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THEORETICAL FRAMEWORKS OF RESPONSIBLE INNOVATIONS

The article is devoted to the development of scientific provisions on responsible innovations that will contribute to the development of an enterprise. An increase in the failure probability contributes to the search for new management solutions in the face of challenges and threats. In particular, one of the tools that will adapt to the new business environment is the introduction of responsible innovations. The research focuses on the analysis of the theoretical framework of "responsible innovation" in a dynamic environment. The article analyses the theoretical basis for the definition of "responsible innovation" and related definitions. The review of 65 scientific articles laid the foundation for the analysis and systematisation of the research on responsible innovation, social and sustainable innovation, as well as responsible research and developments. Summarising these articles made it possible to refine the definition of "responsible innovation". The implementation of these recommendations will increase the efficiency of enterprises in the context of adaptation to an economic space oriented to success.
JEL: F6; M14; O35

Introduction

Responsible innovations when being implemented at an enterprise affect its activity, transforming it, and also increase its level of competitiveness. This is a fairly new trend that will promote the development of the enterprise, which, in turn, will achieve its sustainable development. In particular, this is due to the fact that the activities of the enterprise are aimed

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at reducing the environmental impact, the development of society, increasing ethical responsibility, etc.

A considerable number of studies in contemporary economic literature are devoted to the development of the concept-categorical apparatus of the conception of sustainable development and corporate social responsibility. However, in order to further improve the activities of enterprises, it is necessary to deepen the theoretical basis, to develop practical recommendations for the implementation of the definition of "responsible innovation" within the framework of these concepts. The use of responsible innovation as a basis for the study of innovative processes highlights a wide range of diverse aspects required for innovation at social enterprises (Lubberink, 2017). Therefore, it is advisable to form a single theoretical basis for the analysis of this definition, namely, "responsible innovation".

The purpose of this article is to deepen the theoretical framework of responsible innovations, based on a thorough analysis of theoretic efforts of scientists on approaches to the consideration of the concept of responsible innovations and related concepts.

The findings of this work can be used to provide guidance on how to achieve responsible innovation in the development of business concepts of organisations.

For this purpose, we follow a similar approach to this article as published in Lubberink et al. (2018), which consists of three steps:

Stage 1: A literature reviews to explore approaches to defining responsible innovation; to describe the initial framework of responsible innovation. In the future, this will become the basis for identifying and analysing the sources, in which the research on the enterprise innovation activities has been conducted, in particular, responsible innovations in the face of external challenges and threats to the sustainable development of the society.

Stage 2: Systematic review of sources for responsible innovations in the formation of theoretical frameworks. The literature on the theoretical frame of responsible innovations as well as sustainable and social innovations, responsible research and developments, published between 2000 and 2020, was reviewed. In addition, sustainable and social innovations, responsible research and developments were considered, since, in some sources, responsible innovation is similarly defined. Accordingly, this led to the formation of requirements for the above concepts.

Stage 3: Synthesis. We use this method to review the literature on the theoretical frame of responsible innovation, as our research aims to clarify this base as well as provide practical guidance to businesses engaged in innovation. This improvement will be based on the generalisation of the information received, the source of which is the existing research that has been analysed. This will lead to the improvement of the frame of responsible innovation and a clearer understanding of responsible innovation by enterprises engaged in innovation activities, in particular, certain aspects of implementing the theoretical frame of responsible innovation.

The rest of this article is structured as follows. The first stage presents a review of the literature on responsible innovations and their relationship with aspects of business activities. The second stage explains why these sources were selected for their analysis, and their quality

was evaluated. At the third stage, an analysis of the definitions of responsible innovations in the context of the implementation of the theoretical frame. The concepts of sustainable and social innovations, responsible research and developments are also analysed to determine the boundaries between these definitions and responsible innovations.

It should be noted that the aspects for considering the theoretical frame of responsible enterprise innovation include the impact of the following socio-economic and environmental phenomena. In particular, the role and influence of the concepts of society, ethics, ecology and other concepts related to the functioning of the company in the conditions of dynamic transformation not only in the economic but also socio-political environment, taking into account the economic interest of all economic entities.

The end of the article discusses these suggestions and conclusions that will be useful for researchers and business leaders interested in responsible innovation in the process of forming and implementing the theoretical frame of their companies activities in a turbulent environment.

