The impact of responsible innovations on the enterprise: Transformation, competitiveness, economic indicators, interaction with society and the state

El impacto de las innovaciones responsables en la empresa: transformación, competitividad, indicadores económicos, interacción con la sociedad y el estado

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Abstract

The subject of the article is to study the impact of responsible innovations on the activities of small and medium-sized enterprises in the EU. This study presents the following hypotheses about the impact of responsible innovation on the transformation, competitiveness and economic efficiency of enterprises, as well as society and the state. To collect data and test the hypotheses, a survey of SMEs in EU countries was conducted. The questionnaires filled out by managers and owners of 259 enterprises in various industries and with different forms of ownership were analyzed. Next, a factor analysis was conducted, and the proposed hypotheses were tested using structural equation modeling. As a result, it can be argued that the introduction of responsible innovations has a positive impact on the transformation processes, the level of competitiveness of the enterprise, economic efficiency, social processes and government regulation. Therefore, enterprises should pay attention to the development and implementation of appropriate strategies for responsible innovation, as this will have a positive impact on their activities.

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Resumen

El tema del artículo es el estudio del impacto de las innovaciones responsables en las actividades de las pequeñas y medianas empresas de los países de la UE. Este estudio presenta las siguientes hipótesis sobre el impacto de la innovación responsable en la transformación, la competitividad y la eficiencia económica de las empresas, así como en la sociedad y el Estado. Para recopilar datos y comprobar las hipótesis, se llevó a cabo una encuesta entre las PYME de los países de la UE. Se analizaron los cuestionarios cumplimentados por directivos y propietarios de 259 empresas de diversos sectores y con distintas formas de propiedad. A continuación, se realizó un análisis factorial y se comprobaron las hipótesis propuestas mediante un modelo de ecuaciones estructurales. Como resultado, puede afirmarse que la introducción de innovaciones responsables tiene un impacto positivo en los procesos de transformación, el nivel de competitividad de la empresa, la eficiencia económica, los procesos sociales y la regulación gubernamental. Por lo tanto, las empresas deberían prestar atención al desarrollo y la aplicación de estrategias adecuadas de innovación responsable, ya que ello repercutirá positivamente en sus actividades.

Introduction

For the development of the enterprise in modern conditions there is a need for the introduction of new management tools. The development and implementation of responsible innovations can be one of the mechanisms of adaptation to existing organizational changes. This will help to increase the level of competitiveness, profitability and efficiency of the enterprise as well as its presence on the international markets.

The sustainable development of enterprises (Mafini & Loury-Okoumba, 2018; Scherer & Voegtlin, 2020) is hindered by the challenges they face in the process of their activities. These problems can be solved by focusing on implementing elements of sustainable development, in particular by implementing responsible technologies (Voegtlin & Scherer, 2017). This idea is becoming more and more popular, as well as its application in companies because responsible innovation influences all stakeholders of the integrated process, namely consumers, producers, society, government, and shareholders (Dreyer et al., 2020).

In recent years, there has been an increase in the number of studies by scientists from different parts of the world on responsible innovation, its implementation and its impact on business activity, which is an indication of society's interest in this issue. However, the development, diffusion, implementation

and management of responsible innovations are greatly influenced by certain issues (Gardezi et al., 2022), which makes this issue quite complex and multifaceted. Why did the concept of responsible innovation emerge? What issues does it address? Responsible Innovation is a field of research dedicated to studying the impact of corporate activities on social values related to innovation processes (Rödl et al., 2022). This statement is also confirmed by the European Union's development and approval of the Green Deal program. To solve social problems, innovation departments are unlikely to become a universal solution, however, they create a certain basis for the solution of social aspects in the first stages of planning and development of an innovative product/project in the company, which will contribute to the solution of social problems and challenges (Hartley et al., 2019). Therefore, the introduction of responsible innovations in the activities of the enterprise will have a significant impact on the development of society through such aspects as employment, education and social integration (Antoniou, 2020).

Despite the number of existing articles on the analysis of responsible innovations, there is a question about the implementation of the main ideas and the interest in them by industrial enterprises, since quite a number of the developed provisions, tools and methods are not used in the practice of these enterprises (Dreyer et al., 2017). This indicates that it is currently worthwhile to develop clear and consistent stages for introducing responsible innovations into the activities of enterprises. It is also worthwhile to provide clear algorithms for evaluating the effectiveness of implementing responsible innovations in the enterprise, as well as evaluating the effectiveness and expediency, benefits for society. This is very important because a certain part of society is currently treating this issue rather harshly. They do not see the benefits of introducing this concept into the activities of companies. It is very valuable to get not only theoretical developments at the level of scientists or the state but also feedback from practitioners (Dreyer et al., 2017).

