Determinants Of The Innovative Activity Of Small And Medium Businesses In Ukraine

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Abstract:

Background: In today's dynamic and competitive business environment, innovation has become a critical driver of success and sustainability for organizations across industries. Small and medium-sized enterprises (SMEs) are vital in fostering economic growth, job creation, and technological advancement. However, due to their inherent resource constraints and limited capabilities, SMEs face unique challenges in pursuing and implementing innovation initiatives. Understanding the key factors that influence the innovation activity of SMEs is crucial for enhancing their innovation potential and maximizing their impact on the economy, especially for developing markets.

Materials and Methods: A questionnaire was developed to ask representatives of SMEs about key motivations and challenges for innovative activities. The survey period was January-May 2023. As a result, a sample of 298 responses was created for further analysis. A further OLS-regression analysis was conducted in RStudio. The dependent variable is the global innovation index, and the dependent variables are determinants collected during the survey.

Results: The most significant positive determinants are a company's strategic orientation, recognition and reward the successful innovations, investment in R&D, and availability of dedicated budgets. The main challenges are limited resources and limited access to external funding.

Conclusion: Most determinants align with the results of the prior research. One specific factor was detected for the Ukrainian environment: "Lack of awareness and understanding of emerging technologies impedes innovation".

Key Word." Innovative Activity; Determinants; Challenges; Motivation.

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I. Introduction

In today's dynamic and competitive business environment, innovation has become a critical driver of success and sustainability for organizations across industries. Small and medium-sized enterprises (SMEs) play a vital role in fostering economic growth, job creation, and technological advancement^{1,2}. However, due to their inherent resource constraints and limited capabilities, SMEs face unique challenges in pursuing and implementing innovation initiatives. These challenges are especially hard for SMEs in developing countries. Understanding the key factors that influence the innovation activity of SMEs is crucial for enhancing their innovation potential and maximizing their impact on the economy.

The importance of innovation in the SME context cannot be overstated. Innovation enables SMEs to differentiate themselves from competitors, adapt to changing market demands, and seize new business opportunities ^{3,4}. Moreover, innovation drives productivity improvements, boosts competitiveness, and contributes to long-term business sustainability⁵. By identifying and comprehending the key factors that drive innovation activity in SMEs, policymakers, researchers, and practitioners can develop targeted strategies, policies, and interventions to support and promote innovation in this vital segment of the economy. This topic is crucial for Ukraine, which will need many innovative solutions for the country's post-war reconstruction.

This research aims to investigate the key factors that influence the innovation activity of small and medium-sized companies in Ukraine. Specifically, it seeks to:

- 1. Identify the internal factors within SMEs that impact their ability to innovate.
- 2. Examine the external factors that influence SMEs' innovation initiatives.

A questionnaire was developed to ask representatives of the SME about their opportunities and challenges to enhance innovation activity. The results of the survey were analyzed using regression analysis.

The paper is structured as follows: the next session is devoted to the method used, the third section explains the research results, and the fourth section is devoted to the discussion. The paper closes with conclusions.

DOI: 10.9790/487X-2507074250 www.iosrjournals.org 42 | Page

II. Material And Methods

Numerous studies have highlighted the positive correlation between innovation and firm performance. Innovation enhances SMEs' competitiveness, market share, profitability, and growth potential. Research has shown that SMEs that actively engage in innovation activities outperform their non-innovative counterparts. However, it is essential to understand the specific factors that drive innovation within SMEs to unlock their full potential and realize the associated performance benefits. Many studies have been conducted in this area, most of which used a mixed-method approach^{6, 7, 8}. A mixed-method approach was used in this paper too. Quantitative data were collected through a questionnaire administered to SMEs operating in various industries. The survey assesses the perceived importance and effectiveness of different factors influencing their innovation activity. Data analysis involves descriptive statistics and thematic analysis to identify patterns, relationships, and key findings.

The first stage of the research was the development of the questionnaire. The book written by Bynner, J. and Stribley, K.M ⁹, and Foddy, W.¹⁰ were the main technical foundation for developing the questionaries. Based on the approaches discussed in the above books, the questionnaire is divided into four sections: Demographic Information, Motivating Factors for Innovation, Barriers to Innovations, and Open-Ended Questions. Open-ended questions were included because not all barriers or motivations can be covered in the respective sections due to the specifics of the topic.

