worst scenario impact of the concept drift. Line colors for prediction horizon length: $s = 1$ (blue), $s = 2$ (green) and $s = 3$ (red)

Source: (Kiluk, 2017)

The observed differences between entropy and precision of static IS and dynamic IS reflect slower aging of the contained knowledge with the time despite the nonlinearity of underlying technological process of energy dissipation for indoor climate control. Static knowledge degrades faster contributing to increased demand for maintenance and expertise and driving up the system maintenance costs. Those observations lead to the conclusions that the quality and costs of data driven ML based technologies typical for Industry 4.0 rely

on the access to immediate real-time data and real-time automated ML based supervision. Thus, the access to the frequent measurement is a necessity in order to provide accessibility to accurate, on time and cost effective expertise promoting the energy efficient operations.

19. Conclusions

The output form interviewed entities representing different roles on the granular market unveils strong need for the Industry 4.0 and smart grid related functionalities. This requirement could be fulfilled with real-time energy measurement data and expertise or instrumentation enabling efficiency and diagnostic data analysis. In spite of the ML adoption, delayed data and semi-automated analysis are significantly less accurate than automated ML based tools fed with the real-time data stream.

The lack of interest in building local markets originates from the lack of regulatory frameworks and no clear signals from the DSOs slow to provide solutions enabling e.g. virtualization, dynamic distribution fees or other products promoting direct peer-2-peer transactions within local distribution network.

This output is distinctive in a way that the future role of DSOs is indeed in promoting the new ways of interactions and integrations between current and new actors. The historical constrains of DSOs together with the mix of technical and organizational responsibilities they bare do not ease the DSOs transformation and adoption of new energy market models.

Conclusions from evaluation of impact of the velocity and quality of the data on algorithmically obtained diagnostic knowledge are directly in line with the strong orientation of interviewed entities towards relying on real-time, dense energy consumption measurement availability. Thus, the role of digitalization is recognized in the current efforts in decarbonization and liberalization as demonstrated.

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CHAPTER 7

Knowledge-based Economy and Priorities of Poland's Innovation Policy

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Summary. The chapter deals with the current and widely discussed issues of creating a knowledge-based economy and the role of innovation in this process. Innovation barriers were systematized based on the criterion of cause-and-effect relationships occurring in innovation processes. It has been proven that the level of innovativeness of the economy is influenced not only by the assumptions of the innovation policy, the level and structure of financing, but also by behavioral factors. The need for a systemic approach to the problem of innovation and the development of an effective innovation policy in Poland was justified. Principles for the creation and implementation of this policy have been formulated.

Keywords: knowledge-based economy, economic development, innovation, innovation policy

1. Introduction

Knowledge-based economy (KBE) is no longer a purely theoretical concept. The practice of functioning of the economies of developed countries proves the increasing degree of involvement of knowledge not only in the economic sphere, but in all areas of society's life. One of the dimensions of KBE is innovation, which on the one hand is a "product" of KBE, on the other hand – it determines the directions, scope and areas of knowledge that should be acquired, supplemented, systematized, transferred and used in order to meet the increasingly serious challenges of civilization.

The subject matter discussed in the article is extremely extensive and is displayed in scientific publications from various points of view. It seems, however, that the mutual relations between the KBE and the level of innovation in the economy as a research object need special attention and are an introduction to further considerations. In turn, the issue of innovativeness of the Polish economy, including the study of its barriers and the creation of

innovation policy, is particularly topical due to the low effectiveness of the efforts undertaken by the authorities in this regard. Among the important, but relatively rarely discussed problems in scientific publications, one should distinguish the behavioral aspects of the growth of innovation. The problem of innovation requires not only improving the management of innovation processes at the level of the state, region and enterprise, but above all reforming the approach to creating pro-innovative attitudes of society, which requires the inclusion of not only higher education, but also the education system in the sphere of innovation policy.

2. Knowledge-based economy and innovations

The knowledge-based economy (KBE) is defined by the OECD and the World Bank as a type of economy in which knowledge is created, assimilated and used more effectively by enterprises, organizations, individuals and communities. It is not narrowly focused on high technology industries or information technology, but rather “presents a framework for analyzing the range of policy options in education, information infrastructure and innovation systems that can help kickstart the knowledge economy” (Kukliński, 2001).

The World Bank has identified four pillars of the KBE:

- education and training,
- information infrastructure,
- economic incentives and institutional regime,
- innovation systems.

On the one hand, innovation systems reflect the effectiveness of activities related to other KBE pillars, and on the other hand, they indicate areas and directions for introducing the necessary changes within these pillars. Therefore, the innovativeness of the economy is both an indicator of the progress in creating the KBE, as well as the flexibility and effectiveness of the state’s actions in this direction. The summary of the KEI (Knowledge-Based Economy Index) and SSI (Summary Index of Innovation) indicators of the innovation leaders in the EU and Poland indicate a high level of correlation between them (Table 1).

Table 1. Knowledge-based economy index (KEI) and summary innovation index (SII) of Poland and EU innovation leaders

Country	KEI	SSI
Poland	7.38	0.308
Denmark	9.58	0.689
Sweden	9.52	0.731
Finland	9.37	0.708
Norway	9.27	0.621

Source: World Bank and European Innovation Scoreboard 2021

The close links between the innovativeness of the economy and the progress in creating the KBE lead to the conclusion that the SII indicator is representative as a measure of compliance of the economy with the KBE guidelines.

The analysis of the dynamics of the SII index for the Polish economy seems to be quite positive – from 0.240 in 2012 to 0.308 in 2021. However, Poland is still one of the last places in the EU innovation ranking, ahead only Romania, Bulgaria and Latvia.

The list of statistical data presented in the European Innovation Scoreboard allows, to some extent, to identify the weaknesses of Polish innovation.

The chart presented in Figure 1 makes it possible to estimate the position of Poland against the average of the EU and the innovation leader (Sweden) in the cross-section of 12 dimensions of innovation.

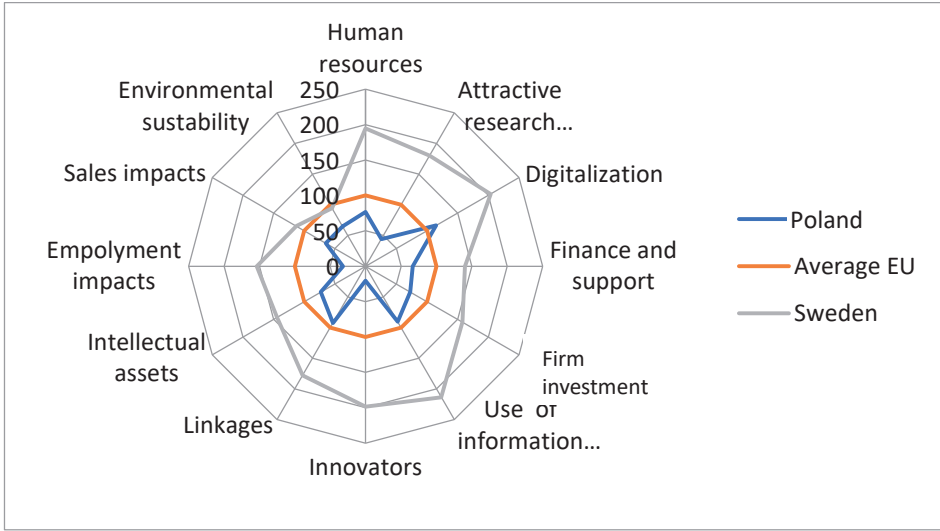


Fig. 1. The position of Poland against the average of the EU and the innovation leader (Sweden) in the cross section of 12 innovation dimensions

Source: own study based on the European Innovation Scoreboard 2021

The presented data show that Poland’s strengths in the studied area are digitization of the economy, the use of information technologies and links in the field of innovation, while the weakest areas are innovative activity at the SME level, the impact of employment, and the attractiveness of the research system. However, a comparison of selected indicators across these dimensions allows for a more precise identification of the weaknesses of the innovativeness of the Polish economy (Fig. 2). The relatively high level of the “Linkages” dimension is due to the high mobility of labour resources (146.2% indirectly in the EU), and the “human resources” dimension to the large number of people with higher education. On the other hand, the quality of this education is to some extent reflected by the number of doctoral students (19.6% compared to the EU average) and the ability to learn throughout life (43.3%). To some extent, the attractiveness of the Polish research system compared to the EU is demonstrated by the number of foreign students in doctoral studies (13.5%).

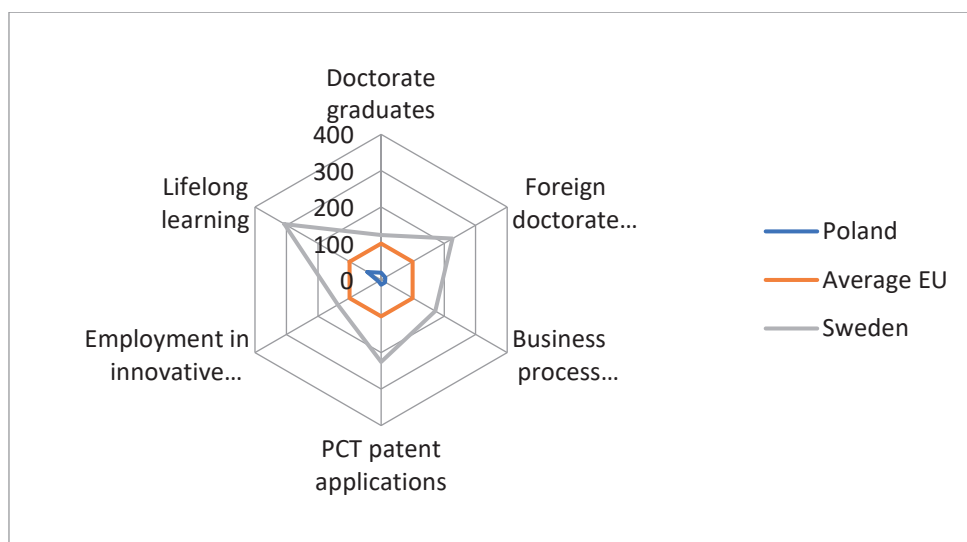


Fig. 2. Selected innovation indicators of Poland, Sweden and average level of EU countries.

Source: own study based on the European Innovation Scoreboard 2021

Certain indicators that make up the SII do not take into account the qualitative nature of innovation processes. The relatively high level of intellectual capital in Poland is the result of the high value of the share of people with higher education, although the quality of this education is not taken into account. Alike a significant level of investment in innovative activities is not caused by good financial results of enterprises Poland is a net importer of innovative products. The inflow of EU funds allows enterprises to finance the purchase of innovative products (technological systems and their components, software, techniques, etc.) abroad. In the long run, this has a negative impact on the innovativeness of the economy, because “EU funds destroy innovation” (Rybiński, 2013).