It should be noted that there is currently no consensus among researchers regarding the definition of such a category as "responsible innovation" and its precise impact on business, society and government.

There is an interest in responsible innovation, but several gaps in the scientific work can still be identified: 1) final agreement on the definition of responsible innovation; 2) scientific works on responsible innovations and their impact on business activities are only beginning to draw certain conclusions; 3) low interest of society and business in implementing responsible innovations; 4) low awareness of all economic entities regarding responsible innovations; 5) lack of understanding of the necessity and usefulness of implementing responsible innovations, especially in the activities of small and medium businesses; 6) use of certain terms in research that are synonymous. Thus, it is very important to consider and raise the issue of responsible innovation in this article, which will contribute to raising awareness of this problem in the business community.

The main contribution of the proposed study to the scientific literature is as follows. First, the question "Does responsible innovation have an impact on business activities? This issue should be developed if companies can develop and implement appropriate strategies to attract responsible innovation, which will provide them with certain benefits. The second contribution is that in the article the author tries to investigate how exactly responsible innovation can affect the company's performance, as well as its interaction with society and the state. Will this interaction positively affect the company?

The purpose of this study is to identify the relationship between responsible innovations and their impact on the activities of small and medium-sized enterprises in EU countries. The following objectives are set: (1) to determine whether responsible innovations affect the transformation of the enterprise; (2) the impact of responsible innovations on the competitiveness of the enterprise; (3) the influence of responsible innovations on the economic indicators of the enterprise; (4) how responsible innovations affect society; (5) whether responsible innovations affect the state.

This study is relevant because it will contribute to developing a theoretical basis for making appropriate managerial decisions regarding the feasibility of developing and implementing Responsible Innovation at the enterprise level in EU countries. As a result of the research, it is planned to deepen the knowledge and vision regarding the necessity and effectiveness of introducing responsible innovations in the activities of SMEs in EU countries.

The article consists of the following sections. The next section is a review of the scientific literature on responsible innovation. The conceptual framework is established and hypothesized. A research methodology section follows. Hypotheses are examined. The article concludes with a discussion as well as suggestions for future research and a conclusion.

Literature review and hypothesis development

Previous studies on responsible innovation in the business world have focused primarily on its impact on the economic growth of a particular company. However, there is no comprehensive research that combines responsible innovations and emphasizes their transformational, economic, environmental, social, and governmental impacts.

Responsible innovations

As a result of the completion of the existing theories, some scholars have made assumptions about responsible innovation and its role in modern society and the functioning of production (Timmermans & Blok, 2021). In recent years, responsible innovation has been attracting more and more attention from

scientists, as it is one of the management tools, but not all of its provisions have been successfully integrated into the policy of research and innovation. Responsible innovation can be considered as one of the directions of an enterprise's activity, its interaction with social needs, as a tool for solving any problems, and also as a trajectory of the enterprise's innovative activity in response to emerging challenges as a result of its activity (Ten Holter et al., 2021). Also, responsible innovation can be considered a field of research that examines in detail the processes of implementing the sensitivity of innovation processes to social values (Rödl et al., 2022).

Currently, there are not enough definitions of the concept of responsible innovation. The concept of "responsible innovation" is a recent emergence, but has some potential for progress (Martinuzzi et al., 2018). In his work, von Schomberg claims: "Responsible innovation is a transparent, interactive process in which societal actors and innovators respond to each other concerning the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (to allow an appropriate embedding of scientific and technological advances in our society)" (R. Schomberg, 2012, p. 47). Another author defines responsible innovation as "an interactive process of innovation creation and implementation 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 outcome of their innovation activities" (Ivanova et al., 2021).

In the countries of Europe and North America, responsible innovation has recently played a significant role in the activities of enterprises, in developing countries - this term is used for analysis (Yan et al., 2022). Responsible innovation is the central aspect contributing to developing and implementing management tools, identifying potential negative consequences of the company's work, as well as solving certain social problems (Voegtlin et al., 2022).

From the above studies, it is not clear whether Responsible Innovations have a significant impact on the company's activities or some specific impact on society or the state as a whole. Therefore, it is worthwhile to look at certain relationships in more detail to formulate relevant hypotheses.