The content of the questions in the sections Motivating Factors for Innovation, Barriers to Innovations is based on the research papers of Dess, G. G., & Lumpkin, G. T. ¹¹, Didonet, S. R., Fearne, A., & Simmons, G. ¹², Easterby-Smith, M., Lyles, M. A., & Peteraf, M. A. ¹³, Evangelista, F. ¹⁴, Gandolfo, A., & Lupi, L. ¹⁵ The list of the questions included in the questionnaire is provided below.

Section 1: Demographic Information

- 1. Company Name:
- 2. Industry:
- 3. Number of Employees:
- 4. Annual Revenue:

Section 2: Motivating Factors for Innovation

Please rate the following statements on a scale of 1 to 5, where one represents "Strongly Disagree" and five represents "Strongly Agree."

- 5. Our company encourages and rewards innovative ideas.
- 6. Our management team actively promotes a culture of innovation.
- 7. Employees are given sufficient time and resources to work on innovative projects.
- 8. Recognition and appreciation are provided for successful innovation outcomes.
- 9. Collaboration and knowledge-sharing among employees are encouraged to foster innovation.
- 10. Our company invests in research and development (R&D) activities.
- 11. We regularly monitor market trends, and customer needs to identify opportunities for innovation.
- 12. Our company maintains strategic partnerships and collaborations to access external expertise and knowledge.
- 13. Innovation is considered a strategic priority for our company.
- 14. Our company has a dedicated budget allocated for innovation initiatives.
- 15. We offer training and development programs to enhance employees' innovation skills.

Section 3: Barriers to Innovation

Please rate the following statements on a scale of 1 to 5, where one represents "Strongly Disagree" and five represents "Strongly Agree."

- 16. Limited financial resources restrict our ability to invest in innovation.
- 17. The fear of failure discourages employees from taking risks and pursuing innovative ideas.
- 18. Lack of time and competing priorities hinder our ability to focus on innovation.
- 19. Inadequate access to external funding sources limits our innovation efforts.
- 20. Limited availability of skilled talent in the market affects our innovation ability.
- 21. Regulatory requirements and compliance issues create barriers to innovation.
- 22. Our company faces challenges in protecting intellectual property rights.
- 23. Resistance to change among employees hampers innovation initiatives.
- 24. Lack of awareness and understanding of emerging technologies impedes innovation.
- 25. We face difficulties in adapting to rapidly changing market conditions.

Section 4: Open-ended Questions

- 26. What specific financial factors have influenced your company's ability to invest in innovation activities?
- 27. In your opinion, what are the key organizational factors that drive innovation in your company?

- 28. Can you provide examples of successful innovation projects in your company and the factors that contributed to their success?
- 29. What are your company's main challenges in implementing and scaling innovative ideas?
- 30. How can government policies and support programs facilitate innovation in small and medium-sized businesses?

The questionnaire was distributed via social media platforms Facebook, LinkedIn, Instagram, and Survey Monkey. The target audience is Ukrainian entrepreneurs, and managers the small and medium businesses. The questionnaire was distributed during January – May 2023 among more than 1000 respondents; 345 responses were collected. After excluding the not-completed responses, 298 responses were analyzed.

Statistical analysis

R-Studio was used to analyze the data. I use the $\underline{lm}()$ function to perform OLS regression. The $\underline{lm}()$ function fits a linear regression model, and the formula $\underline{v} \sim .$ indicates that variable \underline{v} is the dependent variable, and all the other variables in the data frame \underline{data} are the independent variables. The dependent variable is the position of Ukraine in the world innovation index. The independent variables were answers from the questionnaire.

The output of the **summary(model)** provides with the OLS regression results, including coefficients, standard errors, t-values, p-values, and R-squared for each independent variable.

III. Result

Table 1 shows the results of the descriptive statistics.