3. Innovation barriers

Reading scientific publications and statistical data characterizing the cause-effect relationships between the innovativeness of the economy and its effectiveness leads to the conclusion that the problem of increasing the innovativeness of the Polish economy as one of the key factors in creating a knowledge-based economy is systemic and should be solved taking into account social, economic and political determinants of socio-economic development and the need to develop and effectively implement the state’s innovation policy. The reasons for the low level of innovativeness of the Polish economy most often mentioned in scientific publications are:

- lack of sufficient incentive for innovative activities on the part of the authorities (Jasiński, 2014; Ministerstwo Nauki i Szkolnictwa Wyższego, 2006; Pławgo, Kornecki 2010; Stawicka, 2017);

- small demand for innovations among Polish companies (Głuszczyk, 2012; Ministerstwo Nauki i Szkolnictwa Wyższego, 2006; Ministerstwo Rozwoju, 2016; Nieć, 2011);
- low effectiveness of cooperation between the research sector, administration and business (Ministerstwo Rozwoju, 2016; Róžański, 2018; Rybiński, 2011; Weresa, 2020);
- low effectiveness of the state and economic institutions in creating conditions for development based on trust, lack of appropriate institutional infrastructure (Hausner, 2012; Ministerstwo Rozwoju, 2016; Opolski 2020; Piotrowska, 2013; Strużycki, Bojewska, 2011; Stryjek, 2015);
- structure of the economy (Matusiak, Guliński, 2010; Ministerstwo Rozwoju, 2016; Weresa, 2020); dominance of large companies, blocking the possibility of emergence for new entities (Frankowski, Skubiak, 2012; Głuszczyk, 2012; Stawicka, 2017; Strużycki, Bojewska, 2011, pp. 22–23);
- lack of information on possible cooperation and the benefits resulting from it, reluctance to cooperate (including science) (Głuszczyk, 2012; Nieć, 2011; Piotrowska, 2013; Róžański, 2018; Rybiński, 2011; Strużycki, Bojewska, 2011, pp. 22–23);
- ignorance of scientists about business realities and the market (Grajkowski, 2012; Ministerstwo Nauki i Szkolnictwa Wyższego, 2006);
- bureaucracy (Ministerstwo Nauki i Szkolnictwa Wyższego, 2006; Rybiński, 2011);
- high costs of investment preparation and implementation and lack of access to financing sources (Bukowski et al., 2012; Głuszczyk, 2012; Grajkowski, 2012; Nieć, 2011; Plawgo, Kornecki, 2010; Róžański, 2018; Stawicka, 2017);
- lack of qualified personnel and low level of innovation management in the enterprise (Grajkowski, 2012; Głuszczyk, 2012; Matusiak, Guliński, 2010; Nieć, 2011; Piotrowska, 2013; Róžański, 2018);
- low level of financing of science and expenditure on R&D in companies (Rybiński, 2011; Weresa, 2020);
- insufficient quality of science and too little internationalization of research (Rybiński, 2011; Weresa, 2020);
- difficult access to consulting (Róžański, 2018);
- allocating EU funds to import innovation instead of investing in own of R&D development (Gasz, 2015; Hausner, 2012; Rybiński, 2013);
- the education and training system does not meet the needs of the economy in terms of innovation (Frankowski, Skubiak, 2012; Rybiński, 2011);
- awareness and cultural barriers, mainly mental barriers related to the lack of trust as well as the lack of awareness and low social acceptance for innovative attitudes, including the use of stereotypes (Grajkowski, 2012; Matusiak, Guliński, 2010; Myjak, 2018; Rybiński, 2011);
- systemic and institutional barriers, mainly affecting excessive regulations, excessive number of legal acts often inhibiting the development of innovation and extending the process of creation and implementation (Bukowski et al., 2012; Hausner, 2012; Leal Filho, 2005; Matusiak, Guliński, 2010; Nieć, 2011; Piotrowska, 2013; Stawicka, 2017; Strużycki, Bojewska, 2011, pp. 22–23).

The authors of scientific publications in the field of research issues often make attempts to systematize the barriers to innovation based on the use of various criteria for this purpose. These criteria include, among others, stages of the innovation cycle, sources of internal and

external barriers, structural and regional differences, etc. However, solving the problem of low innovativeness of the economy requires establishing cause-and-effect relations, covering the entirety of innovative activity and its conditions, because some of the above-mentioned the above-mentioned barriers are primary, the second part is secondary.

The effectiveness of the state in the field of innovation reflects the level of innovativeness of enterprises. Therefore, the identification of barriers to innovation and the search for directions to overcome them should be considered through the prism of the company's innovative activity.

The internal determinants of the company's innovative activity can be described with the "know, can, want" model (Oksanych, 2020b) and include:

- knowledge resources (formal and informal);
- resources enabling the transformation of this knowledge into an innovative product (mainly financial resources);
- management system where the key role is to be motivated.

On the one hand, external conditions determine the level of motivation to conduct this activity, and on the other, they encourage enterprises to accumulate these resources and seek ways to use them more effectively.

The primary element of each innovation is a certain idea. Knowledge and motivation are the necessary conditions for its creation. Only a motivated employee, armed with knowledge, willing to show initiative that can be a source of innovation. It is especially important if such an initiative is manifested by a manager, as it is his responsibility to make decisions. This aspect of innovative activity was emphasized by P.F. Drucker, who considered the initiative of managers one of the most important determinants of creating a competitive advantage of the enterprise (Drucker, 2006). The ability to learn throughout life and the ability to think and behave creatively arises in the process of education and higher education. Without these skills and abilities, it is difficult to count on the emergence of innovation, even in the conditions of a favorable innovative climate and a significant level of funding for science. Conversely, the effectiveness of the education and higher education system has large influence on the level of innovation in the economy, as evidenced by the experience of the Scandinavian countries (Anioł, 2013; Broström et al., 2021; McKelvey, Holmén, 2010).

Defects in the education and higher education system, mainly due to the maladjustment of higher education to the needs of the market, result in low creativity of university graduates and the level of ability to acquire and effectively use knowledge. Therefore, the level of Poland's intellectual capital is low compared to other EU countries. The "Report on Poland's Intellectual Capital" indicates that, according to the level of intellectual capital among the 16 analyzed EU countries, Poland ranks 13th in the ranking for the generation of children and youth, 13th for the generation of students, 14th for the adult generation and 16th for the senior generation (Sopińska, 2013).

Behavioral factors translate into problems of innovation in enterprises. Passive attitudes of employees, lack of willingness to engage in innovative activities in conjunction with macroeconomic factors that inhibit this activity, result in low innovativeness of enterprises. The result is low innovativeness of the economy, the dominance of industries with low and medium-low production technologies (Oksanych, 2020a).

In particular, the area of financing education, science and innovative activity should be distinguished. In the last 5 years, public expenditure on financing science has increased by over 30%. It is an important factor in the growth of innovation, as the increase in public spending on science and R&D results in increased private sector investment in this direction. “There is no country where private expenditure would be high without explicit public support” (Bukowski, 2012, p. 10).

However, the increase in expenditure of the public sector on science in itself does not mean an acceleration of the pace of growth of innovation. Without an appropriate innovation policy and reforming state institutions responsible for the development and implementation of this policy, it is difficult to expect any noticeable changes in the field of innovative activities. “Increasing public involvement in financing innovation should be accompanied by institutional and regulatory reform of the R&D sector, ongoing evaluation of pro-innovation policies and drawing conclusions from domestic and foreign experiences. This allows to minimize “the barren loss effect” (support for projects that would have been created anyway) or the displacement of private investments by increasing public expenditure on innovation (Bukowski, 2012, p. 11). Unfortunately, the activities of state institutions in this area so far have been ineffective. “The way of spending money on innovation so far is mainly to spoil the market and innovation. The entire program »Innovative Economy« is anti-innovation, precisely because it deals with injecting innovation into enterprises instead of creating conditions for enterprises to be innovative” (Hausner, 2012).

Therefore, the level of innovation in the economy depends on the primary factors (areas of state functioning), which are:

- economic, administrative and legal conditions for conducting innovative activities;
- financing system (size, scope, structure and allocation of funds) for innovative activities (science, R&D, innovation infrastructure);
- creating pro-innovative attitudes of society, the basis of which is the education and higher education system.

These areas determine the effectiveness of the state’s innovation policy, because the decisions made in them directly or indirectly affect the level of innovation in the economy and determine progress in creating a knowledge-based economy.

The diagram presented in Figure 3 reflects the most important cause-and-effect relations between the areas of innovation policy and the behavioral, micro- and macroeconomic aspects of conducting innovative activities.

One of the main reasons for the low effectiveness of innovation policy is the lack of a systemic approach to solving this problem. The state’s activity in all areas presented in the table must be coordinated and be systemic in nature. Innovation policy must cover not only the sphere of direct activity in the field of innovation, but also be closely related to social policy, creating the world view of society to match the needs of the knowledge-based economy. The knowledge-based economy paradigm consists, among other things, in the fact that, on the one hand, it is necessary to create pro-innovative attitudes of society, making people aware of the role of knowledge in socio-economic development, on the other hand – it is possible only with the active role of the state, which must develop and effectively implement appropriate flexible and effective innovation policy. In other words, it is about two key

closely related aspects of the effective creation of a knowledge-based economy – behavioral and institutional. The behavioral aspect manifests itself in creating pro-innovative attitudes in society, which depends primarily on the efficiency of the education system and higher education. On the other hand, this system is oriented towards meeting the socio-economic needs. The needs of the economy are determined by the knowledge, skills and qualification requirements of the workforce. If the economy does not need innovation, the education and higher education system will not create pro-innovative attitudes of the society. On the other hand, decisions about the strategy of socio-economic development are taken by authorities, that is, certain groups of people who represent the society and are authorized to make decisions in an appropriate scope. If the society does not have pro-innovation attitudes, the authorities will also not be effective in increasing the innovativeness of the economy.

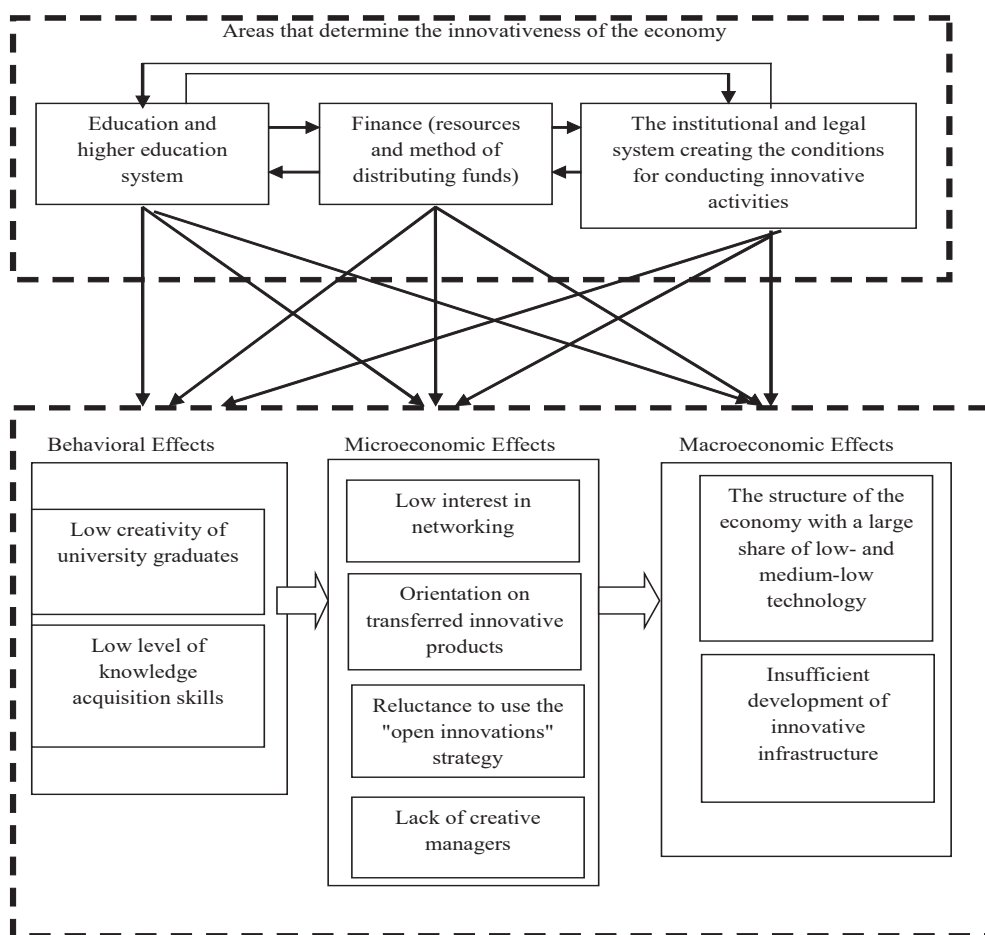


Fig. 3. The most important cause-and-effect relations between the areas of innovation policy and the behavioral, micro- and macroeconomic aspects of innovation activities

4. Directions for creating and implementing effective innovation policy

Creating a knowledge-based economy in Poland is not possible without the development and implementation of an effective innovation policy, because the previous state's activity in this area is characterized by inconsistency and comes down to taking not always coordinated actions in selected areas of the innovative process.

The state's innovation policy can be defined as "a system of central administration activities supporting the creation, implementation and dissemination of technical solutions – this is: (1) activity performed by one of the three main actors on the innovation scene, (2) activity related to the national innovation system and its shaping and (3) a component of economic policy, but specific, because it has many non-economic instruments up its sleeve" (Jasiński, 2018, p. 223).

