Wach, K., & Daszkiewicz, N. (2023). Role of research and development in the internationalization of high-tech firms: Empirical results from Poland. *Journal of International Studies, 16*(4), 245-256. doi:10.14254/2071-8330.2023/16-4/16

Journal of International Studies

Centre of Sociological Research

Scientific Papers

Role of research and development in internationalization of high-tech firms: Empirical results from Poland

Krzysztof Wach
Department of International Trade, Krakow University of Economics, Poland
wachk@uek.krakow.pl
ORCID 0000-0001-7542-2863

Nelly Daszkiewicz
Department of Economics, Gdańsk University of Technology, Poland
ndasz@zie.pg.gda.pl
ORCID 0000-0001-6620-627X

Abstract. This article focuses on the significance of research and development (R&D) in driving the internationalization of Polish high-tech firms. R&D is essential for businesses to remain competitive and adapt their products to the specific requirements of different markets. The study aims to investigate the relationship between R&D and the internationalization process of high-tech firms based in Poland, with a focus on the innovation context. We used a quantitative research method and employed a survey questionnaire to evaluate the internationalization of high-tech firms in Poland. The study employed a computer-assisted telephone interviewing (CATI) method and identified the random sample of 263 fully-filled questionnaires during the survey that were important for further statistical analysis. We confirmed that research and development as it is commonly understood, i.e., having one's own R&D department and making expenditures on R&D, helps and strengthens the internationalization of high-tech firms.

Received: January, 2023
1st Revision: July, 2023
Accepted: October, 2023

DOI: 10.14254/2071-8330.2023/16-4/16

Keywords: internationalization, high-tech firms, internationalization of firm, international entrepreneurship, international business, research and development (R&D)

JEL Classification: F23, L26

1. INTRODUCTION

Research and development (R&D) is vital to the internationalization of high-tech firms. In the fast-paced and ever-evolving world of high technology, businesses must continually innovate and develop new products and technologies to remain competitive (Sabatini et al., 2022). R&D is essential for high-tech businesses and industries as it enables them to develop new and improved products, enhance existing ones, and explore new markets (internationalize). When high-tech firms go international, they must adapt their products and technologies to satisfy the specific requirements of various markets (Ahi et al., 2022). In fact,

different countries' regulatory frameworks, cultural preferences, and technological infrastructures frequently necessitate considerable R&D efforts and international market success is more likely for high-tech firms that invest in R&D to adapt their products to local market requirements (Głodowska et al., 2023a). The impact of the Covid-19 pandemic, which has changed how the global community thinks, acts, produces, consumes, and conducts business, has given the significance of technology-based entrepreneurship and digital transformation a whole new meaning recently (Corvello et al., 2021; Banaszyk et al., 2021; Żur & Wałęga, 2023).

The processes of internationalization, innovation and entrepreneurship are deeply intertwined in the operations of technology-based firms, particularly in high-tech industries (Reuber & Fisher, 2011; Onetti et al. 2012; Gaweł, 2021). As a result, this article will focus on these three issues. To begin, the main research theme is international business, in particular the internationalization of firms. Secondly, we will deal with innovation, mainly from the perspective of research and development (R&D) as a key element of innovation performance.

The objective of this study is to pinpoint the significance of R&D as a driving force of the internationalization of Polish high-tech firms. The first publications dealing with technology-based entrepreneurship in Poland appeared in the literature in the 2010s (Badzińska 2016; Głodowska, 2019). Almost the same is true when it comes to the internationalization of Polish high-tech firms (Daszkiewicz, 2019; Głodowska et al., 2023b). As indicated in 2016, there were only a few papers linking internationalization and technology in the context of Polish firms over the quarter-century period of 1990-2014 (Puślecki et al., 2016).

There are currently not many studies from emerging economies on international entrepreneurship (Perényi & Losoncz 2018; Głodowska 2019; Puślecki et al., 2016). Another viewpoint on this issue is that Poland is an emerging market – the post-transition economy. Empirical research on developing nations, especially those in Central and Eastern Europe, is obviously lacking (Cui et al., 2018). One of the larger nations in Central Europe, Poland is unquestionably a developing economic power.

Based on the bibliometric analysis for the international business literature in Poland published in eminent Polish journals and a few foreign journals, Puślecki et al. (2016) found that there have only been 4 articles published on the role of technology and high-tech in internationalization of Polish firms. Although many editors from leading journals advise and encourage the replication of research in management, economics or business studies (Eden, 2002), numerous academics have different perspectives towards this topic, which is not entitled (Hensel, 2019). The above mentioned arguments make this article seeks answers to the following research question:

RQ: What are the relations between innovation, especially research and development, and the internationalization process of high-tech firms from Poland? Does the innovation context matter?