1. Literature Review

The research on the issues of developing and implementing responsible innovation in the activities of industrial enterprises has been scientifically contributed by such economists as Blok, Chatfield, Stahl, Popper, Scholten, Voegtlin, Shilina, Pavie, Arnaldi, Reber, Ceicyte, Petraite and others.

In particular, Blok (2014) explored the issue of developing the conception that would encourage the dialogue between stakeholders involved in responsible investing.

Chatfield et al. (2017a) conducted an analysis of the enterprises' awareness of information and communication technologies in relation to responsible investments, identified the main barriers arising during the operation of enterprises, as well as factors contributing to their overcoming.

Shilina (2017) conducted the study of responsible innovation within the concept of corporate social responsibility.

Pelle and Reber (2015) investigated the moral aspect of responsible innovation in the context of corporate social responsibility. In particular, the concept of liability was discussed in detail, the approaches to corporate social responsibility (CSR) and the implications of this concept for responsible innovation were developed.

Popper, Popper and Velasco (2017) provided practical guidance on the assessment and management of responsible innovation in Europe. The author's vision contributes to improving the understanding of critical issues related to innovation (barriers, incentives, opportunities and threats) and relationships with stakeholders, as well as their management, which will, in turn, contribute to the sustainable development and transformation of social and technical systems.

Scholten and van der Duin (2015) conducted research on the ability of responsible innovation to absorb external knowledge for the better use of innovation. The authors concluded that the potential for absorption increases with the participation of stakeholders and social responsiveness, while the realised absorption capacity moderately increases through social responsiveness.

Voegtlin and Scherer (2017) argued that a responsible innovation environment is scalable in three dimensions. They also explored how legislation, governments and international organisations influence responsible investments. The recommendations in the work will contribute to complement national and international legislative provisions on innovation activities.

Ceicyte and Petraite (2016), conducted the research of responsible, innovative concepts, in particular an emphasis was placed on the formation of the state policy and innovative business activities.

Pavie, Scholten and Carthy (2014) analysed the concepts of responsibility, innovation, and their impact on the activities of the enterprise. On the basis of the conducted research, the main problems of the introduction of responsible innovation were determined.

Arnaldi and Gorgoni (2016) researched the development of the concept of responsible innovation, its political and economic context.

In his article, van Oudheusden (2014) analysed the concept of responsible innovation at the level of the European Union policy. In addition, the political issues arising in the framework of this concept were highlighted and the ways of their contemplation were proposed.

Reber (2018) considered responsible research and innovation as a link between technology and ethics.

In general, the opinions of these scientists, in our viewpoint, require further study of the theoretical basis in terms of distinguishing the definition of "responsible innovation" as a part of the process of interaction between companies in the same business environment.

2. Systematic Review of Sources for Responsible Innovation

2.1. Methodology

This study provides a systematic review of existing literature on responsible innovations, as well as relatively sustainable, social innovations and responsible research and developments. For this purpose, the algorithm of scientific literature search was used, followed by critical evaluation. In our opinion, this approach is quite transparent, which allows us to confirm the quality of the conducted research (Tranfield, et al., 2003). According to Denyer et al. (2009), five steps were taken to conduct the study, such as: formulating questions; conducting research; selection and evaluation of scientific sources of information; analysis and synthesis; conclusions with results.

2.1.1. Question Formulation

The literature review is designed in such a way that it reflects the research of scientists in accordance with innovations (sustainable, social, responsible), which were considered in the business context. This literature includes sources on responsible, sustainable, social innovations and responsible research and developments.

The analysis of literary sources was conducted on the basis of an approach guided by the answer to the question "How do responsible innovations affect the enterprise activities?"

The list of questions, that are arising during the study is as follows:

1) What definitions of the definition of "responsible innovation" do scientists provide?
2) Are responsible innovations related with society, ethics, ecology?
3) What definitions are provided by the scientists who aimed to explore sustainable, social innovations, responsible research and developments?

In accordance with the formulated questions, the following research hypotheses were identified:

H1. Responsible innovations affect society.

H2. Responsible innovations affect ethics.

H3. Responsible innovations affect ecology.

H4. Responsible innovations are related to related definitions (sustainable innovation, social innovation, responsible research and development).