The state (parliament, government and other institutions of the central state administration) influences innovative activities, e.g. by: creating legal provisions regulating this activity, setting long-term directions of research and setting priorities in this area, financial decisions, i.e. financing public research (institutions, projects), general supervision over the functioning of public scientific institutions and the implementation of research programs and projects, issuing orders or bans related, for example, to the protection of the environment, health or safety of users of new technology (Jasiński, 2014).

Low innovativeness of the economy means low effectiveness of the state's innovation policy. In practice, this is reflected in the low effectiveness of individual instruments of this policy.

The analysis of barriers to innovativeness of the Polish economy makes it possible to identify those areas of innovation policy that need changes and to formulate its goals (Table 2).

Table 2. Areas and objectives of the innovation policy

Areas of the innovation policy	Objectives of the innovation policy
Finance	– increased financing of science, – optimization of the structure of financing science (support for R&D activities and implementation of innovations),
Education, higher education and science	– creating pro-innovative attitudes of young people, engaging students in R&D activities, – organization of internships and apprenticeships in R&D institutions and centres, – adapting scientific research to the needs of the economy
Law and legislative regulations	– adjustment of the judiciary to EU requirements and standards, – protection of intellectual property, – reducing bureaucracy and unnecessary administration of innovative activities, – acceleration of judicial and administrative procedures
Infrastructure of innovation	– providing access to information, – providing access to outsourcing, consulting, brokerage, expertise, etc.

Table 2 cont.

Areas of the innovation policy	Objectives of the innovation policy
Organizational and economic conditions for conducting innovative activities	– creation of an innovation-friendly economic climate (optimization of the tax system, support for the creation of cooperation networks, regional innovation systems, promotion of innovative activity), – increase in the efficiency of state institutions, – effective coordination of public policy
The structure of the economy	– an increase in the share of high and medium-high technology industries, – optimization of the structure of the economy

Source: own elaboration based on Jasiński (1992), Jurkowska (2009), Ziemia, Świeszczak (2012)

Like any type of economic policy, innovation policy must be based on certain principles. The most important among them are the next ones.

System approach. Defining systemic as “a feature of something that constitutes a system – an arrangement of elements with a clear structure” (Glosbe, 2020), this principle should be interpreted as the necessity to create an innovation policy based on a systemic approach. This means the necessity to structure it and take into account the mutual relations between its components. The problem of increasing innovation should be considered as a systemic problem. The lack of coordination and the lack of consideration of cause-effect relations between individual areas of the innovation policy are a serious barrier to the innovativeness of the economy and prevent the creation of a knowledge-based economy. The lack of a systemic approach makes individual efforts to increase innovation ineffective.

A combination of market self-regulation and state intervention. The rule provides for an indirect role of the state in regulating innovative activity. The state must create the conditions in which the private sector would be interested in conducting it. Under these conditions, the market self-regulation mechanism will encourage market participants to engage in innovation processes.

Balance of interests. Reconciliation of the economic interests of the agents of innovation processes – the state, industry, science – is one of the necessary conditions for the growth of innovation. Each of the agents of the innovative process will be motivated to engage in innovative activities and will look for ways to intensify it and increase efficiency, if it is in the sphere of his interests. It follows from the basics of formulating goals in management theory (*SMART Goals...*, 2017).

Social responsibility. Interpreting Corporate Social Responsibility, defined as “the attitude of entrepreneurs towards sustainable development in the economic, social and environmental dimensions, in relations with current stakeholders, as well as in the process of protection and development of resources necessary in the future” (Rok, 2012, p. 424), to a large extent it is determined by the assumptions of the innovation policy, as it is business that is the greatest beneficiary of innovative products.

Creating pro-innovative attitudes of the society, especially young people, managers and owners of enterprises, officials. The behavioral aspect of innovation policy is becoming more and more important in terms of creating a knowledge-based economy. Knowledge

transforms into innovation only under certain conditions, one of which is the motivation of innovation “generators”, that is, people. The system of education and higher education, aimed at creating pro-innovative attitudes, is one of the key determinants of the growth of innovation in the economy. This is confirmed by the achievements of the innovation leaders in Europe – Finland, Sweden, Norway and Denmark. “The factor enabling the creation of innovation is imagination, which must be shaped by the education system, especially the education system. Mechanical, memory and passive learning will never open enormous perspectives of the mind and will not encourage to change and transform” (Opolski, 2020, p. 14).

Flexibility. Knowledge ages and needs constant replenishment. An effective innovation policy must ensure that knowledge is constantly supplemented, especially in those areas that are needed by the economy. Flexibility also means a quick response to changes in the state and development trends in the economy and society.

Social acceptance of the need for innovation. Innovation is always associated with change and risk, which often provokes opposition from these or other market agents or social groups. Therefore, the state’s innovation policy must be created on the basis of social acceptance of the need for innovation, the basis of which must be the promotion of goals, tools and the expected results of the planned changes, both for society as a whole and for individual social groups.

Openness. The innovation policy should foster the integration of efforts of all participants of the innovation process and building a cooperation network, as it is a necessary condition to reduce the costs and risk level of innovative projects.

Adherence to these rules will ensure high efficiency of the innovation policy and make it a tool for creating a knowledge-based economy.

5. Conclusion

Creating a knowledge-based economy is a permanent and consistent process, covering all aspects of socio-economic development. The basic condition for the effectiveness of this process is awareness of the lack of an alternative development model, the basis of which is the need to constantly acquire, supplement, exchange and effectively use knowledge. Among the basic features of the knowledge-based economy, contemporary scientific concepts distinguish the increase in the innovativeness of the economy. To some extent, innovations reflect the effects of the use of knowledge in the economy, the effectiveness of the innovative system, the degree of society’s involvement in the process of changing the management model, consisting in the departure from the key role of “classic” resources and the transition to a model of development based on the use of knowledge.

Each of the many aspects of the problem of creating a knowledge-based economy is a relatively separate area of research. The review of scientific publications leads to the conclusion that the interest in the discussed problem is constantly growing. However, attention should be paid to the necessity of a systemic approach to the conducted research, which would take into account the cause-and-effect relations between individual areas of the process of creating a knowledge-based economy. It seems that the most current research directions in this area are behavioral aspects of increasing the innovativeness of the economy and the development of an effective innovative policy. The society has to accept the changes in the paradigm of socio-economic development, and the state – to provide conditions for the functioning of the economy in which knowledge becomes its leading factor.

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PART III

Impact of COVID-19 on Companies

CHAPTER 8

Organizational Agility in Time of Uncertainty on Example of Game Industry Enterprises in Poland

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Summary. The COVID-19 pandemic made the world of science and business turn its attention to the turbulence of the environment in which enterprises operate. Uncertainty, high dynamics of changes and the complexity of the business environment make it increasingly difficult to find the right recipe for success. The solution that many entities reach for is agility. Agility is the ability to deal with volatility and uncertainty. Agile enterprises build their success on resource flexibility and the ability to adapt to changes. Based on the literature on the subject, the paper presents selected definitions of agility and indicates the features of an agile organization. Due to the pandemic situation, many sectors and businesses are facing a serious crisis. The game industry is one of few exceptions because forced stay at home due to lockdown increased the interest in games as a form of spending time both among adults (increase by 31%) and children (increase by 39%). Selected characteristics of the game industry enterprises in Poland in 2020 are presented in this context. In many cases, they undoubtedly perform excellent in the pandemic reality. Due to their financial results and the implemented business practices – they are an example of agile organizations.

Keywords: uncertainty, COVID-19, agile, game industry

1. Introduction

In recent years, European and world markets have seen significant changes caused by various processes such as globalization, the development of information and communication technologies or emerging economic crises. The COVID-19 pandemic, which has been an unprecedented phenomenon in the last hundred years has also left its mark. It was especially the pandemic that threatened the existence of many organizations on the one hand, but on the other hand, it provided a number of new business opportunities for them. For many entities, it has become a kind of “trigger” of inevitable changes that would normally occur in the future. This especially refers to the area of digital transformation, which during the pandemic

gained significant importance due to the widespread implementation and acceptance of new information and communication tools.

In the conditions of change, risk and uncertainty, lack of business continuity, the organization is expected to have a proper business approach, which is manifested in the ability to react to unforeseen circumstances. It is increasingly emphasized that the agility of the organization and agile competences such as knowledge, experience and skills are useful in such situations. Actions implemented by organizations should be characterized by the ability to adapt to changes and to take strategic actions that are characterized by high efficiency. The need to simultaneously modify strategy and maintain strategic focus is the key challenge in times of change.

Therefore, it can be concluded that an agile approach to organization management is a response to turbulent and unstable environmental conditions, which have undoubtedly increased due to the coronavirus crisis.

Two research questions have been formulated in this chapter:

- 1) What circumstances and business practices have resulted in the market success of gaming companies?
- 2) What financial effects were achieved in 2020 in gaming companies compared to the times before the pandemic?

The aim of the chapter is to present the importance of agility in the context of turbulence in the environment, to characterize the features of agile organization and agile management in theoretical approach, and to present selected elements of the strategy of companies in the gaming industry, which, as one of the few, achieved success in the uncertain times of the pandemic, and thus which can be considered agile organizations.

The main research methods used in this chapter include a literature review and an analysis of a secondary research type.

2. Turbulence in environment of modern enterprises

The concept of environmental turbulence was first used in the literature on the subject by H.I. Ansoff (1985, p. 58). It is characterized by four basic features, which include an increase in the novelty of a change, which means that important events affecting the company increasingly differ from what was known in the past, an increase in the intensity of the environment, which proves that maintaining connections between the company and its partners in the environment absorbs more and more energy and attention of the management, the increase in the pace of changes observed in the environment and the growing complexity of the environment. In turn, R. Bettis and A. Hitt (1995) described the turbulence of the environment in terms of complexity theory and chaos theory. In their opinion, the competitive environment is characterized primarily by the growing dynamics of changes, which is non-linear. As in the classical chaos theory, even seemingly unimportant causes (at the input) can cause significant changes (at the output). As J. Rokita (2007) notes, we live in the world characterized by a specific complexity and chaos. The new reality is characterized by cognitive

dissonances, uncertainty, and ambiguity. Instead of mechanistic metaphors, there are metaphors derived straight from the natural world, which are random or “crawling” (amoebae) patterns of behavior.

In the literature on the subject, the factors indicated most often as causing the increase in turbulence in the environment of a contemporary organization include (Mazurkiewicz, 2011):

- The processes of globalization and, consequently, the need for organizations to conduct activities on the international/global market.
- Increasing national and international competition that leads to focusing on customer needs and on the relationship between results and investments.
- The disappearance of many existing markets and the emergence of new ones.
- The emergence of new organizational forms that result from the functioning of various entities within the network, numerous alliances and mergers.
- Decentralization and flattening of organizational structures.
- Organizing work in the form of multitasking teams, bringing together people with interdisciplinary knowledge and skills, independent and creative people.

It also leads to:

- Fast pace of development and implementation of innovative technologies and operating techniques, which results in increasingly shorter product implementation cycles and short product life cycles.
- The activity of individual groups of stakeholders striving to satisfy their needs.

The growing turbulence of the environment makes the classic approach to strategic management lose its importance. Today, both in theory and in practice, the usefulness of forecasts, especially quantitative, based on trends and historical data, which assumes a certain inertia of the past – is widely criticized. The empirical research conducted by J.C. Collins and J.I. Porras (2003) shows that many large American corporations develop mainly by taking advantage of opportunities. The studies published by K. Krzakiewicz et al. (2006) and R. Krupski (2005) also show that about half of Polish companies develop based on the entrepreneurial use of numerous opportunities and by chance, not based on a plan. Even if the scale of the phenomenon in relation to reality is somewhat exaggerated, it seems that such facts cannot be ignored.

The turbulence of the environment is related to a situation of uncertainty, i.e., an irregular, non-linear, and unpredictable situation. It is difficult to analyze, predict and plan. The previous company's actions do not respond to the fluid situation. Yesterday's business ideas today do not guarantee success. The goals are moving and require a quick reorientation of activities. In a situation of uncertainty, the very definition of success changes. Success may represent minimizing losses or even survival of the organization.

Under “normal” conditions, uncertainty is structured, which allows for controlling it through estimation of risk and its insurance. Enterprises protect themselves against the occurrence of extraordinary threats in several ways. They accumulate reserves and develop crisis management schemes. Thus, they strengthen their resilience to shocks, the nature of which they recognize, because they may have experienced them in the past. The situation is different in the case of unstructured uncertainty related to large-scale threats that are unprecedented (Bettman et al., 2021).