The literature appears to have a research gap, and these relationships have not yet been studied in rising markets, particularly Poland. Additionally, there is a clear shortage of empirical research on developing post-transition economies like Poland (Wach et al., 2022). The research on the internationalization of high-tech firms is advanced and updated in three ways by this paper. First, it is one of the first empirical studies on Poland's high technology industry enterprises going international. Second, it unites two distinct variables - namely, (i) research and development and (ii) the internationalization of firms - into a single research topic. Third, it adds to the body of literature on global entrepreneurship by examining the internationalization of technology-based firms in a more recent setting and in Poland's developing economy, which is one of the few places where high-tech firm internationalization has been studied.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The theoretical framework of the article is based on the overview of the literature on international entrepreneurship (Oviatt & McDougall, 2005; Keupp & Gassmann, 2009; Mainela et al., 2018). Johnson (2004) described the findings of a numerous empirical studies identifying factors influencing the early internationalization of small high technology firms. The studies proved that these firms frequently started early internationalization in order to survive, grow and succeed. Moreover, small high technology firms were driven to internationalize early due to the accelerated pace of worldwide technological innovation. The role of innovation is well identified for the exporting and internationalization across various industries (Almodóvar et al. 2021; Bigos & Michalik 2020, Bigos & Wach, 2021, Trąpczyński et al. 2021) and recently also in the high-tech industry (Wach, 2019). Johnson (2004) also conducted a qualitative and quantitative research of US and UK small international start-ups in high-tech industries. The study supported the factors previously noted in the literature.

In the literature there is an ongoing debate on the role of innovations and the links between innovation and internationalization and sometimes the empirical results are quite contrary. Firm internationalization can be also manifested in the internationalization of R&D thus giving firms the opportunity to look for highly specialised resources needed to conducts works aimed at the achievement of original results (Kosała, 2019). B. Cassiman and E. Golovko (2011) stated that successful product innovation leads to firm's decision to enter the export markets. Moreover, they argue that product innovation, through its effect on firm productivity increases the likelihood of the firm entering the export market. Makiela et al. (2021) proved that FDI as high control entry modes positively impact productivity. The increase of the revenue, in turn, can enhance internal investments in R&D (Tvaronaviciene & Burinskas, 2021). Recently, P. Almodóvar et al. (2021) empirically proved for Spain that information stimulates export, import and the international cooperation. Innovation is the key value creation and export performance for both large multinational enterprises (MNEs) (Cano-Kollmann at al. 2016; Barłożewski & Trąpczyński, 2021) as well as for small and medium-sized enterprises (SMEs) (Saridakis et al. 2019; Oliinyk et al., 2023). K. Bigos and A. Michalik (2020) empirically proved the positive impact of innovation on exporting of 906 new ventures from countries from Central and Easter Europe and Central Asia. Their empirical results reveal that organisational innovations by ventures increases the likelihood of export more than twice, while in the case of process innovations – about one and a half times. There is much evidence that innovation, innovativeness and/or innovative resources are a key driver of firm internationalization especially in high-tech industries but also either in traditional industries (Veglio and Zuchella 2015). These successful practices are often developed as a result of the knowledge management systems advance (Bilan et al., 2023; Straková et al., 2022; Zsigmond & Mura, 2023) including those based on the business–education collaboration (Samoilikova et al., 2023). Wach (2016) empirically proved that innovativeness of high-tech firms contributes to the intensification of their internationalization. Furthermore, it was evidenced that internationalization of high-tech firms is stimulating by the pace of innovation diffusion and the number of implemented innovations. Recently, more attention has been paid to research and development as an important process component of innovation. In comparison to companies in traditional industries, new technology-based enterprises exhibit a considerably greater level of R&D spending, which affects their competitive advantage (Zou et al. 2010). These firms are the source of technical advancements and expect governmental incentives (Sindhu & Mor, 2022). Thus, we will verify the following hypotheses:

H: Widely understood research and development (R&D), in particular (**H1**) having an own R&D department, (**H2**) incurring expenditure on R&D and/or (**H3**) keeping own R&D staff, supports and strengthens the internationalization of high-tech firms.

3. RESEARCH METHODOLOGY

Based on a field survey, we chose to use the quantitative technique. For this study, we used a standard research methodology, which involved retrieving hypotheses from the literature, operationalizing variables, and testing them using specialized computer statistical software (Statistica®). We employed a survey questionnaire with five different theme categories, including (i) respondent characteristics, (ii) advanced technology, (iii) R&D and innovation, (iv) reasons for internationalization, its scope, and entry modes, (v) internationalization trends, and (vi) internationalization strategies.

On the basis of the literature analysis, we made the decision to look at how specific R&D criteria affect the internationalization of Polish high-tech firms. We used a straightforward research model to evaluate hypotheses during the empirical research phase. The suggested model (Figure 1) makes the assumptions about the internationalization of high-tech firms in Poland. Because innovation and R&D seems to be an essence of high-tech firms, and a main characteristics of born global, mentioned in most of the qualitative definitions of this term, that is why we will not link this variable with the early internationalization, but we will check how this widely understood R&D activities impact the scale of internationalization measured by TNI and international sales.