Enterprise transformation

To solve global problems, it is necessary to establish new partnerships or create new governance systems that directly stimulate responsible innovation (Imaz & Eizagirre, 2020). This, in turn, will create an equitable, transparent, and innovative organizational atmosphere in the company to provide it with resources that will help support collective learning to increase the effectiveness of organizational innovation, and will also guide the company to change and enable the smooth implementation of responsible innovation (Cao et al., 2020). Responsible innovation is based on transformational processes,

and it requires developing appropriate standards, auditing, and controlling the organization (Nagy et al., 2020). These measures will help companies to perceive transformation as an opportunity to achieve results through training and sharing knowledge (Dimitrova, 2021). That is, the implementation of responsible innovation will contribute to transformation and enterprise development (Ambos & Tatarinov, 2021).

The results of the research conducted indicated that responsible innovation is the main direction for transforming the company's business model (Imaz & Eizagirre, 2020). This is because responsible innovation results in changes in the enterprise and also contributes to the improvement of management efficiency (Ko & Kim, 2020). In the opinion of Bahta (Bahta et al., 2020), the introduction of responsible innovation in the company's activities results in changes in the company through the transformation of general strategies.

Therefore, to continue to develop, it is necessary for the Company to continuously develop and implement innovative technologies that will contribute to positively transforming the Company. Thus, the company can adapt to modern requirements and obtain certain advantages. The following hypothesis is proposed in light of these views:

H1: Responsible innovation has a positive impact on business transformation processes.

Enterprise competitiveness

Scientists perceive the dynamic economic environment of innovation as one of the mechanisms of the activities of the enterprises, which contributes to the achievement of a sustainable competitive advantage (Hilmi, 2018). Therefore, to increase the level of competitiveness, enterprises should carry out responsible innovations as soon as possible (Martinuzzi et al., 2018). However, in developing countries, due to constant changes in competitive conditions and advanced technologies, the question arises about the ability of enterprises to implement responsible innovations (Ogbeibu et al., 2021). Therefore, it is worthwhile to develop a comprehensive and strategic approach to managing responsible innovation in enterprises, including evaluation and monitoring, which will help enterprises to realize their competitive advantages (Gurzawska, 2021). Responsible innovation plays an important role in considering the economic, social and environmental performance of the enterprise, taking into account the need to increase profit and create social value (Tian & Tian, 2021). As an innovation management strategy, responsible innovation should be understood as the reduction of risks of non-satisfaction with the company's consumers' needs, possible loss of potential markets, and costly adaptation of innovative products by increasing the level of consumer confidence (Jarmai et al., 2020).

Gwarda-Gruszczyńska in her research concludes that responsible innovation can in some way affect the competitiveness of enterprises (Gwarda-Gruszczyńska, 2016). Another author notes as a result

of the analysis that responsible innovation is a key element in increasing the competitiveness of enterprises (Hadj et al., 2020). Bakhta also believes that introducing responsible innovation helps to increase competitiveness (Bahta et al., 2020). And Jarmai asserts that introducing responsible innovations in the activities of companies increases consumer confidence in goods or services, which helps to increase competitiveness (Jarmai et al., 2020).

Because of the above, we believe that to increase the level of competitiveness, companies should implement responsible innovations. Considering all the above mentioned, the following hypothesis is proposed:

H2: Responsible innovation has a positive impact on the company's competitiveness.

Collaboration with society

The responsibility of industrial companies toward society and the environment is a topic that is often discussed both in academic circles and in the business world (Martinuzzi et al., 2018). The involvement of different stakeholders, including society (Häußermann & Schroth, 2020), is supported by the concept of responsible innovation. The management of responsible innovation requires the involvement of the public by the management (Buhmann & Fieseler, 2021). By involving the public, it is possible to solve the problem of strengthening the foundations of corporate responsibility in an innovative context (Ruggiu et al., 2022). There is also an assumption that the subjects of responsible innovation have additional responsibilities toward society, stakeholders and users (Poel & Sand, 2021). The implementation of the idea of responsible innovation encourages the prediction of the level of influence on all interested parties, the main trends of management and the development of measures for the integration of innovative developments (Dreyer et al., 2020).

In addition, a company implementing responsible innovation is obliged to approach the criteria of responsibility from the perspective of various stakeholders, including all those involved in the process of implementing it, taking into account their main needs and demands (Ceicyte & Petraite, 2018). All subjects involved in the implementation of responsible innovation in corporate activities must understand and can predict the positive and negative consequences of possible outcomes (Koottatep et al., 2021).