In the case of unstructured uncertainty, there is a need for a special type of resilience, which results from three sources:

- 1) from the capacity to change in an active and offensive way rather than passive and defensive protection,
- 2) from the internal governance of the company and its relations with various partners (stakeholders),
- 3) from a special resource, which are soft skills related to intellectual and social capital of the company.

Still before the pandemic, many enterprises severely experienced the volatility of the business environment, uncertainty and misunderstanding of new problems, complexity (including chaos and confusion, information overload), and the need to separate information noise from material facts. The above-mentioned features of the business environment are the world of VUCA (Bennet, Lemoine, 2014). The acronym represents four words: volatility, uncertainty, complexity, ambiguity, which identify external and internal conditions determining the functioning of the organization in the 21st century. The response to the VUCA world is the approach known as “VUCA Prime” (Johansen, 2012), which represents shaping the following skills by an organization:

- V(olatility) can be contrasted with V(ision) – having a vision of the organization’s operation is especially important in turbulent times; it allows it to survive the occurring turbulences.
- U(ncertainty) can be contrasted with U(nderstanding) – organizations that have communication skills that go beyond the standard framework of individual business areas have a good chance of implementing a predetermined vision.
- C(omplexity) can be contrasted with C(larity) – appropriate management processes should be implemented to provide decision-makers with the information necessary to make the right decisions.
- A(mbiguity) can be contrasted with A(gility) – organizations should have the ability to quickly adapt and implement changes, adjusting the principles of their functioning to the chaotic environment.

3. Agile organization

A wide interest in the concept of agility among theoreticians and practitioners resulted in numerous publications in this field, but also in some terminological inconsistency (Vázquez-Bustelo et al., 2007). There are many definitions of “agility” and “agile organization” in the literature on the subject. Agility is essentially the ability to react quickly and the capacity to adapt to new conditions in response to constant, surprising and unpredictable changes in the environment of competitive markets. Rapid reaction assumes flexible adaptation by an agile organization of each of its components, such as: people, company goals, technology and organization, to unexpected changes (Kidd, 1994). In general, we can distinguish four motives of agility that are most often mentioned by the authors of the definitions. They include meeting customer needs, surviving in difficult conditions, competitive advantage and the desire to achieve better

efficiency. For example, in the opinion of R. Vokurka and G. Fliedner (1998), agility is the ability to produce and effectively offer a wide range of low-cost, high-quality products in a short time and in a full range of sizes, thanks to which the company creates value for customer through customization. Another approach to this concept emphasizes the ability to quickly adapt to the business environment. Agility understood in this way means the company's strategic ability to quickly adapt to unforeseen and sudden changes on the market (Sanchez, Nagi, 2001). According to O.E. Ofoegbu and P.A. Akanbi (2012) agility and adaptability are influenced by such organizational variables as strategic sensitivity, team commitment and resource fluidity. In yet another approach, agility can be understood as the ability to implement, at the operational level, efficient change understood as a response to growing demands (Narasimhan et al., 2006). Finally, there are also interpretations of the concept of agility as the ability of an organization to cope with changes by developing the ability to survive, despite the presence of various threats in the market environment. An agile organization can gain a competitive advantage through intelligent and quick use of opportunities in the business environment (Meredith, Francis, 2000). It should be emphasized that most of the definitions are disconnected, i.e., they focus on one basic motive for achieving agility.

4. Determinants of agile organization

When discussing the subject of agility, many authors pay special attention to the attributes of an agile organization. A synthetic list of selected proposals is presented in Table 1.

Table 1. Selected list of attributes of an agile organization

Authors	Description
Y.Y. Yusuf, M. Sarhadi, A. Gunasekaran	– speed and flexibility, – response to changes and uncertainty, – high quality and highly customized products, – products and services with high information content and added value, – activating key competences, – response to social and environmental issues, – synthesis of various technologies, – integration both within the enterprise and between enterprises
S.L. Goldman, R.N. Nagel, K. Preiss	– organizing and managing changes by creating flexible organizational structures that allow for instant reconfiguration of human and physical resources, – customer enrichment, i.e., providing them with value and solutions, not products, – using all existing company resources, regardless of their location, to bring products to market quickly and efficiently, – the company's internal cooperation and external cooperation with other entities, i.e., establishing inter-organizational relations
P.T. Kidd	– innovative organizational structure and organization management, – the skills and experience of people who form an agile workforce, – flexible and intelligent technologies that create agile technology

Table 1 cont.

Authors	Description
M. Jackson, C. Johansson	– possibilities related to changing the product, – competency changes as part of the activity, – internal and external cooperation, – people, knowledge and creativity
H. Sharifi, Z. Zhang	– ability to react: the capability to identify and respond quickly to changes, introduce reactive or initiative-taking measures, recovery of the company's good condition after the implementation of change; – competency: the ability to achieve the goals of the organization effectively and efficiently thanks to having a strategic vision, appropriate technology, sufficient technological capacity, product/service quality, cost effectiveness, high pace of introduction of new products, change management, experience, competent and endowed employees, efficiency and effectiveness of operation, rational management of the company's resources, internal and external cooperation of the company, integration; – flexibility/adaptability regarding product volume flexibility, product model flexibility/configuration flexibility, organization flexibility and organizational problems, and employee flexibility; – speed: the ability to achieve planned goals and actions as quickly as possible (e.g., by short time-to-market, fast delivery of products and services, speed of delivery and timeliness of delivery, fast operation time)

Source: own elaboration based on Goldman at al. (1995); Jackson, Johansson (2003); Kidd (1994); Sharifi, Zhang (2001); Yusuf et al. (1999)

It is worth noting that an agile organization needs agile people. In practice, this means searching for and employing outstanding employees with immense potential, focused on development and innovation, who are creative and open to change. Moreover, in such an organization, leadership concerns not only leaders, but every employee is actually predestined to that. Each of them can become a leader of change. This in turn means that the organization creates space for trials and errors. It encourages and inspires. It also means that the organization is ready to welcome ideas and implement them. Procedures support the processes, rather than impede them (Brauer, n.d.).

Despite the growing knowledge of the agile approach to management and its growing popularity in recent years, research shows that it is not a recipe for success in every case. Some market reports indicate that approximately 47% of agile transformations fail. What determines success and makes it easier for some organizations to be agile is following the three basic principles (Kubiak, n.d.):

- 1) Organizations that want to be agile must accept change in every field, and strict adherence to guidelines contradicts this principle.
- 2) Agility is a way of thinking and continuous work on self-management in change. In today's world, accepting the lack of permanence and developing an "agile attitude to life" should be one of the most desirable competences on the market.

- 3) Supporting a learning culture through the implementation of a smart and agile L&D (*learn and development*) strategy is key to success. This is because there is no one fixed set of knowledge and learning the rules does not guarantee success. Organizations that want to be agile must develop an effective plan for information exchange and employee development, using formal and informal methods that not only educate, but also mutually motivate, improve and challenge the status quo by individual team members.

The idea of functioning of an agile organization is an attempt to combine two apparent contradictions – maintaining the clarity of the direction of strategic development and, at the same time, openness to its changes. This concept assumes that in the world that is changing increasingly faster, strategic flexibility is of fundamental importance as it enables reacting to new market opportunities. But it is also a threat as it can lead to distraction and loss of strategic focus. To prevent this, it is necessary to regularly update the “course”, systematically generate innovative ideas, thoroughly assess their potential and set implementation priorities.

5. Game industry – industry of agile entrepreneurs

Although it is not always noticed, cultural and creative sectors play a significant role in economic and social development, in job creation and in the development of innovation. When analyzing numerous publications and statistical data, it can be clearly stated that together with the tourism sector, the sectors were most heavily affected by the effects of the crisis caused by the COVID-19 pandemic (Knaś, Sanetra-Szeliga, 2020; OECD, 2020). The negative effects of the coronavirus crisis did not affect all entities in the cultural and creative sectors to the same extent. Lockdowns resulted in the closure of many thousands of museums around the world and a global decline in ticket revenues in cinemas. Cancellation of hundreds of film, music, book and art festivals was painful not only for the very organizers, but for the entire chain of cooperating companies responsible for infrastructure preparation, catering, etc. The planning cycle of festivals and concerts, as well as the production of films, series and music albums was also completely disrupted (Żak, 2021).

Against the background of this dramatic information, the gaming sector seems to be definitely different, both on the global market and in Poland. It can even be perversely claimed that digital entertainment has gained popularity due to the COVID-19 pandemic. In the period of spring restrictions, in 2020, interest in streaming services, computer games, and the Twitch.tv service for broadcasting computer games increased. After the removal of the restrictions, the interest in gaming decreased to a lesser extent than in conferencing or video streaming services, which indicates a permanent trend.

The importance of the gaming industry in the world is evidenced at least by the fact that it is already much greater than the music and film industry. Within the two decades, the global gaming market has transformed from a niche branch into a powerful business and a crucial element of mass culture. The scale of revenues generated by this market is best reflected in its comparison with the music and film industry. The value of the global gaming market in 2020 is estimated at USD 174.9 billion, while the music industry has revenues of USD 20.2 billion, and the film industry has revenues of USD 42.2 billion. This means that gaming revenues will almost three times exceed the total value of the music and film market (Krampus-Sepielak et al., 2021).

There are over 460 entities involved in the production and publishing of video games actively operating in Poland. Many of them are small teams producing low-budget titles, but there are also larger companies, including those that, with their size and ambitions, compete with global market leaders. The most important of them include CD PROJEKT, Techland, the Polish branch of Huuuge Games, 11 bit studios, Ten Square Games, PlayWay, Bloober Team and People Can Fly.

In 2020, the revenues of the Polish gaming industry amounted to EUR 969 million, there were approximately 20 million declared players reported, of which 80% are adults and 49% are women. This means that we entered the top twenty most profitable markets in the world, taking 19th place. However, the trend is more important than the very rank. Each year, the value of the Polish gaming market is growing faster than in Western countries and it is estimated that in 2022 it will exceed one billion dollars (Fig. 1).

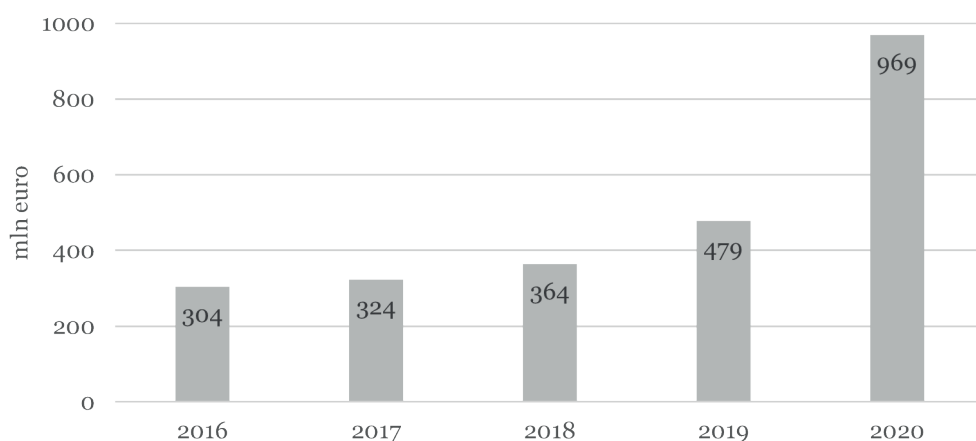


Fig. 1. Revenues of the gaming industry in Poland in 2016–2020

Source: own elaboration based on Marszałkowski et al. (2021, p. 10)

In 2020, 64 gaming companies were listed on the Polish stock exchange (the main trading floor and NewConnect), 20 more than in the previous year. 73% of the gaming companies that can be found on the WSE recorded both a significant increase in revenues and net profit in 2020 (Table 2). The largest companies include CD Projekt, Ten Square Games, BoomBit, PlayWay, People Can Fly, Creepy Jar, Bloober Team, Forever Entertainment, 11 bit studios.

The fact that the gaming industry is doing well can also be proved by the data on the valuation of shares of these entities. Between January 2019 and August 2020, Polish video game companies were very popular on the stock exchange. Between January 2, 2019, and August 10, 2020, the valuation of shares of many listed companies operating in the video game industry increased significantly. Attention should be paid to the Polish gaming company CD PROJEKT which is highest valued at PLN 32.23 billion (data as of October 30, 2020). This company remains at the forefront of WIG20 leaders, even ahead of such companies as Cyfrowy Polsat, Lotos, PZU or KGHM.