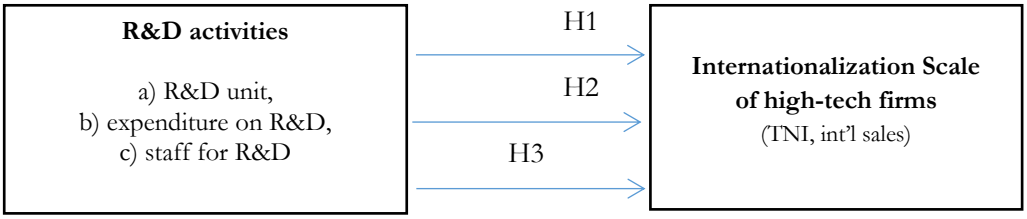

Figure 1. The research model for empirical hypotheses testing
Source: own elaboration

We employed two different dependent variables describing internationalization, based on three well-known concepts: (i) transnationality index, (ii) internationalization scale, and (iii) internationalization scope, which are widely accepted and used as a dependant variable in international business study (Głodowska, Pera & Wach, 2019). International sale is one of the basic and easiest measures of internationalization of the firm, as it measures the share of foreign sale in total sale. From a practical standpoint it is frequently employed in numerous empirical research (Ripollés-Meliá et al. 2007). Finally, we employed a well-known transnationality index (TNI), which is a measure by UNCTAD and other scholars. We also employed four independent and control variables to describe R&D. Table 1 discusses how the variables were created.

Utilizing Computer-Assisted Telephone Interviewing (CATI), the research on the internationalization of high-tech firms was conducted in Poland. The following criteria were used to identify the random sampling (Daszkiewicz, 2019; Daszkiewicz & Wach, 2023):

1) Conducting international business (at minimum exporting).
2) Belonging to one of the activity classes (NACE/PKD - Polish Classification of Activities), that is to "high-tech" or "medium-high-tech"
3) The imperative for the firm to meet at least one of the three following criteria:
   - obtaining patents or licensing agreements in high-tech areas;
   - employing personnel with high scientific and technical qualifications;
   - conducting industrial research or developmental work, as well as activities that prepare the results of this research or work for implementation in the economy.

The aforementioned criteria were used to choose the target population. At first, up to 4075 businesses

were selected from the Polish Agency for Enterprise Development's (PARP)directory of high-tech companies , but it was unable to contact some of them because there we not in operation. We collected 263 fully filled questionnaires during the survey (the return rate was 8.2%), which were important for further statistical analysis. When there was a contradiction or no valid data for further investigation, the computer software, in some cases, eliminated the responses.

Table 1

Used variables in empirical models and statistical calculations

Abbreviation	Full name	Measures	Scale
Dependent variables			
Int_Scope	Internationalization scope	Number of foreign markets the firm operate in	continuous variable
Int_Scope > Q2	Internationalization scope 2	0/1 Scope (measured as above) below and above the median (second quartile).	dummy variable
Int_TNI	Transnationality index	Average share of foreign sale, employment and assets respectively in total sale, employment and assets.	continuous variable
Int_TNI > Q2	Transnationality index 2	0/1 TNI (measured as above) below and above the median (second quartile).	dummy variable
Int_Sale	International sale	Share of foreign sale in total sale.	continuous variable
Int_Sale > Q1	International sale 2	0/1 Sale (measured as above) below and above the first quartile.	dummy variable
Independent and control variables			
R&D_unit	Having own R&D unit	0/1	dummy variable
R&D_expenditure	Expenses on R&D	0/1 Expenses on R&D (in % of income) above the first quartile.	dummy variable
R&D_staff	Staff for R&D	0/1 Staff involved in R&D (in %) above the first quartile.	dummy variable
Int_R&D	Internationalization of R&D	0/1	dummy variable

Source: own study.

4. EMPIRICAL FINDINGS AND DISCUSSION

4.1. Characteristics of the research sample

All sizes of businesses - micro, small, medium, and large - are represented in the research sample. Small and medium-sized businesses make up 82% of the surveyed companies (216), whereas large businesses make up 18% (47). 31% (80 firms) of the analyzed firms were "old" firms, defined as those founded before 1989 (when the economy was in transition). As a result, these companies began operating before Poland's economy transitioned from a centrally planned to a market economy. 59% (156 entities) of all businesses were founded during the transformation period, which ran from 1989 to 2004. A rapid surge in entrepreneurship during that time period led to the establishment of numerous new businesses, particularly small and medium-sized ones. Only 9% (24 enterprises) were founded between 2005 and 2009, yet this was after Poland joined the EU. Only three firms, or 1% of all businesses, were founded after 2010. The poll

was carried out over the entire country of Poland, in each of its 16 regions.

All high-tech and midrange high-tech industries were surveyed. 13% of all the companies surveyed work in the manufacturing of computers, electronics, and optical products (PKD 26), while the majority of businesses in the medium-high tech (MHT) sector work in the machinery and equipment sector that is not otherwise classified (PKD 28). Production of chemicals and chemical products (PKD 20; 14%) and electrical equipment (PKD 27; 17%). The majority of the businesses were involved in the production of electrical machines (34%), non-electrical machines (27%), electronics and telecommunications (17%), and chemicals (14%), according to the SITC product categorization (Standard International Trade categorization).

