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THE ANALYSIS OF THE CAUSALITY BETWEEN INNOVATION AND EXPORT INDICATORS

АНАЛІЗ ПРИЧИННОСТІ МІЖ ІННОВАЦІЙНИМИ ТА ЕКСПОРТНИМИ ПОКАЗНИКАМИ

It is evident that for Ukraine to progress towards an innovation-driven and high value-added economy, it must ameliorate its innovation and entrepreneurial ecosystem. Hence, production of valuable and high-quality innovative products, improvement of existing and introduction of new progressive technologies, change for the innovation environment have the main value for ensuring high level of competitiveness of enterprises in the foreign markets. These features can be secured by the development of both the innovative and export potentials of the enterprise. Hence, in this article, we analysed the causality between innovation and export performance. We defined the concept of «innovation» and its components, which are factors of improvement of export efficiency of the company. Further, we explain the argument whether the implementation of innovation policy causes increased export activity, or vice versa. Hence, we analysed whether exporting firms learn from their participation in foreign markets so that they become more innovative than the firms that focus only on domestic markets, or do firms invest in innovative activities in order to become more innovative and productive before they decide to enter foreign markets. As a result, the model of trade and innovation, as well as the question of the internationalization of R&D of the firm (the situation where firms increasingly offshore R&D activities to other countries to sense new market and technology trends worldwide) were taken into account. Next, we investigated the impact of export 'shocks' on innovation for firms. While from PwC Global Innovation Survey, where they established a clear correlation between innovation and growth, we deduced some lessons how innovative thinking leads to increased company value and as a result foreign activity in the highly competitive market. Further, using regression analysis, we established the correlation between the R&D expenditures and performance indicators of the company (investigating PJSC «Ventilation systems» as a prime example).

Keywords: innovation; export; R&D; model of trade and innovation; causality.

Очевидно, що Україна має покращити інноваційну та підприємницьку екосистему, щоб робити прогрес у напрямку економіки, орієнтованої на інновації та високу додану вартість. Тому виробництво цінних та високоякісних інноваційних продуктів, вдосконалення існуючих та впровадження нових прогресивних технологій, внесення змін для інноваційного середовища мають основне значення для забезпечення високого рівня конкурентоспроможності підприємств на зовнішніх ринках. Ці можливості можуть бути забезпечені розвитком як інноваційного, так і експортного потенціалу підприємства. У даній статті проаналізовано причинні зв'язки між інноваційною діяльністю та експортним потенціалом компаній. Визначено поняття «інновація» та її складові, що є факторами покращення експортної ефективності компаній. Розглянуто протиріччя: чи проведення інноваційної політики спричиняє підвищення експортної активності, або ж навпаки. В результаті було проаналізовано два аспекти взаємного впливу: чи фірми, які експортують, беруть досвід на зовнішніх ринках, щоб стати більш інноваційними, ніж фірми, які зосереджуються лише на внутрішніх ринках (гіпотеза «навчаються за експортом»), або ж вони інвестують в інноваційну діяльність, щоб стати більш інноваційними і продуктивними, перш ніж вони

вирішать вийти на зовнішні ринки (гіпотеза самопідбору). Далі ми пояснили модель торгівлі та інновацій, а також питання інтернаціоналізації науково-дослідної роботи фірми (тобто ситуація, коли фірми все більше переводять діяльність відділу досліджень і розробок на офшор в інші країни, щоб виявити нові тенденції на ринку та технології у всьому світі). Далі визначено основні аспекти інноваційної діяльності, в т.ч. дослідження та розробки, що впливають на результативність фірм. З Global Innovation Survey агентства PwC, яке встановило пряму кореляцію між інноваціями та ростом компанії, ми зробили певні висновки як інноваційне мислення призводить до росту вартості компанії та покращенню зовнішньоекономічної діяльності компанії. За допомогою регресійного аналізу виявлено вплив витрат на дослідження та розробки на показники ефективності діяльності компанії (на прикладі ПрАТ «Вентиляційні системи»).

Ключові слова: інновації; експорт; НДДКР; модель торгівлі та інновацій; причинні зв'язки.

Introduction. In this article, we investigated and gathered the sufficient information on the relation between innovation and export from several major modern researches and scientists. Modern trade and growth theories (Grossman and Helpman [7]; Aghion and Howitt [1]) suggest that firms' access to export affect innovation, if only because improved access to export markets will expand the size of foreign markets that can be seized by successful innovators. To disentangle the problem of the direction of causality between innovation and export performance, Philippe Aghion, Antonin Bergeaud, Matthieu Lequien, and Marc Melitz constructed various firm-level export demand measures in their research paper [1]. Alfons Palangkaraya in his paper The Link between Innovation and Export investigates the connection between innovation activity and exports [3]. However, on the empirical side, the question of how trade and in particular exports can affect firms' innovation performance, has received little attention until recently.