Table 2. Financial results of selected entities in the gaming industry in 2019–2020

Company name	Sales revenues [thousands PLN]		Dynamics of change [%]	Net profit [thousands PLN]		Dynamics of change [%]
	2019	2020		2019	2020	
CD Projekt	521.3	2138.9	410	175.3	1154.3	658
Ten Square Games	241133.1	578194.7	240	7685.8	151599.0	1972
BoomBit	49.7	140.2	282	(9.9)	14.6	148
PlayWay	116.2	164.1	141	97.3	229.9	236
People Can Fly	47462.0	83528.0	176	2235.0	29096.0	1302
Creepy Jar	6986.0	37671.0	539	137.0	22409.0	16357
Bloober Team	19178.5	31395.9	164	3103.4	10330.0	333
Forever Entertainment	13729.6	27322.4	199	6440.7	14281.0	222
11 bit studios	71221.2	87101,8	122	21710,3	37363,1	172

Source: own elaboration based on: CD Projekt (2021), Ten Square Games (2021), Boom Bit (2021), PlayWay (2021), People Can Fly (2021), Creepy Jar (2021), Bloober Team (2021), Forever Entertainment (2021), 11 bit studios (2021)

Polish is the ninth most common language version of video games. We have overtaken Korea in this respect and are catching up Japan. Video games are the only commodity from the cultural and creative industries that has a favorable trade balance. According to the report “The Game Industry of Poland 2021” (Marszałkowski et al., 2021), Poland is a net exporter, which is not only a very favorable economic phenomenon, but also places our country among a narrow club of countries with a very large production potential in this modern sector of economy. Polish games can relatively easily satisfy the tastes of a mass audience in the world, as shown by the international successes of such brands as The Witcher 3, Fishing Clash, The Outriders or Car Mechanic Simulator 2021. 97% of the revenues of Polish game publishers come from exports, mainly to US players (about 50%), the European Union (about 37%) and the Asian market (about 10%), including China (Marszałkowski et al., 2021, pp. 18–19).

Personal computers are the dominant target platform for our developers. Consoles, including Xbox first, then Nintendo, and finally PlayStation, come next. Then there are mobile devices (phones and tablets), followed by AR / VR headsets and finally browser productions. In 2020, domestic developers could boast of the premieres of over 600 game titles on all platforms in total.

Excellent financial results are not the only source of success for entities in the gaming industry. The market success of many entities in this industry was a result of several factors typical of the strategies of agile organizations, which include (Krampus-Sepielak et al., 2021; Marszałkowski et al., 2021):

- Expanding and diversifying the themes of games. The world-famous game “This War of Mine” is an example here. It became the first game in the school reading list in Polish system of education. This achievement can be interpreted in many ways, but by creating works that are engaged and cover important social issues, 11 bit studios, revises the opinion about games as entertainment “at an affordable level”. On the occasion of this event, in June 2020, it was announced that the school reading list would be expanded by games broadening the imagination and bringing something new to both Polish and world culture.
- Changing the method of distribution. It is hard to resist the impression that COVID-19 has not interfered with the success of many players in the gaming industry. Due to its specificity and distribution methods, the gaming industry seems to remain resilient to the pandemic crisis. Although mass gaming events, such as the Intel Extreme Masters in Katowice, had to take place without an audience, and thus lost its prestige and importance, stock market profits and overall sales grew as a result of players staying in their homes.
- Changing the method of promotion. The form of product promotion is another area of activity of gaming companies that also had to be changed. The previous big events, where new games were most often announced or promoted, either were not held (e.g., Electronic Entertainment Expo in Los Angeles) or were replaced by virtual equivalents (Gamescom). On the one hand, this could slow down the marketing promotion projects of many games, but on the other hand, firstly, considerable amounts of money that was saved because the studios did not participate in such events could be spent on other purposes, and secondly, large events were replaced by many small, previously prepared online shows.
- Location near large agglomerations. The vast majority of companies locate their headquarters in large agglomerations in the Mazowieckie (Warsaw), Małopolskie and Śląskie voivodships. The reasons for such locations are related to the populations in these areas and a large number of universities. The obvious reasons also include access to good infrastructure, good network, easy recruitment of employees. In large agglomerations there is also a good access to several types of advertising and media companies, etc. People have better opportunities to meet, exchange views, ideas, they have a good relationship with each other and that is why these centers are the industry drivers and provide “new people”.
- Cooperation and creation of new jobs. Polish companies, as part of outsourcing services, co-produce games for the largest foreign companies (e.g., Disney, Sony). Thanks to this, the gaming industry creates jobs for specialists in the areas of programming, design, graphics, UX, animation, audio, dubbing, video production, *motion capture*, specialized translation, product development, business development, financial analytics, PR, marketing, etc. It is estimated that the gaming industry in 2020 employed over 12,000 people. It can be confirmed that employment grows at an average rate of over 24% year-over-year.

- Concentration on a small number of projects. The vast majority (62%) of companies are able to develop 1–2 projects a year, and 7% more than 10. Creating up to two games at once, in an “overlapping” way, is a good practice. It means that when the first game is not launched on the market yet, but is in its final stage, people who have finished this project, for example concept artists, can start working on a new one.
- Self-financing. Own funds remain by far the most popular source of financing, as indicated by 78% of companies. Moreover, this option is used more often by entities with longer experience, which allows for concluding that the successes of subsequent games create a financial possibility for further productions. Other popular sources of financing include publishers/industry investors (37%) and investors from the non-gaming sectors (20%).
- Relying on your own strength. Almost two-thirds of companies (63%) publish their games as part of self-publishing, appreciating the freedom provided by this approach, control of the entire process of reaching the customer and the possibility of keeping entire profits in the enterprise, which in the era of the decline in the importance of physical distribution seems a very attractive solution. However, 37% of entities (especially small companies with little experience) decide to cooperate with an external publisher, and the vast majority of them choose a partner from Poland.
- Business model. The business model most followed by gaming companies is the premium model (62%), and the second most popular approach is F2P – *free to play* – (19.5%).
- The growing role of marketing, also in the context of costs. Increasing importance of spending on marketing activities – nearly 39% of companies allocate at least 10% of the costs of a given project for this purpose.
- Dominance of small and medium-sized enterprises. There are as many as 61% of entities employing less than 10 people, and slightly more than one third of companies has a staff of 10–49 people. Large enterprises account for only 6% of the entire industry. On the other hand, in terms of preferred forms of employment, civil law contracts dominate, which is observed in 57% of companies.
- Focusing on young, internationalized and knowledge-hungry teams. Men represent 74% of employees, almost 50% of employees are aged under 30, 74% of employees have higher education, 45% of people have been working in the company for less than two years, 48% of companies employ foreigners (most often from Ukraine, Belarus, the USA and France), and 60% of companies offer their employees subsidies to participate in conferences and trainings.
- Focusing on competences. Polish gaming companies still have plans to increase employment – 72% of them indicate such a demand, and the skills of candidates for employment are the most critical issue. The greatest demand is for software developers, game designers, animators, producers, graphic designers and marketing specialists.
- Self-improvement and cooperation. Many companies assess badly the preparation of potential employees in terms of working in the gaming industry. Therefore, more than half of them are ready to support or organize industry workshops, lectures and training courses to prepare the candidates for work. The establishment of a new field of study, Video Game Development, at the Film School in Warsaw was one innovative solution. The curriculum was designed by people working in the gaming industry, who are associated with this business on a daily basis, therefore they know very well what to teach young people and what they will need to create games.

- Independence. In general, the vast majority of the gaming industry representatives (71%) do not use public support. However, if they do, the most frequently indicated initiatives are programme “GAMEINN” implemented by the National Center for Research and Development, “Support for Creative Industries” Programme at the Ministry of Culture and National Heritage, R&D Relief, Go to Brand, Kreatywna Małopolska (*Creative Malopolska*) and ARP Games Accelerator in Cieszyn. The relatively low interest in this type of assistance results from the high discretionary nature of granting support, high bureaucratic burden, the need to conduct research and insufficient evaluation of financed projects.

6. Conclusions

Currently, changes in the market environment are so dynamic that traditionally organized enterprises are not able to follow them. The environment is becoming turbulent, which means that it is characterized by high complexity, the dynamics of changes and their unpredictability (Gunasekaran, 1999; Yusuf, Gunasekaran, 2002; Sharifi, Zhang 2001).

The COVID-19 pandemic caused a fundamental change in the rules of the game, as overnight we moved from the world of complexity to the world of ambiguity, i.e., a reality in which the level of complication of the environment moved into the background, and unpredictability became the basic challenge. The concept of an agile organization, i.e., one that is characterized primarily by a flexible attitude, openness to failures and differences of opinion, as well as taking responsibility is becoming an antidote to such a situation. Survival and development of such an organization is the result of cooperation and commitment of all its participants. Agility therefore is a concept qualitatively different from the previous ones used in management.

The coronavirus pandemic and the related lockdown drastically affected the work of companies around the world and in Poland. COVID-19 forced many organizations to suspend their activities or move work from offices to homes. The gaming industry is one of the few exceptions. Therefore, the chapter asks what circumstances and business practices caused the market and financial success of gaming companies. Due to the specific character of this industry, most companies managed to adapt relatively well to the new situation and continue to develop projects remotely. The gaming industry companies presented in the study undertook many adjustment activities, which consequently increased their financial efficiency. Due to the more difficult communication between the teams, the work slowed down and, as a result, some games appeared on the market later than expected, but in general, the game production segment proved to be one of the sectors of the economy that the new reality was kind to.

It is expected that the trend, which is beneficial for the industry, will continue in the future. The lockdown of schools and the search for entertainment on the Internet by the youngest Internet users was an additional favorable factor beside those discussed in this chapter. The generation of young adults for whom gaming and broadcast tracking is one of the ways of spending free time, similar to watching broadcasts from sports competitions is also growing up.

Considering the presented image of the gaming industry, it can be concluded that, despite various turbulences, there are strong, dynamically developing, successful entities on

the domestic and international market that respond to the needs of a diverse consumer. It is worth learning from these practical experiences and changing the world by implementing the concepts of agility in various organizations.

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CHAPTER 10

Impact of Crisis Caused by COVID-19 Pandemic on Enterprise Strategies. Example of Woodworking Industry

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Summary. The choice of an appropriate strategy is crucial to the development of an enterprise. Our research has determined the crisis associated with the pandemic adversely affected the woodworking industry. This is corroborated by the fact that (on the macro scale) the percentage of enterprises whose condition was assessed as good or very good fell from 60% to 20%, while of those whose condition was regarded as bad or critical rose from 27% to 52% in the period under analysis. It also turns out the intensities of the strategies applied, in particular, the strategy of market penetration and diversification, were different prior to and during the crisis, which is in line with the results reported by other researchers. The intensity of the market penetration strategy declined considerably at the time of the pandemic, while the strategy of diversification was employed more intensively.

Keywords: crisis, strategy, COVID, woodworking industry

1. Introduction

Although economic crises are natural parts of the cycle of economic development, they are challenges to enterprises (Wysłocka, 2011) and may become the sources of internal crises and threats to ongoing business (Zelek, 2000). Crises require enterprises to take appropriate actions (Siuta-Tokarska, 2011; Wawrzyniak, 1989) or even to modify their strategies (Krza-kiewicz, Cyfert, 2008; Pasieczny, 2009; Romanowska, 2015). They can afflict in particular small enterprises with their lower reserves of resources (both material and financial) (Cowl-ing et al., 2020).

Prevention is the best way of managing a crisis and anticipating it is the best method of prevention (Mikušová, Horváthová, 2019). Crisis management is a process whereby an organisation fights a crisis which poses a risk to itself, its stakeholders or the public in order to limit actual harm (Bundy et al., 2017; Coombs, 2014). An organisation's responses may be

planned or ad hoc, as initially identified and described by Pearson and Clair (1998). According to Coombs (2014), the process of crisis management consists of four stages:

- 1) prevention (steps taken to avoid crisis situations);
- 2) preparation (including a plan of crisis management);
- 3) response (application of the preparation components to a crisis situation);
- 4) revision (an evaluation of the organisation's responses to potential and real crises).