4.2. Logistic regression for R&D activities

The empirical statistic chi-squared $\chi2 = 151.246$ gives the value of level $p = 0.000$, and thus, at the level of significance $\alpha = 0.05$, we find that selected determinants together have a significant impact on the scope of internationalization of the surveyed firms (Table 2). The assessment of the parameter b with the variable "R&D unit" equal to 0.747 and odds ratio 2.111 means that the chance of achieving a high international scope is more than twice as high if you have your own R&D unit, which means that we can confirm the hypothesis H1. The assessment of the b parameter with the "R&D expenditure", "R&D staff" and "internationalizing of R&D" variables has (-) which means that these factors reduced the internationalization scope, also odds ratios (0.952, 0.351 and 0.444 respectively) mean that the chance of achieving a high international scope is lower for these variables.

Table 2

Results of estimation of parameters of the logistic models of the internationalization scale

Model 1: Int_Scope > Q2 ("1" – 89, "0" – 174)	Total loss: 151.246 Chi-squared (4) = 23.573 **p = 0.000** Modelled probability that Int_Scope < Q2				
	Constant	R&D_unit	R&D_expenditure ME/Q2	R&D_staff ME/Q2	Int_R&D
Assesment	0.747	0.747	-0.048	-1.047	-0.813
Odds ratio w. unit	2.111	2.111	0.952	0.351	0.444
Classification	chances: 2.857%, correct: 67.06%, percent correct > Q2 = 28.40%, percent correct < Q2 = 87.80%				
Model 2: Int_TNI > Q2 ("1" – 34, "0" – 229)	Total loss: 90.952 Chi-squared (4) = 13.746 **p = 0.008** Modelled probability that Int_TNI < Q2				
	Constant	R&D_unit	R&D_expenditure ME/Q2	R&D_staff ME/Q2	Int_R&D
Assesment	1.183	1.183	0.822	-0.133	-1.324
Odds ratio w. unit	3.264	3.264	2.274	0.875	0.266
Classification	chances: 1.734%, correct: 55.09%, percent correct > Q2 = 14.87%, percent correct < Q2 = 90.84%				

Source: own study based on the survey (n = 263).

We build also the second model with three dependent variable TNI > Q2. The empirical statistic chi-squared $\chi2 = 90.952$ gives the value of level $p = 0.008$, and thus, at the level of significance $\alpha = 0.05$, we find that selected determinants together have a significant impact on the scope of internationalization of the surveyed firms. The assessments of the parameter b with the variables "R&D unit" and "R&D expenditure" have (+) which means these factors positively impact the scale of internationalization. The odds ratio of

3.264 means that the chance of achieving a higher TNI is almost 3.3 times higher if you have your own R&D unit. The odds ratio of 2.274 means that the chance of achieving a higher TNI is almost 2.3 times higher if you invest into R&D expenditure. So we can confirm hypotheses H1 and H2. While because of the (-) assessment of the parameter b in both models (model 1 with internationalization scope and model 2 with TNI as internationalization scale) we must reject the hypotheses H3.

In turn, the classification of the surveyed firms, we can assess the average validity of the estimated model in the classification of the surveyed firms surveyed (Table 2). We see that among firms whose internationalization scope is > Q2, the correct classification by the model was 28.4%, while the scope is < Q2 so correct classification was 87.8%. For model 2 predicting the impact on TNI the calculations are respectively 14.9% for TNI > Q2 and 90.8% for TNI < Q2.

4.3. Scientific discussion

Innovation is closely related to internationalization, and the relationship is two-sided. The literature on the subject offers two approaches: internationalization as an effect of innovation and innovation as an effect of internationalization. It is a common point of view, confirmed in large number of empirical studies that innovation positively impact internationalization (Almodóvar et al. 2021; Bigos & Michalik 2020; Wach 2016; Veglio & Zuchella 2015; Cassiman & Golovko 2011) and our empirical results are in line with the previous investigations. Nevertheless, we focused only on selected aspects of R&D activities, not on innovation en bloc.

The empirical findings presented above add hitherto undetected nuances to the current literature in this area of the world and in this region of Europe. Although numerous scholars from various established economies have been studying the internationalization of technology-based global enterprises for the past 20 years (Ahi et al., 2022; Choquette et al. 2017; Onetti et al. 2012), other emerging markets, such as Poland, have not yet addressed this issue. Despite the occasionally negative connotation that academics give to study replication in business studies, it appears to be pertinent and, in some cases, even important (Hensel, 2019). Because Polish realities are vastly different from those in other countries, we felt it was worthwhile to investigate how these internationalization processes among Polish high-tech firms compare to those documented in the international literature. Specifically in the context of the recent technological revolution and Industry 4.0 (Rymarczyk, 2020; Rymarczyk, 2021), as well as the entrepreneurial economy (Sieja & Wach, 2019), artificial intelligence development (Korzyński et al., 2023; Wach et al., 2023; Sieja & Wach; 2023) and the dynamic development of international e-commerce (Grochal-Brejak & Szymura-Tyc, 2019), this article contributes to the literature on technological entrepreneurship (Badzińska 2016; Jafari-Sadeghi et al., 2021). This article advances the international entrepreneurship literature generally from the perspective of Central Europe, which is by itself of some added value (Perényi & Losoncz 2018) as it replicates empirical research from other regions of the world (Eden 2002; Hensel 2019) given the obvious dearth of empirical studies on developing nations, such as Poland.