Setting objectives. The main aim of the article is to investigate and establish the link between increasing export of the firms and their innovation capabilities. Moreover, we will examine the correlation ties that bind innovation activity and company growth on the example of PJSC «Ventilation Systems».

Methodology. The main research base for given article is the scientific and practical research of scientists in the field of innovation and finance management, and PwC Global Innovation Survey. The regression analysis for revenues and R&D expenditures was computed based on the MS Excel spreadsheet, while the data for analysis was extracted from Stock market infrastructure development agency of Ukraine (SMIDA) database.

Research results. The innovation activity investigation first of all requires to review the concept of «innovation» and «innovation process».

In 1939, the Austrian scientist Schumpeter introduced the concept of «innovation» into the scientific circle in his work «Business cycles» [12]. The scientist considered innovation as a process in a dynamic context. He identified innovation as the commercialization of «new combinations» based on:

- the use of new materials and components;
- the use of new products;
- introduction of new processes and technologies;

- opening new markets;
- introduction of new organizational forms.

In other words, Schumpeter regarded innovation as a process in which one innovation causes another, for instance, a change in technology, the emergence of new materials and components lead to the emergence of a new product that requires changes in business processes. New products can lead to the formation of new markets, new organizations, new partnerships. Concerning the new market, the vital role here belongs to correct export strategy.

Different authors interpret this concept depending on the object and subject of their research. In the Oslo Manual [10], which is a methodological document developed by an Organization for Economic Cooperation and Development, innovation is «the introduction into the use of any new or significant improvement of a product (product or service) or process, a new marketing method or a new organizational method in a business practice, organization of workplaces or communications».

P. Drucker [5] believed that innovation is a special tool for entrepreneurs, a means by which they use change as a chance to make a new kind of business or service: «innovation is not an invention and not a discovery. It focuses not on knowledge, but on efficiency, and in business - on economic efficiency. Its essence is more conceptual than technical or scientific. The characteristic quality of the innovator is the ability to integrate into the system something that for the others seems to be an unbroken set of different elements. The quality of innovation does not depend directly on its size. This is a successful attempt to find and incorporate into your business the last piece that was lost to transform the already existing elements like knowledge, goods, consumer demand, markets into a new, much more productive whole».

Further, we will try to establish the link between innovation aspect and export market penetration of the enterprises.

In his paper *The Link between Innovation and Export* [3], Alfons Palangkaraya makes an empirical investigation of the direction of causality between innovation and export market participation. Authors aim to address whether exporting firms learn from their participation in foreign markets so that they become more innovative than the firms which focus only on domestic markets (learning-by-exporting hypothesis) or do firms invest in innovative activities in order to become more innovative and productive before they decide to enter foreign markets (self-selection hypothesis) [8]. The paper provided few new insights and principles regarding the relationship between export and innovation. In particular, with regards to the direction of causality, the evidence is consistent with the notion that process innovation leads to export market activities which then leads to further process innovation. For product innovation, there is weaker evidence that current product innovation may lead to a higher probability of becoming a ‘new’ exporter in the current period [3].

Hitherto an impact of innovations on export was analysed. Nevertheless, some researchers and scientists investigate the impact of export shocks on innovation for firms [1]. A model of trade and innovation with heterogeneous firms predicts that a positive export shock should raise innovation more for initially more productive firms.

Demand shocks generate both market size and competition effects. A larger market size increases the incentives for innovation for all firms, whereas the increased competition generated by the larger market reduces the incentives for innovation most strongly for less productive firms. The model highlights how the increased competition from higher demand can generate losses and hence lower incentives for innovation for a subset of less productive firms. Authors found very strong confirmation of both this market size and competition effect for manufacturing innovators. Their empirical work merges three exhaustive firm-level datasets: customs, patent, and production data [1]. They show that patenting responds very strongly to increases in export demand, but only for relatively more productive firm (closer to the technology frontier). This patenting response steadily increases for firms that are closer to the technology frontier (higher initial levels of productivity) (Figure 1).