The COVID-19 pandemic had a substantial effect on the global economy. To alleviate it, governments worldwide took extraordinary measures and spent unprecedented monies on healthcare, economic stabilisation and stimuli like direct outpayments and support for part-time work (Hartman et al., 2022). The challenges the enterprises faced of keeping their business afloat focussed on efforts to determine and prioritise the key organisational resources (Brinks, Ibert, 2020). The business continuity refers to a newly formalised concept defined as an organisation's ability to continue supplying products and services within acceptable time-frames and at a specific productivity during disturbances (Gródek-Szostak et al., 2022).

The crisis associated with the outbreak of the COVID-19 pandemic in 2020 was one of the more serious. To enterprises, it spelled such unheard-of challenges as the interrupted chains of supply, reduced demand or staff in quarantine. This is a study of enterprise responses to those challenges.

Before the pandemic, the Polish furniture-making sector had celebrated its record sales and progress up the ranking of the biggest global exporters: with the estimated sales of PLN 50.5 bn and exports of EUR 11.2 bn, Poland came first in Europe (ahead of Germany) and second globally (after China) (Kaczorowska et al., 2019). The crisis in the furniture sector has been caused by the demand falling due to the ban on trade, advice to stay home, and a sudden decline in consumer confidence. Payment backlogs are the second gravest problem (Kaczmarek, Jasiński, 2021).

This study aims to analyse the impact of the crisis associated with the coronavirus pandemic on the operation of woodworking businesses. The claim: 'The crisis associated with the coronavirus pandemic had an adverse effect on the woodworking industry' is the key research hypothesis.

The following detailed hypotheses are formulated as well:

- H1: The times prior to and during the crisis were characterised by different intensities of strategies applied.
- H2: The occurrence of the crisis significantly changed the results of the enterprises studied in the dimensions analysed.
- H3: The different types of results translate into the various impacts of the particular strategies.
- H4: The market situation determines the impacts of the particular strategies on enterprise results.

This study is part of research into the effectiveness of strategies in a variety of conditions determined by enterprise environment and into the potential of applying strategic planning during some turbulent changes of the environment (Romanowska, 2010). The period reviewed exhibited a high variability of external conditions. It allowed for registering enterprise responses to varying conditions over a relatively short time – given the scale of changes during the crisis triggered by the COVID-19 pandemic, those responses involved some strategy changes as well (Suder, Kusa, 2022).

2. Methodology

Several interviews with woodworking shop owners or managers preceded the process of data collection. A survey was prepared following the interviews and completed electronically. The surveys were sent to the enterprises that had agreed to fill them before, which makes the choice of the study group intentional. The data were gathered from July to September 2022.

The impact of four strategies is analysed: market penetration (MPS), market development (MDS), product development (PDS) and diversification (DS) on the performance variables defined as: market performance (MP), financial performance (FP), and firm growing (FG). The intensity of strategy application is examined by means of the five-degree Likert scale. The survey's questions relate to how intensively a given strategy is applied (1 – the strategy is not implemented, ..., 5 – the strategy is realised with a great intensity). The respective performance variables (products) are structured to reflect answers to the relevant questions. The respondents indicated to what degree they agree with a statement concerning these variables (1 – I absolutely disagree, ..., 5 – I absolutely agree).

The respondents said to what degree they apply the particular strategies in the two periods suggested in the survey, namely: Period I – before the crisis (till March 2020), Period II – during the crisis.

The completed questionnaires were verified for the correctness and completeness. In effect, the data derived from 30 surveys served further analysis. Since the performance variables, i.e., market result, financial result, and enterprise development, are constructs based on several indicators (to be precise, they are arithmetic means), it's necessary to verify their reliability. Table 1 lists the number of questions in each particular and the Cronbach's alpha values calculated for the two periods of analysis.

Table 1. The characteristics of independent variable indicators

Indicator	Symbol	Number of items	Cronbach's alpha	
			before the crisis	during the crisis
Market performance	MP	5	0.758	0.88
Financial performance	FP	3	0.738	0.911
Firm growing	FG	5	0.807	0.879

Since all the values of Cronbach's alpha coefficient are above 0.7, the result constructs can be treated as internally coherent.

3. Results and discussion

The study was divided in two stages. A comparative analysis of the intensities of the particular strategies and the variable results in the two periods was undertaken as part of the

first stage. At the second stage, some linear models were built of the dependences of results on the strategies applied in both the periods.

For the purposes of a more detailed description of the variables and assessing how the level of the particular strategy application and of enterprise productivity changed across the periods of analysis, basic statistics were defined for the variables analysed. They are illustrated in the tables below.

Table 2 suggests two conclusions concerning the strategies under analysis. First, the average degrees of the diversification and penetration are lower than of the other strategies. In Period I (before the pandemic), the mean diversification was 2.26, whereas the ones for the remaining strategies (market and product development) were greater than 3. Likewise, the mean for the strategy of penetration was below 3 both prior to and during the crisis. On the other hand, the comparison proves the intensities of three strategies, i.e., MPS, MDS, PDS, were lower in Period II than in Period I. Thus, the intensities declined in effect of the crisis. As far as the diversification strategy is concerned, the intensity of its application is greater in Period II than in Period I. At the time of the pandemic, the mean intensity of the strategy rose by 0.62. To verify the differences noted for the applications of the particular strategies in the periods examined, some tests for dependent variables were used, namely, Wilcoxon signed-rank test and rank sum test. These tests are selected as the variables are rank and dependent data (the same group is studied, though in different periods). Tables 3 and 4 contain the results of these tests for the strategies produced by means of Statistica package.

Table 2. Basic statistics for strategies indicators in the selected periods

Strategy type	Type of statistics	Period	
		I	II
MPS	average	2.94	2.15
	median	3	2
	standard deviation	1.37	1.18
MDS	average	3.03	2.79
	median	3	3
	standard deviation	1.03	0.91
PDS	average	3.82	3.35
	median	4	4
	standard deviation	0.87	1.10
DS	average	2.26	2.88
	median	2	3
	standard deviation	1.19	1.01

Table 3. The results of Wilcoxon signed-rank test for the strategies

Strategy type	Non-ties number	$v < V$ [%]	Z	p
MPS	22	18.18	2.77	0.0056
MDS	29	44.83	0.37	0.7103
PDS	24	37.50	1.02	0.3074
DS	30	73.33	2.37	0.0176

Table 4. The results of Wilcoxon rank sum test for the strategies

Strategy type	N valid	T	Z	p
MPS	22	28.00	3.20	0.0014
MDS	29	174.00	0.94	0.3469
PDS	24	82.50	1.93	0.0538
DS	30	127.50	2.16	0.0308

The tests show some substantial differences in the periods under discussion concern two strategies, i.e., market penetration and diversification. The intensity of the market penetration strategy reduced significantly during the pandemic (compared to the time before). As far as the diversification is concerned, on the other hand, its application exhibited a marked intensification. Thus, the hypothesis H1 is upheld in part, or for some strategies.

A parallel analysis was then conducted for the results. Although this is not a case of ordinal variables, non-parametric testing is employed here as well, since the sample was relatively small and the assumptions for normal distribution are not fulfilled. Table 5 lists the basic measures of position and dispersion for the results in the two periods.

The figures in Table 5 suggest the businesses examined suffered declining results in all their dimensions. This is true of the results category, WR, where the mean fell from 3.67 to 3.57, RF, where it reduced from 3.51 to 3.28, and WF, from 3.5 to 3.3. Thus, the results did not return to their pre-pandemic levels in all the three cases. What's noteworthy, the median for the market results is higher in Period II than I.

Table 5. The basic statistics for performance in the selected periods

Performance type	Type of statistic	Period	
		I	II
FG	mean	3.51	3.29
	median	3.7	3.5
	standard deviation	0.65	0.93

Table 5 cont.

Performance type	Type of statistic	Period	
		I	II
MP	mean	3.68	3.57
	median	3.7	3.9
	standard deviation	0.57	0.84
WF	mean	3.50	3.33
	median	3.7	3.7
	standard deviation	0.63	0.97

The test results that serve to verify the significance of the result differences in both the periods are presented in Tables 6 and 7.

Table 6. The results of Wilcoxon signed-rank test for firm performance

Performance type	Non-ties number	$\nu < V$ [%]	Z	p
MP	32	56.25	0.53	0.5959
FP	21	42.86	0.44	0.6625
FG	32	43.75	0.53	0.5959

Table 7. The results of Wilcoxon rank sum test for firm performance

Performance type	N valid	T	Z	p
MP	32	248.50	0.29	0.7719
FP	21	86.50	1.01	0.3135
FG	32	205.50	1.09	0.2740

Based on the test results, it can be concluded the emergence of the crisis did not affect the results of the enterprises studied significantly in any of the result dimensions analysed. Therefore, hypothesis H2 is not affirmed.

The models of multivariate regression are used to test the relationship of the enterprise performance and the intensities of their strategies. Since the independent variables, or strategies, are measured with the Likert scale, the classic multiple regression cannot be applied. Therefore, the module Regression, available with the application SmartPLS 4.0, is utilised in this study. As a bootstrap is used in this module, the significance of the particular regression coefficients can be evaluated. The following model types are taken into account, therefore:

$$W = \beta_0 + \beta_1 \cdot MPS + \beta_2 \cdot MDS + \beta_3 \cdot PDS + \beta_4 \cdot DS + \beta_5$$

where W is one of the result variables (MP , FP or FG).

All the dependent variables are considered in all the tested models for each result and in each period. Only those variables whose coefficients prove statistically significant are taken into account in the results, though. One-tailed distribution is adopted for the test. The analysis results are shown in Table 8.

Table 8. The models representing the impact of the strategies tested on the performance

Period I	Period II
$MP_1 = 2.009 + 0.396 \cdot PDS_1$ $R^2 = 35.7\%$	$MP_2 = 1.276 + 0.349 \cdot MDS_2$ $R^2 = 30.1\%$
$FP_1 = 3.144$ $R^2 = 12.54\%$	$FP_2 = 0.339 \cdot MDS_2 + 0.269 \cdot PDS_2$ $R^2 = 28.8\%$
$FG_1 = 1.622 + 0.341 \cdot MPS_1 + 0.441 \cdot PDS_1$ $R^2 = 34.3\%$	$FG_2 = 0.427 \cdot MDS_2$ $R^2 = 31.2\%$

An estimation of the models' parameters suggests none of the strategies had a significant impact on the financial performance in the period before the crisis. Product development (PDS) proved significant to the market and development results. In addition, the strategy of penetration turned out to be a significant factor for the development of the dependent variable FG. The forces of these strategies' effects, expressed as the coefficients of regression, are similar. The significance of the particular variables changed in Period II. The strategy of market development (MDS), absent from all the models in Period I, proved significant in all the models. The strategy of product development had an additionally significant impact on the financial result. The coefficients of determination R^2 for all the models (except the Period I model for FP) are 30%, a satisfactory value in social research. Since the models were slightly different for the particular results, although the differences were insignificant, it can be said H3 is upheld in part. In turn, the differences of modelling for Periods I and II are quite considerable, therefore, hypothesis H4 is corroborated.

The businesses examined exhibited some changes in their strategies, with some applied more intensively and some far more weakly during the crisis. The strategy of market penetration can serve as an example. Its intensity declined considerably in the period of the pandemic, when diversification was applied more intensively. Economic ratios determine the utilisation of a given strategy. The role of the market development strategy, where a business enters new sales markets with its existing products, can also be observed to grow at a time of economic difficulties. Such an approach is complicated and requires substantial preparation, yet it may become a way of maintaining the earlier performance in a crisis situation. The crisis associated with the coronavirus pandemic adversely affected the woodworking industry and forced it to change its existing strategies. A return to the solutions tried and tested at the time of economic stability may be posited once the pre-pandemic conditions are restored. Besides, the businesses studied managed to attract nearly as many completely new customers in the period of the pandemic as before the crisis. This may have been a result of the strategy of market development and thus of entering new sales markets with existing products. The levels of customer retention and of new orders declined a little during the pandemic, though.

Enterprise profitability before and during the crisis differed, as better results had been reported in the earlier period. What is more, such indicators as market results, financial results, and enterprise development declined in the period analysed.