Stakeholders should pay attention to identifying and managing risks, overcoming challenges, committing to a set of ethical and social principles when developing appropriate products and services to meet user needs and implementing responsible innovation in the company's activities (Eyre et al., 2020). The latest research on responsible innovation emphasizes the fact that it is necessary for the results of enterprises to be desirable and ethically acceptable (L. von Schomberg & Blok, 2021). Therefore, it is so important that the concept of responsible innovation in the process of involving various interested parties

in the implementation of innovations, the company focuses on ensuring the satisfaction of the current and future needs of society (Pīlēna et al., 2021). Since companies are increasingly turning to the implementation of responsible innovation to solve social problems because they are trying to create value for many stakeholders through the development of new products or services that do not cause harm and improve the conditions for the acceptance of society as a whole (Bacq & Aguilera, 2021).

The authors Fløysand and Jakobsen emphasize that responsible innovation has a certain impact on society (Fløysand & Jakobsen, 2016). Through the development and implementation of responsible innovation policies, companies are required to take on an additional level of responsibility toward society (Poel & Sand, 2021). Jakobsen proposes the implementation of responsible innovation in companies to positively impact society (Jakobsen et al., 2019). We believe that responsible innovation should raise and resolve certain social and ethical issues (Brand & Blok, 2019).

The trust of the public in entrepreneurship should increase due to the introduction of responsible innovations, which would create a certain amount of social value (Martinuzzi et al., 2018). Therefore, this study aims to more closely analyze how responsible innovations affect society, which is considered to be relevant. This leads to the following hypothesis:

H3: Responsible innovation has a positive impact on social phenomena.

Economic performance

As a result of the implementation of responsible innovations, the focus of companies should be on the achievement of social benefits (Koottatep et al., 2021). As a result of the research, it was found that the practice of the implementation of responsible innovations should be oriented toward the achievement of sustainable development (Maletič et al., 2014). In this way, responsible innovation becomes the most important factor in the achievement of economic results by the company (Bahta et al., 2020). The concept of responsible innovation suggests that its implementation should consider a balance of economic, ethical, social and sustainable aspects to demonstrate a certain level of care (Assis de Souza et al., 2020).

Companies that implement responsible innovations improve their economic performance (Bocquet et al., 2017). By implementing responsible innovation, the company increases its potential and improves economic indicators (Maletič et al., 2014). If we take into account small and medium-sized enterprises, they receive a positive impact on economic efficiency as a result of the implementation of responsible innovations (Bahta et al., 2020).

Therefore, the introduction of relevant innovations in the activities of the company can have a positive impact on its economic indicators. The responsible innovation can be of great importance for the economic success of a company. As a result, the following hypothesis is formulated:

H4: Responsible innovation has a positive impact on the company's economic performance.

State regulation

Businesses and the governments of the countries in which they operate are paying more and more attention to the concept of responsible innovation (Steen et al., 2021). The process of management of the implementation of responsible innovation in enterprises must be following the norms of law in the state (Setiawan, 2020). For this, it is necessary to take into account certain relationships and aspects of the interaction of enterprises with responsible innovations, as well as the state, mass media and society (Buhmann & Fieseler, 2021). Therefore, to achieve greater efficiency in enterprises, it is necessary to pay attention to the development of public administration in the field of responsible innovation (Mei et al., 2020). Because when developing certain innovative products in the enterprise, the state should encourage such entrepreneurs and regulate them accordingly, considering certain factors (Tait et al., 2021). This means the state government also has an indirect influence on the implementation of responsible innovation in the company (Cao et al., 2020).

Regulating the process of implementing responsible innovations in the enterprise should be controlled by the state, as well as provided by appropriate policies and regulations at the state level (Yu et al., 2020). The innovation authority should be the regulator of all processes that take place during the activity of innovative enterprises, as this is a contribution to their effective development in the right direction (Silva et al., 2019).

Based on the analysis of literary sources, it can be assumed that the implementation of responsible innovations at the enterprise should be regulated by state bodies and, therefore, will have a certain influence on them. Therefore, the following hypothesis is proposed:

H5: Responsible innovation has a positive impact on the processes that take place in government.

Research method

Instrumentation

Data were collected from the respondents through the use of a structured survey questionnaire (see Annex 1). A quantitative study was chosen to test the relevant relationships between the proposed hypotheses.

The developed questionnaire was presented to two academics and four business leaders for review. Following this, modifications were made and a preliminary survey was carried out with a random sample of five companies. Based on the responses received, the questionnaire was revised and improved to ensure that it would be understood and able to be used in the EU countries.