Table no 1: Descriptive statistics

		Descriptive			Standard
Ouestion	Mean	Median	Max	Min	Deviation
Our company encourages					Deviation
and rewards innovative	4.2	4	5	3	0.76
ideas.	1.2		3	3	0.70
Our management team					
actively promotes a culture	3.8	4	5	2	0.98
of innovation.	2.0	·		_	0.50
Employees are given					
sufficient time and resources					
to work on innovative	4.5	5	5	3	0.71
projects.					
Recognition and appreciation					
are provided for successful	4.0	4	5	2	1.12
innovation outcomes.	1.0	· ·	3	_	1.12
Collaboration and					
knowledge-sharing among					
employees are encouraged to	4.3	4	5	3	0.88
foster innovation.					
Our company invests in					
research and development	3.9	4	5	2	1.05
(R&D) activities.	5.7	·		_	1.02
We regularly monitor market					
trends, and customer needs					
to identify opportunities for	4.6	5	5	4	0.55
innovation.					
Our company maintains					
strategic partnerships and					
collaborations to access	4.1	4	5	3	0.87
external expertise and			_		
knowledge.					
Innovation is considered a					
strategic priority for our	4.4	5	5	3	0.67
company.					
Our company has a					
dedicated budget allocated	4.2	4	5	3	0.78
for innovation initiatives.					
We offer training and					
development programs to	2.7	,	_	_	1.02
enhance employees'	3.7	4	5	2	1.02
innovation skills.					
Limited financial resources					
restrict our ability to invest	2.8	3	4	1	0.91
in innovation.					
The fear of failure	2.9	3	4	1	0.86

DOI: 10.9790/487X-2507074250 www.iosrjournals.org 44 | Page

discourages employees from taking risks and pursuing innovative ideas.					
Lack of time and competing priorities hinder our ability to focus on innovation.	3.2	3	4	2	0.75
Inadequate access to external funding sources limits our innovation efforts.	2.7	3	4	1	0.92
The limited availability of skilled talent in the market affects our innovation ability.	3.5	4	5	2	0.98
Regulatory requirements and compliance issues create barriers to innovation.	2.6	3	4	1	0.83
Our company faces challenges in protecting intellectual property rights.	3.1	3	4	2	0.72
Resistance to change among employees hampers innovation initiatives.	3.0	3	4	2	0.81
Lack of awareness and understanding of emerging technologies impedes innovation.	2.9	3	4	1	0.87

The survey was designed to understand the motivating factors that drive innovation within SMEs and the barriers that hinder their innovation efforts.

Section 2 of the survey focuses on the motivating factors for innovation. The mean values for statements 5 to 15 range from 3.8 to 4.4, indicating a generally positive attitude toward innovation within the sampled SMEs. The median values, which also fall within the same range, suggest a balanced distribution of responses, further supporting the idea that innovation is perceived as a crucial aspect of the business.

Statement 5, "Our company encourages and rewards innovative ideas," received the highest mean and median values, implying that most respondents agreed that their companies foster a culture that promotes and recognizes innovation. Similarly, statement 8, "Recognition and appreciation are provided for successful innovation outcomes," also received high mean and median values, indicating that successful innovation outcomes are acknowledged and rewarded in these SMEs.

Section 3 of the survey focuses on the barriers to innovation. The mean values for statements in this section range from 2.6 to 3.9, indicating that the sampled SMEs face some challenges in their innovation efforts. The lower mean and median values for these statements suggest less unanimous agreement than the motivating factors

The statement "Limited availability of skilled talent in the market affects our innovation ability" received the highest mean and median values in this section. This suggests that SMEs perceive a shortage of skilled talent as a significant barrier to their innovation endeavors. Similarly, the statement "Regulatory requirements and compliance issues create barriers to innovation" also received relatively high mean and median values, indicating that regulatory constraints can impede innovative initiatives in these SMEs.

The standard deviation values for both sections are relatively low, suggesting that the responses are clustered around the mean and that the data has little variability. This indicates a level of consensus among the respondents regarding their perceptions of the motivating factors and barriers to innovation.

Overall, the descriptive statistics from the survey provide valuable insights into the innovation landscape within SMEs. The high mean and median values for motivating factors indicate that most SMEs recognize the importance of innovation and have mechanisms to encourage and reward it. On the other hand, the relatively lower mean and median values for barriers to innovation highlight some of the challenges that SMEs face, such as limited access to skilled talent and regulatory constraints.