4. Conclusion

Every crisis is complex, not only in its causes, but also its nature. A crisis usually leads to far-reaching, adverse economic consequences and a range of problems with the functioning of societies and organisations. An economic crisis is a situation where economic indicators substantially decline, though it may be a result of not only financial but also health issues. The coronavirus pandemic may be an example that engendered negative effects in professional, social, and economic contexts. In Poland, that period of the pandemic commenced in March 2020. An industry is analysed in this study with reference to the declining economic indicators. The woodworking sector and the impact of the crisis associated with the coronavirus pandemic on its functioning in recent years are examined. This research suggests the crisis failed to have a considerable effect on the performance of the businesses studied in the result dimensions reviewed. Therefore, such negative indicators as were reported by the industry on average did not materialise in the study group. This may be due to the small size of the sample, a limitation of the study. It's additionally been established the different types of results translate into the varying impacts of the particular strategies, as demonstrated by the differences across the models generated. Besides, the market situation has been found to determine the intensity of impact of the particular strategies on enterprise performance. This is corroborated by the differences in modelling results for the first and second period, which were sufficiently significant to prove these research assumptions true as well. In effect, the businesses in the study group suffered poorer performance, which means the crisis associated with the coronavirus pandemic had a varied, though normally the same adverse effect on the woodworking industry.

The results also indicate the intensities of impact of the particular strategies on enterprise results change dependent on the market situation (in this study, this refers to the conditions before and after the outbreak of the crisis), while the particular strategies introduced in response to the crisis determine the enterprise position to different extents, which is in line with the results reported by other investigators (Klyver, Nielsen, 2021; Suder, Kusa, 2022). Such dependences could be observed on the occasion of previous crises as well (Brzozowski, Cucculelli, 2016; Stefaniak-Kopoboru, Kuczevska, 2014).

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CHAPTER 11

Changes in the European Union Countries' Levels of Innovation Performance at Time of Pandemic

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Summary. The main objective of this chapter is to present changes in the levels of innovation performance of the EU economies during the pandemic. This is realised by analysing the changes of the Global Innovation Index (GII) in 28 European Union countries in 2019 and 2022. The empirical research (including data visualisation, descriptive statistics and *k*-means clustering) has been performed in the R programming language. The results clearly show the time of the pandemic was in no way conducive to the growth of innovation in the economies. The mean GII for EU-28 in 2019 was 49.1, to decline to 46.09 in 2022. Twenty-five EU countries experienced falling GII in 2019–2022. Only 3 out of the 28 countries reviewed managed to slightly improve their innovativeness (France, Malta, and Estonia). The added value of this study consists in supplying data on the changes of innovation levels in the particular countries, tracking these changes in comparison with other countries, and identifying similarities (a division into clusters). This may provide valuable information to decision-makers in the individual countries when making informed decisions about innovation policies.

Keywords: innovation, Global Innovation Index, European Union, pandemic, clusters

1. Introduction

The European Union pays considerable attention to the assessment and growth of innovation in its member states. Evaluating changes in the levels of innovation performance in the particular EU countries becomes a key issue, therefore. The analysis and assessment of these changes during the pandemic is an extraordinarily interesting and topical problem. Thus, the chief objective of this chapter is to present changes in the levels of innovation performance in the EU economies during the pandemic. 2019 and 2022, that is, the year before and after the pandemic, are selected for the purpose. To reach the objective, the changes of the Global Innovation Index (*Analysis...*, n.d.) in 28 European Union countries at the time are reviewed.

The United Kingdom is taken into account, not an EU member since 1 January 2020, but still one in 2019. Since the authors were anxious to have as up-to-date figures as possible, the innovation reports for 132 global economies, published annually at the Global Innovation Index (GII) website, are the principal source of data. The following research hypotheses are posited:

- HS1: The GII declined for most EU-28 countries in the period under analysis.
- HS2: The GII changes for the European Union countries during the pandemic are not homogeneous and certain country groupings (clusters) can be distinguished in respect of their GII structure.
- HS3: Migrations of some countries between the clusters identified for 2019 and 2022 are expected.

The hypotheses are verified by analysing the changes of GII for 28 countries and by identifying the changes of cluster structures formed on the basis of the index in 2019 and 2022. The empirical study consists of two stages. First, the basic measures of time series dynamics are used to define the dynamics of the index changes. In order to classify the countries with the similar values and structures of the GII, the cluster analysis is then applied, one of the fundamental unsupervised learning methods.

The added value of this study consists in supplying data on the changes of innovation levels in the particular countries, tracking these changes in comparison with other countries, and identifying similarities (a division into clusters). This may provide valuable information to decision-makers in the individual countries when making informed decisions about innovation policies.

2. Key factors of innovative activity

Innovations have become a driving force of the economy and a major determinant of a country's socio-economic development. They are important for driving economic progress and competitiveness for both developed and developing economies. Many governments are putting innovation at the centre of their growth strategies.

Economic sciences owe the first definition of innovation to J.A. Schumpeter. He defined it as an inimitable, fundamental and radical change; a transformation of a new idea or technological invention into a marketable product or process. This is a broad approach to innovation, which covers the introduction of a new method or production organization, application of new raw materials or semi-products in the market, introduction of new products to the manufacturing process, or developing of a new market (Schumpeter, 1960, pp. 99–101).

These days, the innovation discussed in various studies more often includes both fundamental changes to new products and processes – new for an industry as well as for enterprises – and simple modifications to existing products, processes and practices (Matusiak, 2011, p. 112).

Such an understanding of innovation refers to the implementation of a new or significantly improved product (or service) or process, a new marketing or organisational method to economic practice, reorganising a way of working, a workplace or a company's relations with its social environment. Products, processes and methods (technical, organisational and marketing) may be called innovations if they are new or substantially improved, at least from

the viewpoint of the company introducing them. Innovations include social, business model, and technical aspects. Innovative activities are understood as all the activities of a scientific, technical, organisational, financial, and commercial nature which aim at the commercial application of a new solution. Some of these activities are innovative themselves, while others may not involve an element of novelty, but are essential for the development and implementation of innovation. Innovation may be created by an enterprise itself or may rely on purchased external goods or services, including knowledge or consulting services (*Podręcznik Oslo...*, 2008, p. 48). A crucial element of the innovation process is its commercialisation. This is a wide spectrum of activities that refer to the transformation of knowledge into new products, technologies and organisational solutions (Matusiak, 2011, pp. 139–140).

3. Research methodology

The Global Innovation Index figures for 2019 and 2022 (*Analysis...*, n.d.) serve to analyse changes in the levels of innovation performance in 28 EU countries caused by the pandemic. The study addresses the United Kingdom, too, still an EU member in 2019.

The GII reveals the most innovative economies in the world, ranking the innovation performance of 132 economies. It helps countries assess areas in which they need to concentrate their efforts to boost their innovation performance. The Global Innovation Index (GII) was launched in 2007 with the aim of identifying and determining metrics and methods that could capture a picture of innovation in society that is as complete as possible. The purpose of the GII is to provide insightful data on innovation, to track major innovation developments at the country and regional levels and, in turn, to assist policymakers with evaluating their innovation performance and making informed innovation policy decisions (Dutta et al., 2022, p. 57).

Our empirical research was carried out using k -means clustering with the aid of the R programming language. More precisely, the implementation of ‘ k -means’ function belongs to the package ‘stats’. We have decided to use Hartigan and Wong algorithm (Hartigan, Wong, 1979) as it usually converges well. The general idea of clustering is to partition points into k groups such that the sum of the squared distances from the points to assigned cluster centres is minimized. Furthermore, all cluster centres lie at the mean of the respective Voronoi sets (Voronoi set is a set of data points nearest to the centre of a cluster). The unique feature of Hartigan and Wong algorithm is the initial assignment of data points to random centroids. Then, in the loop, the centroids are recalculated as the mean of assigned data points. The loop ends when convergence is achieved (meaning that no data point changes its assignment in the next iteration).

4. Innovation performance of the European Union countries in 2019 and 2022 – empirical results

The analysis of changes in the levels of innovation performance by selected countries in 2019 and 2022 clearly demonstrates the time of the pandemic was a period of declining innovation for most of them.

Figure 1 presents a visualisation of changes in Global Innovation Index between 2019 and 2022. The 2019 values are shown on the x-axis the 2022 values, on the x-axis. All the countries are respectively labelled, the black dots represent the exact pairs of (2019, 2022) values. Therefore, by adding lines between the axes y and x , we can separate our dataset into two groups:

- 1) The countries above the line, meaning that their 2022 GII value is greater than the 2019 GII value – we can conclude that these countries are more competitive in terms of innovation now than three years ago. We have identified only three such countries (Estonia, France, and Malta).
- 2) The countries below the line, meaning that the 2022 GII value is smaller than the 2019 GII value – this implies that innovation competitiveness decreased in the period discussed. A vast majority (25 out of 28) of the examined countries are in this group.

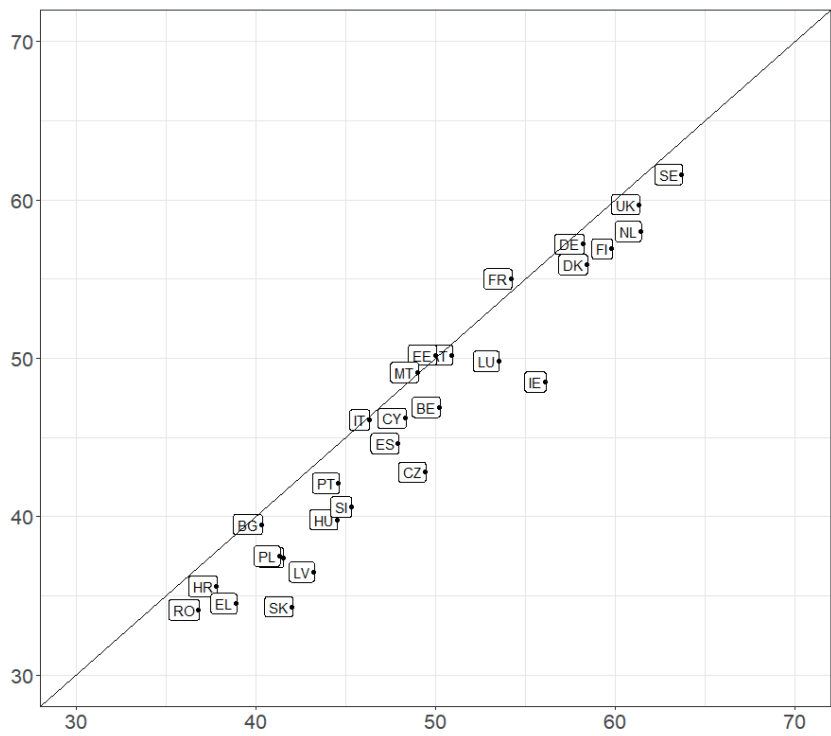


Fig. 1. A visualisation of changes in the Global Innovation Index in the 2019–2022 timeframe

An overall decrease of the Global Innovation Index in the population of countries considered is examined more closely using additional visualisation and statistical tools:

1. Table 1 presents the values of some of the key descriptive statistics indicators – minimum, median, mean, and maximum. We can conclude that all of the above declined in the research period – both in absolute and relative terms.

- Figure 2 presents two boxplot charts, for the 2019 and 2022 data, respectively. These reinforce our conclusion of an overall decrease in GII – both for the core part of the population represented by the “boxes” and the outliers represented by the “whiskers”.
- The most sophisticated support for our point is achieved by the use of the empirical cumulative distribution function (ECDF) as shown in Figure 3. Separate ECDF functions are plotted for the 2019 and 2022 data for a more convenient comparison. We can conclude that the GII generally reduced in that period as, for any given percentile, the 2019 GII value is greater than or equal to the 2022 GII value.