All of the previous studies were studied in detail for the development of the questionnaire. To evaluate the answers, respondents used a five-point Likert scale (Likert, 1932) (where it was necessary to evaluate the relationship of the proposed statements from complete absence (1) to the significant relationship (5) or influence depending on no influence (1) to significant influence (5)).

Sample and data collection

SMEs operating in various sectors of the EU countries were selected for the survey. Enterprises from different regions of EU countries represent their economic development with different degrees of market economy. The total number of small and medium enterprises in these regions is about 22.8 billion units (information taken from the database website - Eurostat).

For this survey, managers and owners of small and medium-sized enterprises in the European Union were selected. This is due to several factors. First of all, managers and owners of small and medium-sized enterprises are key figures in the management of enterprises. Their strategic decisions and business practices determine the success and competitiveness of their companies. Therefore, their perceptions and beliefs about the implementation of responsible innovations are essential for understanding the impact of such initiatives on the enterprise. Second, focusing on small and medium-sized enterprises allows us to take into account the diversity of industries in which these enterprises operate. They are represented in different sectors of the economy and have different sizes, providing a broader picture of the impact of responsible innovation on business operations. This makes our research more representative and applicable to a wide range of businesses.

Using Raosoft's sample size calculator, it is determined that the margin of error is 5%, the confidence interval is 90%, and the response distribution is 50%. Therefore, the recommended sample size was 270 respondents. With this recommendation in mind, for the survey 300 questionnaires were e-mailed to small and medium-sized enterprises. Of these, 276 were returned, of which 17 were rejected due to errors or missing data. Therefore, a total of 259 questionnaires were used for the final analysis. A response rate of 86% is considered satisfactory. The characteristics of those surveyed are shown in Table 1.

Table 1
Sample description

Characteristics of Firms	Frequency	Percentage
Gender		
Male	221	85
Female	38	15
Industry type		
Manufacturing	88	34
Agriculture	71	27
Electricity, gas	45	17
Waste management	26	10
Others	29	11
Years of Tenure		
< 2 years	67	26
2–5 years	121	47
6–9 years	53	20
10 and above	18	7

Source: Collected by the author.

The survey was conducted from June 2021 to June 2022, using emailed questionnaires sent to companies.

Data analysis

The data from the questionnaires of the SMEs that have passed the verification process are entered into an Excel spreadsheet. The entered data were analyzed using the Statistical Package for Social Sciences (SPSS) software. As a result, descriptive statistics, alpha values and Cronbach's correlations were obtained. Analysis of Moment Structures (AMOS) statistical software was used to check the properties of measurement scales and the hypotheses of this study.

The following considerations: the respondents' consent to data processing, the right to anonymity, the right to confidentiality of the information provided, the right to refuse an interview, and the protection of the respondents from possible harm while providing information were taken into account in the process of collecting information with the help of the developed questionnaire.

Results

CFA was used for the analysis of the psychometric properties of the scale measurements. As a result, indicators of reliability, validity, and conformity were obtained. This analysis is presented in Table 2.

Table 2
Psychometric properties of measurement scales

Research constructs	Correlations coefficient	Loadings of factor	Cronbach's alpha	Average variance	Mean	Standard deviation
Responsible innovations						
RI1	0.61	0.73	-	-	-	-
RI2	0.53	0.64	-	-	-	-
RI3	0.66	0.62	0.76	0.47	3.59	0.86
RI4	0.69	0.56	-	-	-	-
RI5	0.51	0.51	-	-	-	-
Enterprise transformation						
TE1	0.66	0.71	-	-	-	-
TE2	0.61	0.72	-	-	-	-
TE3	0.58	0.68	0.82	0.45	3.53	0.91
TE4	0.61	0.63	-	-	-	-
TE5	0.67	0.75	-	-	-	-
Enterprise competitiveness						
CE1	0.62	0.71	-	-	-	-
CE2	0.58	0.68	-	-	-	-
CE3	0.61	0.63	0.86	0.49	3.91	0.89
CE4	0.66	0.69	-	-	-	-
CE5	0.58	0.72	-	-	-	-
Impact on society						
IC1	0.63	0.71	-	-	-	-
IC2	0.58	0.66	-	-	-	-
IC3	0.51	0.51	0.91	0.43	3.71	0.85
IC4	0.66	0.77	-	-	-	-
IC5	0.57	0.62	-	-	-	-
Economic indicators						
EI1	0.68	0.68	-	-	-	-
EI2	0.53	0.63	-	-	-	-
EI3	0.56	0.61	0.82	0.48	3.78	0.83
EI4	0.58	0.73	-	-	-	-
EI5	0.62	0.71	-	-	-	-
State impact						
SI1	0.54	0.62	-	-	-	-
SI2	0.55	0.57	-	-	-	-
SI3	0.59	0.53	0.75	0.42	3.27	0.74
SI4	0.62	0.55	-	-	-	-
SI5	0.58	0.67	-	-	-	-
SI6	0.53	0.59	-	-	-	-