Based on the questions raised, a qualitative analysis of the scientific literature was conducted, in which innovative activities at the enterprise were considered. Therefore, we believe that this approach is more appropriate than other methods, such as statistical ones.

2.1.2. Locating Studies

A background search was first used to find the literary sources related to the definition of innovative activity, including responsible innovation. After that, an analysis of the selected sources was made to ensure that these articles answer the questions raised. For this purpose, it was evaluated whether responsible, sustainable, social innovations, as well as responsible research and developments, were mentioned in the articles. Search queries were found to include different keywords. At this stage, a research methodology specialist, who specialises in systematic literature reviews, was involved. Under his leadership, keywords and phrases were developed and refined for research.

To conduct the research, a systematic search was conducted in electronic databases, in particular, such as: Web of Science and Scopus. Library search engines and manual information retrieval were used to better reach the sources of information on innovation enterprise activities.

The obtained results of the search and analysis of the literature are given in the discussion.

2.1.3. Study Selection

There were distinguished the following types of literature for conducting this research: articles, conferences, book chapters, reviews of articles. The main criteria for the inclusion of sources were the following: articles including information on the introduction of innovative activity at the enterprise; empirical articles; articles covering responsible, sustainable, social innovations, responsible research and developments; articles on Responsible Innovation. Exclusion criteria: articles written in languages other than English or awkwardly translated into English; articles on policy and innovative activity; articles that are journalistic in nature; articles concerning state regulation of enterprise innovation activities; articles of inadequate quality and content.

As a result of the literature analysis, the articles with corresponding titles, abstracts and keywords were selected. Four researchers searched for relevant articles. Then they discussed the search results and the possibility of including the selected material in the study. After that, the authors further engaged in the selection of relevant literature. Making a unanimous decision on the relevance of the article was followed by the source-for-match keyword evaluation of the source.

2.1.4. Evaluation

Subsequently, all the articles that were selected during the discussion were evaluated for their quality. This was done on the basis of a method that allows assessing quality on the basis of the following questions: whether innovative issues may be useful in the study; whether the studies are presented in a way that can be used by other researchers; whether the research is well done using the methodology; whether the study is consistent with the goal (Walshe, Luker, 2010).

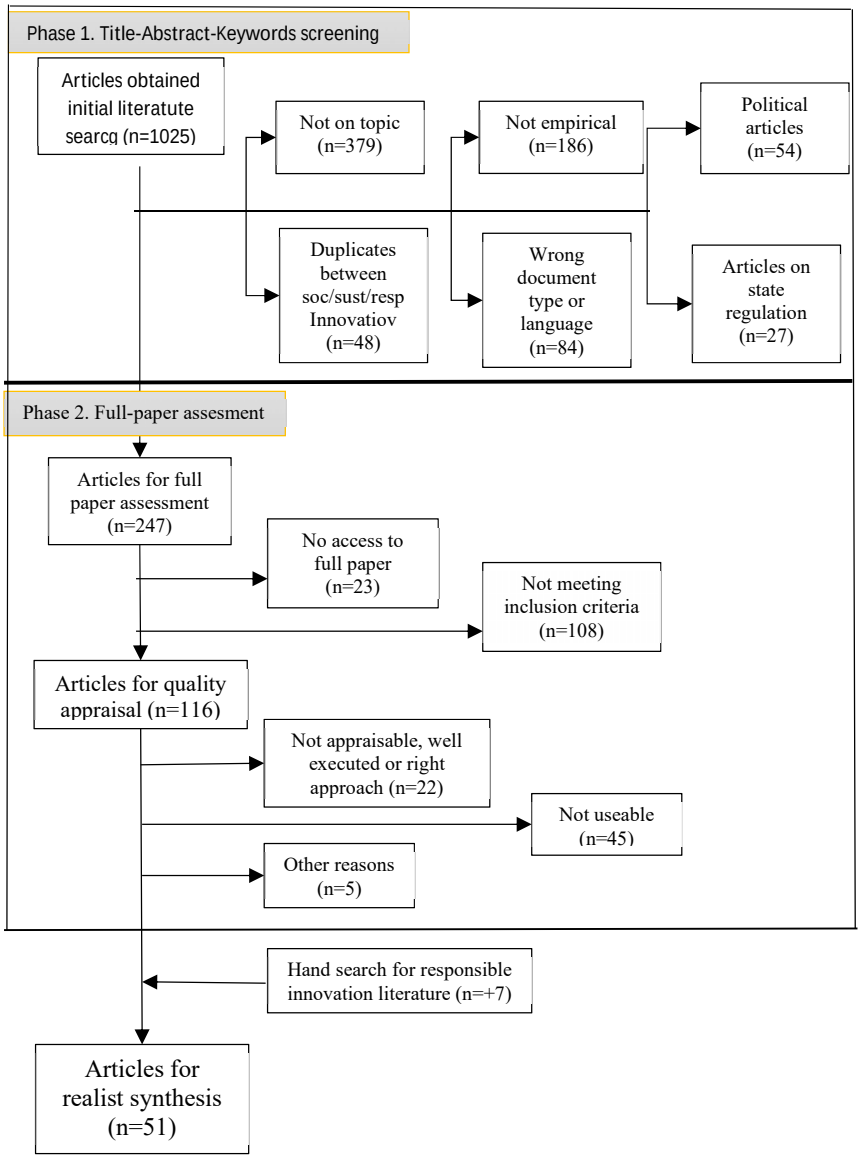
To evaluate the quality of literature sources, initially, the first question was asked. If the article did not meet this criterion, then no further steps were taken regarding it.