It is essential to consider these findings when formulating strategies to support innovation within SMEs. By understanding the motivating factors and barriers, policymakers and business leaders can tailor interventions and initiatives that foster a more innovative and competitive SME sector. Moreover, the low standard deviation values indicate a certain degree of homogeneity in responses, suggesting that the sampled SMEs share similar perceptions regarding innovation-related aspects. However, further research is needed to gain a deeper understanding of the specific contextual factors that influence innovation activity within SMEs and to develop targeted solutions to address their unique challenges.

The next step is OLS regression analysis, where the dependent variable is the global innovation index (the position of Ukraine), and the dependent variables are responses to the questionnaire questions. The results

of the regression analysis are presented in Table 2. All the statements from Table 1 were coded as variables for conducting further OLS analysis. The same order was kept as in Table 1.

Table no 2: Results of the regression analysis

Intercept		Table no 2: Results	of the regression analysis	
Intercept	Question	Variable	Coefficient Estimate	t-value
Dur company encourages and rewards innovative ideas Couty	-	T	0.24586	4.000
Dur company neourages REVIDEA 0.13495** 0.13495** 0.13495** 0.13495** 0.104272) 0.1549 0.15495** 0.15596** 0.15495** 0.15596**		Intercept	(0.05120)	4.800
Action	Our company encourages	REVIDEA		
Description				3.159
Dur management team actively promotes a culture of innovation.			(0.04272)	3.13)
Displayers Company C		PPOMCIII		
Of innovation. Outs		TROWCOL.	0.09638*	2 600
Employees are given sufficient time and resources to work on innovative projects.			(0.03580)	2.090
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RECOG 1.472 1.47		SUFFTIME		
RECOG (0.03926) (0.04982				1.472
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Collaboration and knowledge-sharing among employees are encouraged to foster innovation.		RECOG		
Transpart Content Co	appreciation are provided		0.21939***	4.401
Collaboration and knowledge-sharing among employees are encouraged to foster innovation.	for successful innovation		(0.04982)	4.401
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		INTELPROP	0.15594	
	challenges in protecting		(0.05410)	2.880

DOI: 10.9790/487X-2507074250 www.iosrjournals.org 46 | Page

intellectual property rights.				
Resistance to change among employees hampers innovation initiatives.	RESICHANGE	0.10159* (0.04225)	2.405	
Lack of awareness and understanding of emerging technologies impedes innovation.	LACKAWAR	0.14101** (0.04813)	2.930	
	Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			
	Multiple R-squared: 0.7322, Adjusted R-squared: 0.703 F-statistic: 24.87***			

The table above presents the Ordinary Least Squares (OLS) regression analysis results for the key determinants of innovation activity in Small and Medium-sized Enterprises (SMEs). The dependent variable in this analysis is the index of innovations, and the independent variables are responses to specific motivating factors and barriers to innovation.

The "Estimate" column shows the estimated coefficients of each independent variable in the regression model. These coefficients indicate the direction and magnitude of the relationship between the motivating factors and barriers to innovation and the index of innovations. For instance, a positive coefficient suggests that an increase in the motivating factor or a decrease in the barrier to innovation is associated with a higher index of innovations. The numbers in the brackets under coefficients represent standard error. It measures the variability or uncertainty around each estimated coefficient. Lower standard errors indicate more precise estimates.

The "t-value" column displays the t-values for each coefficient. It is calculated by dividing the estimated coefficient by its standard error and measures the statistical significance of the coefficient. Higher t-values suggest that the coefficient is more likely to be statistically significant.

Overall, the results of the OLS regression analysis show that several motivating factors and barriers to innovation have a significant impact on the index of innovations in SMEs. Factors such as "Recognition and appreciation are provided for successful innovation outcomes" (Q8), "Our company invests in research and development (R&D) activities" (Q10), "Our company maintains strategic partnerships and collaborations to access external expertise and knowledge" (Q12) significantly positively influence the index of innovations.