Source: Data analysis

Calculations obtained the value of Cronbach's alpha, whose value is above the minimum threshold of 0.7, so it can be said that all research designs are reliable. The reliability of the proposed scale was satisfactory because the value of the correlation coefficient is higher than the recommended minimum

value of 0.3. We can also say that the calculations are satisfactory because the standard deviation exceeds the minimum of 0.5. The proposed hypotheses can also be considered satisfactory since the average variance obtained is higher than the minimum value of 0.4.

The range of the average values of the scores for the structures was obtained as follows (Table 2): from 3.27 to 3.91. Since the average score for all the constructs is 3.59, this is an indication that SMEs can currently consider the implementation of these measures. Considering the highest values obtained for the constructs related to the competitiveness of enterprises (x = 3.91) and economic indicators (x = 3.78), we can conclude the high interest of enterprises in these issues and their connection with responsible innovation. The average score in this construction is 3.27 if we consider the influence of the state. Thus, it can be assumed that the level of trust in government bodies is not currently high. Also, since the standard deviations range from 0.74 to 0.91, the selected indicators are correct and the research results are reliable.

Discriminant validity

Correlation calculations between the proposed structures were performed. Table 3 shows the results of the correlation analysis.

Table 3
Pearson correlations between constructs

Constructs	RI	TE	CE	IC	EI	SI
Responsible innovations (RI)	1.000	-	-	-	-	-
Enterprise transformation (TE)	0.551	1.000	-	-	-	-
Enterprise competitiveness (CE)	0.626	0.554	1.000	-	-	-
Impact on society (IC)	0.583	0.499	0.428	1.000	-	-
Economic indicators (EI)	0.535	0.521	0.731	0.621	1.000	-
State impact (SI)	0.493	0.462	0.358	0.527	0.387	1.000

Source: Data analysis

Since the proposed designs do not overlap and the correlation value does not exceed the threshold of 0.85, it can be said that they are appropriate and correct.

Table 3 shows that r values are positive and range from 0.358 to 0.731 (this value should not exceed 0.9, this condition is met). The maximum correlation between competitiveness and economic efficiency was 0.731, but this value is still less than 0.9. Also, the research results indicate that the proposed constructs are positively related. In addition, the constructs in the study oscillate together and increase or decrease accordingly. In conclusion, the results of the research are that all the scales of measurement are reliable.

Hypothesis testing

The SEM procedure was used to test the hypotheses. The results of this procedure are presented in Table 5.

Table 5
Results of hypotheses tests

Proposed relationships	Hypothesis	Beta coefficient	P	t	Decision
Responsible innovations → Enterprise transformation	H_1	0.621	0.006	2.681	Accepted
Responsible innovations → Enterprise competitiveness	H_2	0.647	0.005	3.253	Accepted
Responsible innovations → Impact on society	H_3	0.501	0.007	2.956	Accepted
Responsible innovations → Economic indicators	H_4	0.714	0.004	3.124	Accepted
Responsible innovations → State impact	H_5	0.486	0.006	2.751	Accepted

Source: Data análisis

Table 5 shows that the beta coefficient of all the hypotheses proposed in the study is statistically significant, as it has a value of 0.01. Therefore, it allows us to state that the research hypotheses are acceptable.

Discussion

The first hypothesis (H1) proposes that responsible innovation can have a positive effect on the transformation processes in the company. Due to the revealed positive and significant relationship between responsible innovation and the transformation processes of the enterprise, this hypothesis is acceptable (Beta coefficient = 0.621; p = 0.006; t = 2.681). On the basis of the identification of positive effects, it can be argued that responsible innovation and business transformation are processes that are interrelated. This is also in line with a previous study (Imaz & Eizagirre, 2020) that found that companies benefit from the implementation of responsible innovation through the process of business model transformation. Bahta (Bahta et al., 2020) also indicate that responsible innovation is a critical factor in the achievement of business transformation. Thus, there is support for the hypothesis that the adoption of responsible innovation can be a catalyst for certain business transformation processes.