R&D can aid high-tech firms in forming strategic alliances and partnerships with other companies and institutions worldwide (Antoncic & Prodan, 2008). These alliances can assist businesses in gaining access to new markets, technologies, and knowledge, as well as contribute to the development of global innovation ecosystems. In conclusion, R&D is an integral part of the internationalization process of high-tech firms. It aids businesses in innovating, adapting their products to local market demands, creating and protecting intellectual property, and forming strategic alliances and partnerships in the globe (Ahi et al., 2022).

There has been a lot of research done to date that supports the idea that high-tech firms' internationalization tendencies differ from those of low-tech firms, despite the fact that opinions on their international behaviour are still divided. The study that produced the empirical findings that are being

presented involved 263 firms from Poland that are involved in high-tech and medium-tech industries. The statistical computations allowed for the verification of two out of every three hypotheses (Table 3). Research and development as it is commonly understood, particularly having one's own R&D department and making expenditures on R&D, helps and strengthens the internationalization of high-tech firms.

For high-tech firms to prosper in the global market, innovation, which is a primary driver of R&D, is a crucial component. Having an own R&D department can be extremely important for high-tech firms as they expand internationally. There are some specific ways an R&D department can assist a high-tech company's internationalization process, namely: (i) create and develop new goods and services, (ii) adapt existing products and services to foreign markets, (iii) enhance production processes in the global marketplace and global value chains, (iv) build intellectual property, which is crucial for high-tech firms. R&D departments are crucial for high-tech companies that want to compete on the global market. High-tech companies can better fulfill the needs of various worldwide markets and compete more successfully on a global level by investing in innovation and creating new goods and services.

Table 3

The results of the hypotheses verification

Hypotheses	Verification status	Method of verification
Widely understood research and development (R&D), especially		Logistic regression (model 1 and model 2)
(H1) having an own R&D department,	H1 confirmed (M1, M2),	
(H2) incurring expenditure on R&D and/or	H2 confirmed (M2),	
(H3) keeping own R&D staff,	H3 rejected (M1, M2)	
supports and strengthens the internationalization of high-tech firms.		

Source: own study.

Similarly, research and development spending is essential for high-tech firms to expand internationally. High-tech firms operate in industries that move quickly and where technological innovation is essential to their success. Businesses can create new technologies, products, and processes that are crucial for their competitiveness in the global market by investing in R&D. Here are some specific roles that spending on R&D plays in the process of high-tech companies going international, namely: (i) developing new technologies, (ii) adapting to local market conditions, (iii) improving production processes, (iv) protecting intellectual property.

5. CONCLUSION

It is without doubt that the initial findings require more investigation. However, given that this field appears to be prospering in Poland at the moment, the acquired and presented empirical data provide for a check on the realities of Polish high-tech businesses. Replicating empirical research in the social sciences is not only feasible, but also highly encouraged (Eden 2002; Hensel 2019) to observe how it performs in other ecosystems in various parts of the world because these systems differ from one another and could affect the results. This paper seems to fill a research gap on the internationalization of technological businesses from post-transition countries, particularly Poland.

This research has its own limitations. Because the research sample was not sufficiently representative of the entire population, it is impossible to generalize the findings to other high-tech companies in Poland. This is the fundamental weakness of the study that was done. Nevertheless, even though the results are limited to the studied high-tech firms (n = 263), the sample size is substantial for Polish circumstances. Additionally, the survey included businesses with nationwide operations as well as medium- and high-tech businesses, thus businesses from all industries are represented in the research sample.

Regarding future study directions, we think it is worthwhile to concentrate on a smaller group of businesses, especially those engaged in ultra-high technologies, in particular examining the internationalization processes of high-tech corporations. Additionally, studies on the connections between internationalization and innovation, technological capability and internationalization strategies, and the importance of an international entrepreneurial orientation in the internationalization of high-tech firms are all worthy of consideration. Undoubtedly, the employed approach has to be developed and enhanced, for instance by using new research instruments, such as qualitative research based on management interviews, or more advanced quantitative tools. This topic also offers a lot of promise for a strong comparative research, such as a detailed examination of the factors that led high-tech firms outside of Poland, particularly those from developing markets like Central and Eastern Europe, to internationalize.

ACKNOWLEDGEMENT

In case of Krzysztof Wach, the publication was co-financed from the subsidy granted to Krakow University of Economics (Poland) – Project no. PRW/WPOT/2023/0045 (*Digital challenges for international trade and business*). In case of Nelly Daszkiewicz, this publication was co-financed from the subsidy granted to the Faculty of Management and Economics, Gdansk University of Technology (Poland).