2.2. Descriptive Summary

At the beginning of the search for sources for the study, 1025 articles were obtained. The title, abstract, and keywords were downloaded for each of them. Subsequently, 778 articles were excluded based on inclusionary and exclusionary criteria. In total, 247 articles were evaluated. Of these, 108 articles did not meet the inclusion criteria and were excluded. Also, 23 articles could not be retrieved via the Internet or libraries. Thus, as a result, 116 articles were downloaded. Of these, 27 articles did not meet the quality criteria and were therefore excluded. Another 45 articles were decided not to be included as they were not considered useful after evaluating their content. The last stage was a re-search for scientific sources, as long as this topic is relevant and new articles constantly appear. This step resulted in additional 7 articles. Therefore, the research is based on 51 scientific sources. The graphical representation of the described process is presented in Figure 1.

Figure 1

Block diagram of the choice of scientific sources for the research



3. Defining Responsible Innovation in the Theoretical Frameworks

When analysing approaches to defining the frame of "responsible innovation", it was discovered that there is no consensus among modern scholars about it. In the course of our study, it was discovered that there are several approaches to this framework, in particular, those based on the selection of the following determinants: social, ethical, ecological.

3.1. Responsible innovation and society

The first approach to defining the frame of "responsible innovation" is based on the fact that the innovation activity of a particular enterprise is viewed only as an instrument for improving its social sphere.

Ravesteijn, Liu and Yan (2015, p. 675) indicate that "responsible innovation is a new and promising approach in addressing social problems through new technology and in dealing with diverging values in particular, thus addressing the dilemmas of sustainable development".

Brand and Blok (2019, p. 7) note in their study, that "the aim of RI is that innovators also take responsibility for the impact of their products on society as a whole".

Von Schomberg (2011, p. 47) identifies that "responsible innovation" is:

A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).

In the viewpoint of Rip (2014a), "responsible research and innovation implies changing roles for the various actors involved in science and technology development and their embedding in society".

Grinbaum and Groves (2013, p. 132) note that "the innovator, as bearer of a political responsibility specific to his or her social role, has to ask herself about the wider social and political significance of what she intends to accomplish, and what her actions may accomplish despite her intentions".

For example, Chen (2016, p. 14) reckons that "sustainable innovation indicates the process of which within a long period, depending on the continuous learning of its employees, the enterprise continuously implements innovative integration of its key resources (knowledge, production, and market) to obtain uninterrupted growth and sustainable development".

These definitions, in our opinion, are, to some extent, of one-sided nature, since they take into account, first and foremost, the social component of the enterprise. In the framework of this approach, the authors use the term "responsible innovation" in the sense of "social development". However, we believe that responsible innovation is a complex category that can not be reflected only by one side of the enterprise activities.

3.2. Responsible innovation and ethics

Some authors consider only the ethical aspect of the theoretical framework of "responsible innovation".