The second hypothesis (H2) proposes a positive relationship between the adoption of responsible innovations and the competitiveness of the company. Since a positive and significant relationship was found between the variables, this relationship exists (Beta coefficient = 0.647; p = 0.005; t = 3.253). The obtained results indicate that the company's decisions regarding responsible innovations

affect its level of competitiveness. In Xu's work (Xu, 2020) he claims that in the process of implementation of responsible innovations, there is a positive change in the level of competitiveness of the company. In another paper (Ko & Kim, 2020), the authors also found a significant impact of responsible innovation on the increase of the company's competitiveness. Hadj (Hadj et al., 2020) studied the impact of responsible innovation on SME competitiveness. Therefore, we can conclude that implementing responsible innovation in the company has a strong impact on increasing its competitiveness.

The third hypothesized relationship between responsible innovation and society (H3). Due to the revealed positive relationship between responsible innovations and processes in society, the proposed hypothesis was confirmed (Beta coefficient = 0.501; p = 0.007; t = 2.956). The obtained indicators mean that the introduction of responsible innovations in the company has a positive effect on the society. The authors of another study (Jarmai et al., 2020) claim that responsible innovations should be developed for the positive impact of the company on society. Long (Long et al., 2020) suggests that responsible innovation promotes public awareness. The implementation of responsible innovations in the enterprise is necessary in order to have positive results from innovations that are expressed in their social desirability and ethical acceptability ((L. von Schomberg & Blok, 2021); (Liu, 2018)). If society rejects responsible innovations, this may lead to negative consequences in the activities of the enterprise ((Hartley et al., 2019); (Bourban & Rochel, 2021)). As a result, there is a conclusion that the adoption of responsible innovations will have a positive impact on society.

The fourth hypothesis (H4) is to determine the influence of responsible innovations on the economic efficiency of the enterprise. As a result of calculations, this hypothesis was accepted because a positive relationship between these two constructs was found (Beta coefficient = 0.714; p = 0.004; t = 3.124). The implication is that responsible innovation has an impact on the economic performance of companies. In their study, L. von Schomberg and Blok (L. von Schomberg & Blok, 2021) found that when developing responsible innovations, the company's management is primarily driven by economic performance. Abdallah (Abdallah et al., 2016) claim that responsible innovation has a significant and positive impact on a company's economic efficiency. Jarmai in his work (Jarmai et al., 2020) points out that in order for an enterprise to achieve economic benefits, it should pay attention to responsible innovation. Thus, this confirms the conclusion that responsible innovation increases the economic indicators of the company.

The fifth hypothesis (H5) examines the impact of responsible innovations and the government. As a result of the calculations, there is a significant relationship (Beta coefficient = 0.486; p = 0.006; t = 2.751) between responsible innovations and government processes. Therefore, it is very important that the government and its agencies participate in the development and implementation of responsible innovations in the enterprise, stimulating and supporting these processes. In other studies (Yu et al., 2020)

it was found that developing certain types of standards of responsible innovation for enterprises should be done at the state level since this makes it possible to achieve a higher level of economic efficiency. Gwarda-Gruszczyńska (Gwarda-Gruszczyńska, 2016) claims that the introduction of responsible innovations at the enterprise level stimulates its economic development, which in turn affects its competitiveness, and also becomes a factor of sustainable growth of the region and the whole country. We believe that the country's development indicators and its position in the global economy will be positively affected by the introduction of responsible innovations at the enterprise level.

The study proposes to study the relationship between responsible innovation and transformation, competitiveness and economic indicators of the company, as well as its impact on society and government. As a result of the research, all the hypotheses were accepted. Therefore, we can say that the introduction of responsible innovations in the activity of the enterprise has a positive effect on most aspects of its activity. This study is a confirmation and complement of the results of previous studies and can be a benchmark for other similar studies.

Conclusion

This study makes a certain contribution to the impact of responsible innovations by expanding and enriching the scientific literature through an empirical study of the impact of responsible innovations on the activities of the enterprise and its environment.

The next contribution can be the improvement of the scientific sources, because the importance of the implementation of responsible innovations in the activities of the enterprises of the EU countries has been proved, and this practice may be useful for other countries. This practice can be useful for other countries as well. Previously, other effects of responsible innovation were studied, for example in the United States. Therefore, an effective approach to implementing Responsible Innovation in EU countries will make them more attractive to investors and help to become competitive in international markets.

The fact that the survey was conducted among SMEs in EU countries can be considered a limitation of this study. Similar studies in other countries may provide more accurate results. The research was also conducted in companies operating in different industries. It may be possible to find some additional interdependencies if the surveys are carried out in a single industry sector.