Table 1. The descriptive statistics of Global Innovation Index data (2019 and 2022 comparison)

	2019	2022	Change	Relative change [%]
Minimum	36.8	34.1	−2.7	−7.34
Median	48.65	46.15	−2.5	−5.14
Mean	49.1	46.09	−3.01	−6.13
Maximum	63.7	61.6	−2.1	−3.30

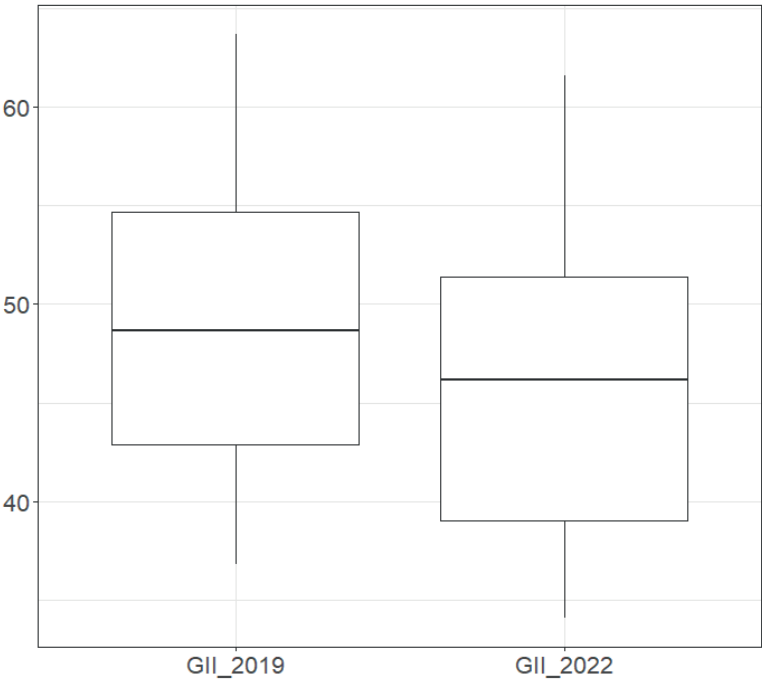


Fig. 2. Boxplots describing the distribution of the Global Innovation Index data for 2019 and 2022

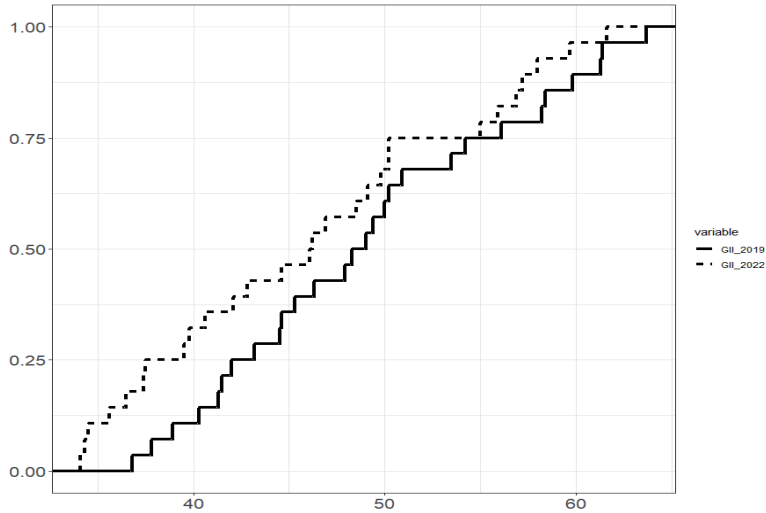


Fig. 3. A comparison of the 2019 and 2022 Global Innovation Index data using the empirical cumulative distribution function

Figure 4 visualises the results of k -means clustering applied to the Global Innovation Index data together with its subindices, for 2019 data. Four clusters were set in the Hartigan and Wong algorithm as the results were the most appealing. The number of countries in each cluster is reasonably stable, which was not the case when the number of clusters was increased. Given the split of the GII into two subindices, one can plot the cluster using two dimensional coordinates, therefore, assessing the sensibility and quality of clustering is significantly simpler. We deem the clusters to be separated well and concentrated around their respective centroids (marked as the larger rectangles on the chart). If we enumerate clusters from I to IV, where I represents the cluster with the lowest mean GII and IV is the cluster with the highest mean, we obtain (in alphabetic order):

- I cluster: Bulgaria, Croatia, Greece, Lithuania, Poland, Romania (6 countries);
- II cluster: Hungary, Italy, Latvia, Portugal, Slovakia, Slovenia (6 countries);
- III cluster: Austria, Belgium, the Czech Republic, Cyprus, Estonia, France, Luxembourg, Malta, Spain (9 countries);
- IV cluster: Denmark, Finland, Germany, Ireland, the Netherlands, Sweden, the United Kingdom (7 countries).

Figure 5 visualises the results of k -means clustering applied to the Global Innovation Index data together with its subindices, for 2022 data. The results of clustering are as follows:

- I cluster: Croatia, Greece, Latvia, Lithuania, Poland, Romania, Slovakia (7 countries);
- II cluster: Bulgaria, the Czech Republic, Hungary, Portugal, Slovenia, Spain (6 countries);
- III cluster: Austria, Belgium, Cyprus, Estonia, Ireland, Italy, Luxembourg, Malta (8 countries);
- IV cluster: Denmark, Finland, France, Germany, the Netherlands, Sweden, the United Kingdom (7 countries).

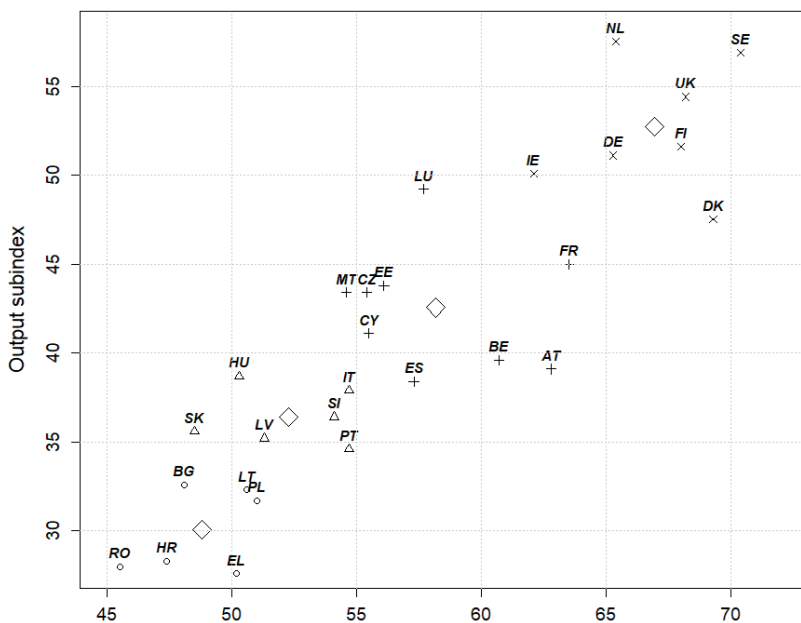


Fig. 4. A visualisation of k -means clustering applied to the 2019 Global Innovation Index data

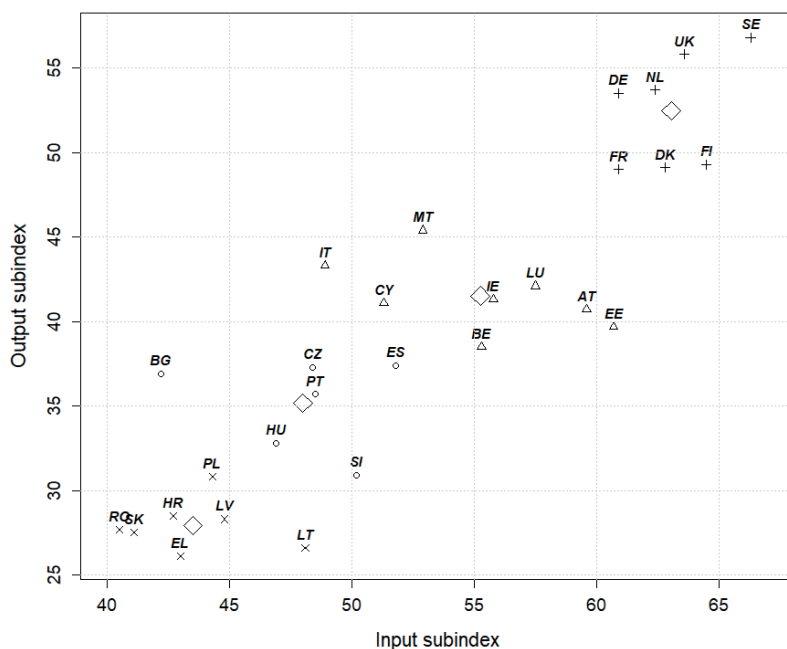


Fig. 5. A visualisation of k -means clustering applied to the 2022 Global Innovation Index data

Analysing the Global Innovation Index for the countries concerned as set against EU-28 average (which was 49.1 in 2019 and 46.09 in 2022), we can conclude that:

- In 2019, 15 out of 28 countries exhibited GII values below EU-28 average – Bulgaria, Croatia, Cyprus, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, and Spain.
- In 2022, 13 out of 28 countries were assigned to GII values lower than EU-28 average – Bulgaria, Croatia, the Czech Republic, Greece, Hungary, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, and Spain.
- In 2019, Romania had the lowest GII (36.8), while Sweden reached the highest GII (63.7)
- The lowest GII value was noted for Romania in 2022 – 34.1. On the other hand, the highest GII value was achieved by Sweden in 2022 – 61.6.
- GII values greater than EU-28 average in both the years under review were scored by the following countries: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden, and the United Kingdom.
- The highest absolute increase in GII (0.8) and the highest relative increase (1.476%) were generated by France.
- The largest absolute and relative decreases in the GII are observed for Slovakia, -7.7 and -18.33% , respectively.

5. Conclusion

The objective of this chapter is to present the changes of innovation performance in the EU economies during the pandemic. To this end, the research hypotheses are verified.

The analysis of results shows the GII exhibited some changes between the two years discussed, i.e., 2019 and 2022. The changes are distinctly negative, as they involve the substantially lower levels of innovation performance in most economies reviewed in the period studied.

Hypothesis 1, which states GII declined for most EU-28 countries in the period under analysis, is upheld. The average GII for EU-28 was 49.1 in 2019, to reduce to 46.09 in 2022. 25 EU countries experienced GII falls in 2019–2022. Only France, Estonia, and Malta noted modest GII increases at the time (1.48%, 0.4%, and 0.2%, respectively).

Hypothesis 2, according to which the GII changes for the European Union countries during the pandemic are not homogeneous and certain country groupings (clusters) can be distinguished in respect of the GII structure, is affirmed as well. 4 clusters are distinguished for both 2019 and 2022. Cluster I comprises the countries whose GII is minimum among the countries analysed in a given year, whereas cluster IV consists of countries that reached the highest values of the Global Innovation Index in a year. These most innovative countries included Denmark, Finland, Germany, the Netherlands, Sweden, and the UK in both 2019 and 2022. It should be pointed out, though, all these economies displayed lower innovation indices in 2022 than in 2019. Among the most innovative economies, the decline was the sharpest in the case of Ireland (by 13.55%), which slid down to cluster III in 2022 as a result.

Both in 2019 and 2022, Austria, Belgium, Cyprus, Estonia, Luxembourg, and Malta belonged to cluster III. Ireland joined them in 2022, though it had been classified into cluster IV in 2019. The Czech Republic and Spain, cluster III in 2019, have moved up to cluster II

in 2022. It should be noted Italy moved from cluster II to III in 2019–2022, although its GII reduced by 0.43% at the time.

Hungary, Portugal, and Slovenia were in cluster II both in 2019 and in 2022. In 2022, Spain joined cluster II, shifted from cluster III. In 2019, Latvia and Slovakia qualified for cluster II, in 2022 moving to cluster I, which includes countries with the lowest GII.

Croatia, Greece, Lithuania, Poland, and Romania were in cluster I in both 2019 and 2022. Bulgaria was assigned to that cluster In 2019, too, yet it moved to cluster II in 2022, although its GII fell by 1.99% in 2019-2022.

The above migrations of states between the clusters prove the hypothesis 3, which anticipates migrations of some countries between the clusters identified for 2019 and 2022.

The results of this analysis clearly show the years of the pandemic were extraordinarily difficult for a great majority of economies worldwide, not only those weakest. Countries with the highest levels of innovation performance (Sweden, UK, the Netherlands, Germany, Finland, and Denmark) experienced declining innovation indices as well.

To achieve a high level of innovation performance, countries need a balanced innovation system performing well across all dimensions. They need an appropriate level of public and private investment in education, research and skills development, effective innovation partnerships among companies and with academia, as well as an innovation-friendly business environment, including strong digital infrastructure and skills (*European Innovation...*, 2022, p. 6). This research implies the period of the pandemic escalated these needs even more.

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