REFERENCES

Ahi, A.A., Sinkovics, N., Shildibekov, Y., Sinkovics, R.R., & Mehandjie, N. (2022). Advanced technologies and international business: A multidisciplinary analysis of the literature. *International Business Review*, 31(4). https://doi.org/10.1016/j.ibusrev.2021.101967

Almodóvar, P., Nguyenb, K.T.Q., Verbeke, A. (2021). An integrative approach to international inbound sources of firm-level innovation. *Journal of World Business*, Ahead-of-Print. https://doi.org/10.1016/j.jwb.2020.101188

Antoncic, B., & Prodan, I. (2008). Alliances, corporate technological entrepreneurship and firm performance: Testing a model on manufacturing firms. *Technovation*, *28*(5), 257-265. https://doi.org/10.1016/j.technovation.2007.07.005

Badzińska, E. (2016). The Concept of Technological Entrepreneurship: The Example of Business Implementation. *Entrepreneurial Business and Economics Review*, *4*, 3, 57-72. https://doi.org/10.15678/EBER.2016.040305

Banaszyk, P., Deszczyński, P., Gorynia, M., & Malaga, K. (2021). The Covid-19 pandemic as a potential change agent for selected economic concepts. *Entrepreneurial Business and Economics Review*, *9*(4), 35-50. https://doi.org/10.15678/EBER.2021.090403

Barłożewski, K., & Trąpczyński, P. (2021). Internationalisation motives and the multinationality-performance relationship: The case of Polish firms. *Entrepreneurial Business and Economics Review, 9*(2), 85-104. https://doi.org/10.15678/EBER.2021.090206

Bigos, K., & Michalik, A. (2020). The influence of innovation on international new ventures' exporting in Central and Eastern Europe and Central Asia countries. *Entrepreneurial Business and Economics Review*, *8*, 3, 47-63. https://doi.org/10.15678/EBER.2020.080303

Bigos, K., & Wach, K. (2021). Product innovation as the cause for export propensity in the Caucasus: Empirical evidence for Armenia, Azerbaijan and Georgia. *Central Asia and the Caucasus*, *22*(2), 90-100. https://doi.org/10.37178/ca-c.21.2.08

Bilan, Y., Oliinyk, O., Mishchuk, H., & Skare, M. (2023). Impact of information and communications technology on the development and use of knowledge. *Technological Forecasting and Social Change*, *191*, 122519. DOI: 10.1016/j.techfore.2023.122519

Cano-Kollmann, M., Cantwell, J., Hannigan, T.J., Mudambi, R., & Song, J. (2016): Knowledge connectivity: An agenda for innovation research in international business. *Journal of International Business Studies, 47***,** 255–262. https://doi.org/10.1057/jibs.2016.8

Cassiman, B., & Golovko, E. (2011). Innovation and internationalization through exports. *Journal of International Business Studies*, *42*, 1, 56-75.

Choquette, E., Rask, M., Sala, D., & Schroder, Ph. (2017): Born Globals – Is there a fire behind the smoke?. *International Business Review*, *26*, 3, 448-460. https://doi.org/10.1016/j.ibusrev.2016.10.005

Corvello, V., De Carolis, M., Verteramo, S., & Steiber, A. (2022). The digital transformation of entrepreneurial work. *International Journal of Entrepreneurial Behavior & Research*, *28*(5), 1167-1183. https://doi.org/10.1108/IJEBR-01-2021-0067

Cui, L., Fan, D., Guo, F., Fan, Y. (2018). Explicating the relationship of entrepreneurial orientation and firm performance: Underlying mechanisms in the context of an emerging market. *Industrial Marketing Management*, *71*, 27–40.

Daszkiewicz, N. (2019). Internationalisation Patterns of Polish Family High-Tech Firms. *Entrepreneurial Business and Economics Review*, *7*(4), 147-163. https://doi.org/10.15678/EBER.2019.070409

Daszkiewicz, N., & Wach, K. (2023). Networking and Familiness as Factors Stimulating the Early Internationalization of High-Tech Firms. *Engineering Economics*, 34(5), 554–567. https://doi.org/10.5755/j01.ee.34.5.33855

Eden, D. (2002). From the Editors: Replication, Meta-Analysis, Scientific Progress, and AMJ's Publication Policy. *Academy of Management Journal*, 45, 5, 841–846.

Gawel, A. (2021). International trade in the high-tech sector – support or obstacle to start-up processes at the macro level in European Union countries?. *Journal of Theoretical and Applied Electronic Commerce Research, 16*(5), 1877-1892; https://doi.org/10.3390/jtaer16050105

Głodowska, A. (2019). Comparative international entrepreneurship: Theoretical framework and research development. *Entrepreneurial Business and Economics Review*, *7*(2), 235–248. https://doi.org/10.15678/EBER.2019.070213

Głodowska, A. (2019b). The concept of high-tech firms and their role in the contemporary economy (chapter 1). In N. Daszkiewicz (ed.), *The Internationalization of High-Tech Firms: Patterns, Innovation, and Research and Development*. Newcastle upon Tyne (UK): Cambridge Scholars Publishing. pp. 6-35.