Another limitation may be the fact that the research focus was on the relationship between responsible innovation and categories such as transformation, competitiveness, economic activity, and impact on society and government. Another research direction could be to analyze the legislation of certain countries, to identify certain contradictions or gaps related to responsible innovation. Another research

could be to develop a strategy for developing responsible innovation until 2030, considering the global situation.

Future research may also include the development of measures to comprehensively evaluate the effectiveness of responsible innovations as a result of their implementation in the enterprise. Attention should also be paid to the development of an effective mechanism for the management of responsible innovation at the enterprise or state level. In addition, it is worth studying the influence of decision-making culture on responsible innovation in the enterprise.

Therefore, the management of enterprises should pay more attention to the processes of implementation of responsible innovations, as this will contribute to their effective development, development of adequate management solutions, and also increase the level of adaptability to modern conditions. The aspects studied in this article will help to understand certain aspects of the scientific basis for developing appropriate measures for implementing responsible innovation at the enterprise level. The conclusions of this article can be a certain guide for the clarification and justification of the need at the level of top management of the company.

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Annex

Table A1

Responsible innovation (adapted from scales of several authors: Liang & Chen, 2015; Stilgoe et al., 2013).

Please indicate the extent to which you believe each of the following definitions of responsible innovation has been implemented in your company (five-point scale: 1 = not considered; 2 = planned to be considered; 3 = currently being considered; 4 = started implementation; 5 = successfully implemented).

RI1: Adoption of innovative technologies
RI2: Operation of new innovative facilities
RI3: Develop programs to implement responsible innovation in the organization
RI4: Use of an external coach to train employees to work with responsible innovations
RI5: Management recognizes enterprising employees who seek to implement responsible innovations.

Enterprise transformation (adapted from scales of several authors: Donaldson et al., 2015; Vallespir & Ducq, 2018)

Please indicate the impact of responsible innovation on the transformation of your company (five-point scale: 1 = no impact at all; 2 = little impact; 3 = some impact; 4 = relatively strong impact; 5 = significant impact).

TE1: Elimination of unprofitable products from the product range
TE2: Change in the company's production structure
TE3: Change in the organizational structure of the enterprise
TE4: Identification of the most competitive products of the enterprise
TE5: Market analysis and acquisition of new technologies

Enterprise competitiveness (adapted from scales of several authors: Ezenwakwelu et al., 2018; Ferreira et al., 2017; Li et al., 2019)

Please indicate the impact of responsible innovation on the competitiveness of your company (five-point scale: 1 = not affected at all; 2 = have little impact; 3 = affected to some extent; 4 = relatively strong impact; 5 = significantly affected).

CE1: Improve product quality without compromising consumer value
CE2: Increase in number of products
CE3: Enter new markets
CE4: New areas of product use
CE5: Reduce product prices

Impact on society (adapted from scales of several authors: Jiya, 2019; Smallman, 2018)

Please indicate how responsible innovations affect society (Five-point scale: 1 = not at all affected; 2 = have little impact; 3 = affected to some extent; 4 = relatively strong impact; 5 = significantly affected).

IC1: Development of goods that better meet public needs
IC2: Focus on the needs of society in production
IC3: Incentives for citizens who use innovative products of the enterprise
IC4: Providing consumers with suggestions for improving the company's products
IC5: Collaborate with universities to attract the most progressive graduates

Economic indicators (adapted from scales of several authors: Laliene & Sakalas, 2012; Terzic, 2017)

Please indicate the impact of responsible innovation on the following performance indicators (five-point scale: 1 = no impact at all; 2 = little impact; 3 = some impact; 4 = relatively strong impact; 5 = significant impact).

EI1: Reduce production costs
EI2: Increased profit
EI3: Elimination of costly components in production
EI4: Increase profitability of production
EI5: Increase in sales

Impact of the government (adapted from the scales of several authors: Voegtlin & Scherer, 2017; Nazarko, 2020)

Please indicate whether there is a relationship between responsible innovation and government policy (five-point scale: 1 = no relationship at all; 2 = little relationship; 3 = some relationship; 4 = relatively strong relationship; 5 = significant relationship).

SI1: Development of government programs to support SMEs
SI2: Development of legislation to support SMEs
SI3: Provision of benefits to enterprises that implement responsible innovations
SI4: Development of state-owned innovative enterprises
SI5: Public investment in enterprises implementing responsible innovation
SI6: Public awareness of SMEs implementing responsible innovation