Van den Hoven (2013, p. 82) defines "responsible innovation" as (social and ethical determinants):

An activity or process which may give rise to previously unknown designs either pertaining to the physical world (e.g. designs of buildings and infrastructure), the conceptual world (e.g. conceptual frameworks, mathematics, logic, theory, software), the institutional world (social and legal institutions, procedures and organisation) or combinations of these, which when implemented expand the set of relevant feasible options regarding solving a set of moral problems.

In their work, Chorus, van Wee and Zwart (2012) emphasise that "responsible innovation is an innovation that minimises unwanted side-effects of the production and use of innovation and integrates social, environmental and ethical aspects in the innovation process". It focuses on the development of social, environmental and ethical components.

L'Astorina and Fiore (2017, p. 164) note that "ethics in RRI focuses on research integrity: the prevention of unacceptable research and research practices, and on the ethical acceptability of scientific and technological developments in the society".

Burget, Bardone and Pedaste (2017) adhere to the same approach. They suggest understanding "responsible innovation" as "to include all the stakeholders and the public... to increase the possibilities to anticipate and discern how research and innovation can or may benefit society as well as prevent any negative consequences from happening" (Burget, et al., 2017, p. 15).

The analysis of the approaches to defining the frame of "responsible innovation" has shown that the attention of researchers is focused mainly on the development of entrepreneurial activities, based on the introduction of measures to improve the ethical sphere. However, the introduction of measures to implement responsible innovation in the activities of the enterprise should contribute to the development of other areas of its activities as well.

3.3. Responsible innovation and ecology

The report of the European Commission (2012) with the account of social and ecological constituents gives the following definition: "responsible innovation means taking care of the future through collective stewardship of science and innovation in the present".

Based on the selection of social, economic and environmental determinants, Tihon and Ingham (2011) suggest their definition. The authors assume that "responsible (product) innovation strategy is the voluntary integration of social and environmental concerns in the development, production and marketing of new products, their underlying processes and relationship with stakeholders, that lead to superior (economic and non-economic) performances and enable to meet present needs without compromising the capability for future generation to meet their own needs".

In particular, Sutcliffe (2013) notes that "responsible innovation" is implemented "to achieve social or environmental benefits. Assessing the effectively prioritising social, ethical and environmental impacts, risks and opportunities both now and in the future, alongside the technical and the commercial".

Ceicyte and Petraite (2014, p. 404) give the following definition:

Responsible innovation meet the criteria of evaluation taken in several stages in the development of innovative solutions as a balanced whole, based on the interaction with the stakeholders; manifested through an organisational profile in the innovation process, the assessment and provision of social, ecological, economic and ethical responsibility to society and the environment.

The presented interpretations of this definition are much more meaningful, but all the same, scientists emphasise only certain components of responsible innovation.

In our opinion, it is still advisable to define the notion of "responsible innovation" on the basis of a systematic approach, that is, the one that combines all the identified determinants (social, economic, ecological, ethical).

3.4. Responsible innovation and other definitions

Table 1

The key content of the theoretical frameworks "responsible innovation" and related economic categories

Economic concepts	Factors influencing making decisions as for the importance of the implementation into the enterprise's activities	Major outcomes of the implementation
Responsible innovation	Challenges arising from the innovation activities of enterprises	Acquisitions resulting from the activities of innovation that promote the development of the enterprise in economic, social, ethical and environmental spheres
Sustainable innovation	Solving issues related to the negative impact on the environment, profit from activities related to the implementation of the principles of sustainable development (Adams, 2016; Charter, 2007; Franceschini, 2016; Lubberink, 2018; Schiederig, 2012; Ozaki, 2011; Hargadon, 2015; Maxwell, 2009)	The result is an innovation, that takes into account social, economic and environmental trends (Boons, 2013; Chalmers, 2013; Draper, 2013; Lubberink, 2018; Schiederig, 2012; Smith et al., 2010; Alvaro, 2018; Boons and Lüdeke-Freund, 2013; Larson, 2000)
Social innovation	Certain processes taking place in society, unresolved social issues (Burget, 2017; Lubberink, 2017; Mulgan, 2007; Repo et al., 2019; Unceta et al., 2016; Huczek and Smolarek, 2018; Bitencourt et al., 2016)	Innovation that allows the introduction of measures that will facilitate the resolving of certain social issues (Burget, 2017; Lubberink, 2017; Sharra, 2009; van der Have, 2016)
Responsible research and development	Innovative activity, which arises as a result of research on the basis of responsible activity (Burget, 2017; Lubberink, 2018; Ribeiro, 2016; Stilgoe, 2013; Von Schomberg, 2011; Wickson, 2014)	Development of innovative activities of the enterprise, based on the introduction of certain decisions grounded on the principles of responsible attitude (Lubberink, 2018; Von Schomberg, 2011; Blok et al., 2018; Stahl et al., 2017)

Source: compiled by the authors on the basis of literature analysis.