Głodowska, A., Maciejewski, M., & Wach, K. (2023). Navigating the digital landscape: A conceptual framework for understanding digital entrepreneurship and business transformation. *International Entrepreneurship Review*, 9(4), 7–20. https://doi.org/10.15678/IER.2023.0904.01

Głodowska, A., Maciejewski, M., & Wach, K., (2023b). Does high-tech industry matter for marketing strategy selection? Adaptation vs. standardization on the international market. *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego* [Studies of the Industrial Geography Commission of the Polish Geographical Society], *37*(1), 70–82. https://doi.org/10.24917/20801653.371.4

Głodowska, A., Pera, B., Wach, K. (2019): International strategy as the facilitator of the speed, scope, and scale of firms' internationalization. *Central European Management Journal*, 27(3), 55-84. http://dx.doi.org/10.7206/cemj.2658-0845.3

Grochal-Brejdak, M., & Szymura-Tyc, M. (2018). The Internationalisation Process of an E-Commerce Entrepreneurial Firm: The Inward-Outward Internationalisation and the Development of Knowledge. *Entrepreneurial Business and Economics Review*, *6*(4), 103-123. https://doi.org/10.15678/EBER.2018.060406

Hensel, P.G. (2019). Supporting replication research in management journals: Qualitative analysis of editorials published between 1970 and 2015. *European Management Journal*, *37*, 1, 45-57. https://doi.org/10.1016/j.emj.2018.03.004

Jafari-Sadeghi, V., Garcia-Perez, A., Candelo, E., & Couturier, J. (2021). Exploring the impact of digital transformation on technology entrepreneurship and technological market expansion: The role of technology readiness, exploration and exploitation. *Journal of Business Research*, *124*(2021), 100–111. https://doi.org/10.1016/j.jbusres.2020.11.020

Johnson, J.E. (2004). Factors influencing the early internationalization of high technology start-ups: US and UK evidence. *Journal of international Entrepreneurship*, *2*, 1-2, 139-154.

Keupp, M.M. , & Gassmann, O. (2009). The past and the future of international entrepreneurship: A review and suggestions for developing the field. *Journal of Management*, *35*(3), 600-633.

Korzyński, P., Mazurek, G., Altman, A., Ejdsys, J., Kazlauskaite, R., Paliszewska, J., Wach, K., Zięba, E. (2023). Generative Artificial Intelligence as a New Context for Management Theories: Analysis of ChatGPT. *Central European Management Journal*, *31*(1). https://doi.org/10.1108/CEMJ-02-2023-0091

Kosała, M. (2019). The internationalization of research and development activities of high-tech firms (chapter 4). In N. Daszkiewicz (ed.), *The Internationalization of High-Tech Firms: Patterns, Innovation, and Research and Development*. Newcastle upon Tyne (UK): Cambridge Scholars Publishing. pp. 98-138.

Mainela, T., Puhakka, V., & Sipola, S. (2018). International entrepreneurship beyond individuals and firms: On the systemic nature of international opportunities. *Journal of Business Venturing*, *33*(4), 534-550. https://doi.org/10.1016/j.jbusvent.2018.04.002

Makiela, K., Wojciechowski, L., & Wach, K. (2021). Effectiveness of FDI, technological gap and sectoral level productivity in the Visegrad Group. *Technological and Economic Development of Economy*, *27*(1), 149-174. https://doi.org/10.3846/tede.2020.14017

Oliinyk, O., Mishchuk, H., Vasa, L., & Kozma, K. (2023). Social Responsibility: Opportunities for Integral Assessment and Analysis of Connections with Business Innovation. *Sustainability*, *15* (6), 5608. https://doi.org/10.3390/su15065608

Onetti, A., Zucchella, A., Jones, M.V., McDougall-Covin, P.P. (2012). Internationalization, innovation and entrepreneurship: business models for new technology-based firms. *Journal of Management Governance*, *16*, 337–368. https://doi.org/10.1007/s10997-010-9154-1

Oviatt, B. M., & McDougall, P.P. (2005): Toward a theory of international new ventures. *Journal of International Business Studies*, *36*, 1, 29-41.

Perényi, Á., & Losoncz, M. (2018). A Systematic Review of International Entrepreneurship Special Issue Articles. *Sustainability*, *10*, 3476.

Puślecki, Ł., Trąpczyński, P., & Staszków, M. (2016). Emerging advanced topics in an advanced emerging market? International business research in Poland in the period 1990-2014. *Journal of East European Management Studies*, 21, 2, 139–166.

Reuber, A.R., & Fischer, E. (2011). International entrepreneurship in internet-enabled markets. *Journal of Business Venturing*, *26*(6), 660-679.