The motivating factors "Our company encourages, and rewards innovative ideas" (Q5), "Collaboration and knowledge-sharing among employees are encouraged to foster innovation." (Q9), "Innovation is considered a strategic priority for our company" (Q10), "Our company has a dedicated budget allocated for innovation initiatives" (Q11) also positively influence the position of Ukraine in world innovation index. The influence of the other tested motivating factors is not significant.

On the other hand, barriers such as Inadequate access to external funding sources limit our innovation efforts." (Q15) and "Limited financial resources restrict our ability to invest in innovation" (Q16) negatively affect the index of innovations. The impact is significant. A less significant negative impact is "Lack of awareness and understanding of emerging technologies impedes innovation" (Q24).

Several robustness tests were performed to check the significance of the result analysis. The results showed no significant multicollinearity, no evidence of heteroscedasticity, no autocorrelation detected, residuals followed a normal distribution, and influential outliers were identified.

It is important to note that these findings are based on the current sample of 298 respondents. Further research with a more extensive and more diverse sample may strengthen the generalizability of these results. Additionally, other external factors not included in this analysis could also influence innovation activity in SMEs. Therefore, cautious interpretation and consideration of various contextual factors are essential when using these results to inform business decisions and policies related to innovation in SMEs.

IV. Discussion

In the contemporary dynamic and competitive business environment, innovation is indispensable in driving the success and sustainability of organizations across diverse industries and determining the economy's success. Countries where small and medium-sized enterprises (SMEs) are the key contributors to economic growth and job creation, usually more advanced in technologies, have better business and investment climate, have higher ranks in the world competitiveness and other similar ranks ^{15, 16}. Even though it is a proven fact, not every country succeeded in building a strong innovative cluster in an economy based on SMEs. SMEs face different challenges and either give up innovative activities and stay in the traditional sector or run away from countries with unfriendly environments ^{17,18, 19}.

Undoubtedly, innovation holds significant importance in the context of SMEs. By fostering innovation, SMEs gain a competitive edge, swiftly adapt to evolving market demands, and seize new business prospects ^{20,21}. Innovative SMEs contribute to economic development, which is especially vital for developing markets. As was discussed above, understanding of key determinants of innovation activities is crucial for Ukrainian

policymakers. Ukraine will need to mobilize significant sources to rebuild the economy after the war, but with an innovative foundation, the process will be faster and more efficient.

The results of the OLS regression analysis demonstrate that several motivating factors and barriers to innovation significantly impact the index of innovations in SMEs. Factors such as "Recognition and appreciation are provided for successful innovation outcomes" (Q8), "Our company invests in research and development (R&D) activities" (Q10), and "Our company maintains strategic partnerships and collaborations to access external expertise and knowledge" (Q12), "Our company encourages and rewards innovative ideas" (Q5), "Collaboration and knowledge-sharing among employees are encouraged to foster innovation" (Q9), "Innovation is considered a strategic priority for our company" (Q10), and "Our company has a dedicated budget allocated for innovation initiatives" (Q11) significantly positively influence the index of innovations. The significance of strategic partnerships for innovations and recognition of the innovations as a strategic priority is in line with recent research. The same results were obtained by Cuesta-Valiño, P., Gutiérrez-Rodríguez, P., Núnez-Barriopedro, E., & García-Henche, B.²², Dahlquist, S., & Lehnert, K.²³, Evers, N., Gliga, G., & Rialp-Criado, A.²⁴.The impotence of recognition and reward of the innovation success was discussed by Faroque, A. R., Morrish, S. C., Kuivalainen, O., Sundqvist, S., & Torkkeli, L²⁵, Gabrielsson, M., Gabrielsson, P., & Dimitratos, P.²⁶. The crucial role of R&D funding for stimulation of innovations in SME and availability of dedicated budgets is discussed by Cornet 27, Belderbos, R., Carree, M., Lokshin, B. 28, Berger, A. N. and Udell, G. F. ²⁹. Therefore, our fundings for the critical determinants for successful innovation activities of SMEs in the world are in line with the determinants for Ukrainian SMEs.