In order to avoid the false interpretation of the theoretical frame of "responsible innovation", it is necessary to carry out its analysis with related definitions. Some scholars in their work offer the following definitions along with responsible innovation: innovation, social innovation, responsible research and developments. Therefore, in order to specify the content of the category "responsible innovation", it is necessary to conduct an analysis with the identified economic categories, to identify the key differences (Table 1).

The results shown in Table 1 allow concluding that the main features indicating the difference between the identified related categories are: the factors that determine the need for certain activities at the enterprise; implications of the implementation of the proposed measures.

Discussion

Consideration and research of the formulated scientific hypotheses showed:

According to the first hypothesis, it was suggested that responsible innovations affect society. The study found that the definition of "responsible innovation" has an impact on social processes.

Accordingly, the second hypothesis was that responsible innovations might affect the ethical component of the enterprise. This hypothesis is also confirmed, as other authors also emphasise the ethical behaviour of the enterprise.

The third hypothesis was that the relevant innovations affect the environment. Many authors are currently concerned about the environmental component of business activities. We believe that in defining the concept of "responsible innovation" it is worth noting their impact on environmental issues.

In formulating the fourth hypothesis, it was noted that in addition to the concept of "responsible innovation", some authors operate with related or related concepts. However, the concepts of "responsible innovation", "sustainable innovation", "social innovation", "responsible research and development" should be distinguished. Therefore, this hypothesis cannot be accepted, because in the process of research, a number of differences between these definitions were identified.

Consequently, based on our analysis, we believe that responsible innovation is an interactive process of creating and implementing innovation based on the empirical combination of determinants (social, economic, ecological, ethical) that motivates all stakeholders involved in the innovation process to be responsible to society and the environment for the result of their innovation activities.

Conclusions

The development of the global economy and the deepening of integration processes, especially in Europe, lead to the improvement and emergence of new economic processes in a turbulent environment.

As a result, we highlight the core theoretical frameworks of responsible innovation:

- at the stage of creating the idea of the responsible innovation, it is necessary to think strategically about the perspective needs of society, and not only about personal profit in the market;
- the success of responsible innovation depends, among other things, on the willingness of society to perceive this innovation as a market necessity and not as a trend of the rivalry of innovators;
- successful responsible innovations can only be achieved if they are environmentally sound;
- the essence and purpose of responsible innovations must be in accordance with the principles of ethics;
- success in implementing responsible innovations is not constant and requires continuous monitoring and appropriate response to changes in the market environment;
- the success of responsible innovation is partly accompanied by uncertainty, so innovators should be prepared not only for success but also for failure;
- quite often, the success of responsible innovation is influenced by the factor of credibility, but it should not be expected

The scientific novelty of the research is to develop the theoretical frameworks of "responsible innovation" based on the definition of the main determinants of this process, the identification of the related categories and the development of measures for the implementation of responsible innovation in the activities of enterprises.

However, there are several limitations to this study that must be considered in interpreting the results of these scientific advances. For example, a systematic review of literature takes a long period of time, and the interval between the search for literature, the systematisation, the evaluation of the literature, and the publication of these research results is quite significant. Therefore, as a limitation, it may be argued that perhaps the most recent research on responsible innovation may have been overlooked. Another limitation is the exclusion from the study of empirical articles that are not written in English. Thus, some of the achievements in this field have been omitted on the one hand, and on the other – substantial scientific research is published in English to attract the attention of the scientific community of different countries of the world.

In our opinion, further research may be conducted to study practical international experience in the development and implementation of a system for making managerial decisions in the context of responsible innovations implementation by enterprises, as an integral part of the organisation strategic management.

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