Ripollés-Meliá, M., Menguzzato-Boulard, M. & Sánchez-Peinado, L. (2007): Entrepreneurial orientation and international commitment. *Journal of International Entrepreneurship*, *5*, 65–83. https://doi.org/10.1007/s10843-007-0016-0

Rymarczyk, J. (2020). Technologies, Opportunities and Challenges of the Industrial Revolution 4.0: Theoretical Considerations. *Entrepreneurial Business and Economics Review*, *8*(1), 185-198. https://doi.org/10.15678/EBER.2020.080110

Rymarczyk, J. (2021). The impact of industrial revolution 4.0 on international trade. Entrepreneurial Business and Economics Review, *9*(1), 105-117. https://doi.org/10.15678/EBER.2021.090107

Sabatini, A., Cucculelli, M., & Gregori, G.L. (2022). Business model innovation and digital technology: The perspective of incumbent Italian small and medium-sized firms. Entrepreneurial Business and Economics Review, *10*(3), 23-35. https://doi.org/10.15678/EBER.2022.100302

Samoilikova, A., Korpysa, J., Vasylieva, T., & Filep, B. (2023). Business – education collaboration in R&D investment: Analysis of development gaps and critical points using MAR-splines. *Journal of International Studies, 16*(2), 57-71. doi:10.14254/2071-8330.2023/16-2/3

Saridakis, G., Idris, B., Hansen, J.M., & Dana, L.P. (2019). SMEs' internationalisation: When does innovation matter?. *Journal of Business Research*, *96*, 250-263. https://doi.org/10.1016/j.jbusres.2018.11.001

Sieja, M., & Wach, K. (2019). The Use of Evolutionary Algorithms for Optimization in the Modern Entrepreneurial Economy: Interdisciplinary Perspective. *Entrepreneurial Business and Economics Review*, *7*(4), 117-130. https://doi.org/10.15678/EBER.2019.070407

Sieja, M., & Wach, K. (2023). Revolutionary artificial intelligence or rogue technology? The promises and pitfalls of ChatGPT. *International Entrepreneurship Review*, 9(4), 101–110. https://doi.org/10.15678/IER.2023.0904.07

Sindhu, S., & Mor, R. (2022). Modelling the interactions among enablers of technology entrepreneurship: An ISM and Fuzzy-MICMAC approach. *Entrepreneurial Business and Economics Review*, 10(2), 97-111. https://doi.org/10.15678/EBER.2022.100206

Straková, J., Talíř, M., & Váchal, J. (2022). Opportunities and threats of digital transformation of business models in SMEs. *Economics and Sociology, 15*(3), 159- 171. doi:10.14254/2071-789X.2022/15-3/9

Trąpczyński, P., Mertens, H., Peters D., & Barłożewski, K. (2021). Export performance research: Where should we go next?. *International Entrepreneurship Review, 7*(1), 59-72. https://doi.org/10.15678/IER.2021.0701.05

Tvaronaviciene, M., & Burinskas, A. (2021). Internal funding determinants of R&D expenditures for U.S. mature firms. *Journal of International Studies, 14*(1), 276- 284. doi:10.14254/2071-8330.2021/14-1/19

Veglio, V., & Zucchella, A. (2015): Entrepreneurial firms in traditional industries. Does innovation matter for international growth?. *Journal of International Entrepreneurship*, *13*, 2, 138-152.

Wach, K., & Głodowska, A (2021). How do demographics and basic traits of an entrepreneur impact the internationalisation of firms?. *Oeconomia Copernicana*, *12*(2), 399–424. https://doi.org/10.24136/oc.2021.014

Wach, K., Duong, C. D., Ejdys, J., Kazlauskaitė, R., Korzynski, P., Mazurek, G., Paliszkiewicz, J., & Ziemba, E. (2023). The dark side of generative artificial intelligence: A critical analysis of controversies and risks of ChatGPT. *Entrepreneurial Business and Economics Review*, 11(2), 7–30. https://doi.org/10.15678/EBER.2023.110201

Wach, K., Maciejewski, M., & Głodowska, A. (2022). U-shaped relationship in international entrepreneurship: Entrepreneurial orientation and innovation as drivers of internationalisation of firms. *Technological and Economic Development of Economy*, *28*(4), 1044-1067. https://doi.org/10.3846/tede.2022.16690

Zsigmond, T., & Mura, L. (2023). Emotional intelligence and knowledge sharing as key factors in business management – evidence from Slovak SMEs. *Economics and Sociology, 16*(2), 248-264. doi:10.14254/2071-789X.2023/16-2/15

Zou H., Liu X., & Ghauri P. (2010): Technology Capability and the Internationalization Strategies of New Ventures. *Organizations & Marketing in Emerging Economies*, 1, 1, 100-119.

Żur, A., & Walęga, A. (2023). Internationalization and innovation orientation as factors of employee learning and development adaptation during Covid-19: Evidence from Polish SMEs. *Entrepreneurial Business and Economics Review*, *11*(1), 77-91. https://doi.org/10.15678/EBER.2023.110104