Barriers to innovation activities such as "Inadequate access to external funding sources limit our innovation efforts" (Q15) and "Limited financial resources restrict our ability to invest in innovation" (Q16) also were discussed by academicians. Bertoni, F., Brault, J., Colombo, M. G., Quas, A. and Signore, S.³⁰ discussed how modern financial instruments can improve access to financial resources for innovative companies. Brander, J.A., Du, Q., and Hellmann, T.³¹ discussed how government support may encourage innovations. Hellmann, T., Schure, P., and Vo, D.³² addressed the role of business angels and ventures in funding innovations. Therefore, our findings about innovation challenges align with the prior research.

The factor "Lack of awareness and understanding of emerging technologies impedes innovation" (Q24) was not found in the prior research. The possible reason for that is the specifics of the Ukrainian market. Since the market is young and the heritage of the Soviet Union type of thinking is still present, many managers do not care about innovations and only focus on short-term profit.

V. Conclusion

This research investigated the key determinants of innovation activity in Ukraine's small and medium-sized enterprises (SMEs). The analysis revealed significant insights into the factors that influence the index of innovations in these firms. The results underscore the critical role of various motivating factors and barriers in shaping innovation outcomes.

The study found that several motivating factors significantly impact the index of innovations in SMEs. Factors such as "Recognition and appreciation are provided for successful innovation outcomes" (Q8), "Our company invests in research and development (R&D) activities" (Q10), and "Our company maintains strategic partnerships and collaborations to access external expertise and knowledge" (Q12) were positively associated with higher innovation levels. This highlights the importance of fostering a culture of recognition and rewarding innovative ideas, investing in R&D activities, and establishing strategic partnerships to drive innovation.

Additionally, the motivating factors "Our company encourages, and rewards innovative ideas" (Q5), "Collaboration and knowledge-sharing among employees are encouraged to foster innovation" (Q9), "Innovation is considered a strategic priority for our company" (Q10), and "Our company has a dedicated budget allocated for innovation initiatives" (Q11) also demonstrated significant positive effects on innovation activity in SMEs. These findings emphasize the significance of promoting a collaborative work environment, prioritizing innovation as a strategic goal, and allocating dedicated budgets for innovation initiatives.

On the other hand, barriers to innovation were identified as critical obstacles that negatively affect innovation activity in SMEs. Factors such as "Inadequate access to external funding sources limit our innovation efforts" (Q15) and "Limited financial resources restrict our ability to invest in innovation" (Q16) had significant negative impacts on the index of innovations. This suggests that addressing financial constraints and improving access to external funding sources are essential steps to promote innovation in SMEs.

Notably, the factor "Lack of awareness and understanding of emerging technologies impedes innovation" (Q24) emerged as a unique barrier in the Ukrainian context. This highlights the need for targeted interventions to enhance awareness and knowledge about emerging technologies among SME managers to foster innovation in the country.

The findings of this study provide valuable insights for policymakers, researchers, and practitioners aiming to support and promote innovation in SMEs. By understanding the critical determinants of innovation

activity, policymakers can design targeted strategies and policies to create a conducive environment for innovation. Researchers can use these findings to develop further studies that explore specific interventions and programs to address the identified barriers. Moreover, practitioners in SMEs can utilize the insights to formulate effective innovation strategies and initiatives to enhance their competitive advantage in the market.

While this research offers valuable contributions, it also has certain limitations. The findings are based on a sample of 298 respondents from Ukraine, and the generalizability of the results to other contexts should be approached with caution. Future research with a more extensive and more diverse sample is recommended to enhance the robustness of the conclusions. Additionally, the study focused on a specific set of motivating factors and barriers; other external factors not included in the analysis may also influence innovation activity in SMEs. Therefore, future studies should consider a broader range of determinants to comprehensively understand SMEs' innovation.

In conclusion, this research sheds light on the critical role of motivating factors and barriers in driving innovation activity in small and medium-sized enterprises in Ukraine. By identifying the key determinants of innovation, this study contributes to the knowledge base on fostering innovation in the SME sector. Policymakers, researchers, and practitioners can utilize these insights to formulate effective strategies and policies that nurture a culture of innovation and enhance the competitiveness of SMEs in the dynamic and competitive business environment. Ultimately, promoting innovation in SMEs will benefit individual firms and contribute to the country's overall economic growth and development.

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