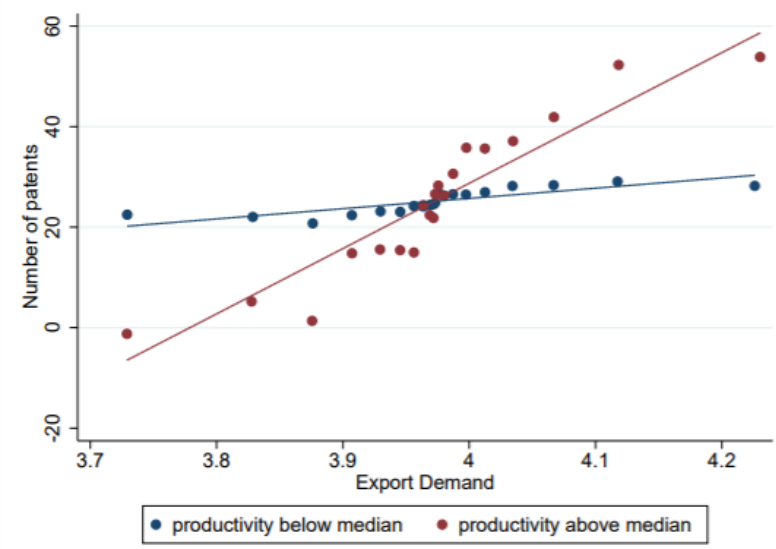

Figure 1 - Patenting increases more with demand for initially more efficient firms [1]

Research and Development plays a critical role in the innovation process. It's essentially an investment in technology and future capabilities which is transformed into new products, processes, and services. As global competition intensifies and innovation becomes riskier and more costly, the business sector is internationalising knowledge-intensive corporate functions, including R&D. Firms increasingly offshore R&D activities to other countries to sense new market and technology trends worldwide. Overall, the internationalisation of a firm's R&D promises substantial benefits (cost efficiency, learning potential, etc) but also creates serious challenges for many countries (such as the loss of R&D jobs and knowledge) [4].

PwC Global Innovation Survey [11] established a clear correlation between innovation and growth. Researchers ranked the 1,757 businesses that took part in their

study to arrive at a top 20% segment[1] of the most innovative companies based on their responses to six different questions (see more details at [11, p. 41]). Using publically-available information, they tracked the revenue growth of this top 20% over the past three years, and compared it with the performance of the bottom 20%. The results show that the most innovative 20% had already grown at a rate 16% higher than the least innovative. This equates, on average, to each of the most innovative companies delivering $0.25bn of additional revenue over the last three years, compared with the least innovative (anticipating an extra 6% per annum in growth (on average) [11]. The most innovative companies are set to grow at twice the pace of the global average, and three times the least innovative, over the next five years.

The conclusion of the PwC research shown in the Table 1 below.

Table 1 - Lessons deduced from the PwC research [11, p. 18-19]

Main peculiarities	**Companies, %**		**Explanation**
	Most innovative	**Less innovative**	
1. Recognise the importance of innovation	67	19	Two-thirds of the most innovative companies say innovation is a competitive necessity compared with 19% among the least innovative
2. Innovate with purpose (with business outcomes in mind)	32	20	The most innovative companies are more concerned about developing the right innovation strategy: 32% vs. 20%
3. Have a coherent strategy	79	47	Nearly 80% of the most innovative say they have a well-defined innovation strategy compared with 47% of the least innovative
4. Treat innovation like any other management process	78	66	The most innovative are more likely to manage innovation efforts formally or in a structured way: 78% vs. 66%
5. Experiment with new innovation operating models	13	7	The most innovative companies are more likely to use corporate venturing to drive growth: 13% vs. 7%
6. Target a higher proportion of breakthrough (or even radical) innovations.	2X	X	The most innovative companies are almost twice as likely to be targeting breakthrough and radical innovations
7. Innovate your business model(s), not just your products and services	79	59	The most innovative companies are planning to enhance the business model with new value offerings over the next 3 years
8. Use social media to help you innovate	67	39	The most innovative companies use social media more often to collaborate externally

[1] For the purpose of PwC analysis, from the 1,757 companies interviewed they have identified the top 20% innovators (359 companies), and the bottom 20% innovators (395 companies) to compare and contrast their relative characteristics and experiences [11]

9. Collaborate more	34	10	When it comes to developing new products and services with external partners, the most innovative companies collaborate over three times more often
10. Reap the rewards	62,2 %	20,7 %	The most innovative companies are growing at a much faster rate

In order to establish the correlation between expenditures on innovation (product innovation) and company revenues over the years, we examined the Ukrainian Private Joint Stock Company «Ventilation Systems» (VENTS), the world leader in ventilation production. VENTS is a powerful research, development and production enterprise that owns a largest state-of-the-art production facility in Europe and manufactures the full ventilation and air conditioning equipment range from simple to the most complicated product known as VENTS, Domovent, Plastivent, Aluvent, X-VENT, AirVENTS TM.

The main portion of company`s revenues is derived from exports to Europe, US, Middle East and Russian Federation. Therefore, the relation we are trying to establish further is between revenues from export and expenditures on R&D.

According to the Paragraph 20 of Provision (Standard) of Accounting Number 16, research costs are included in other operating expenses in accordance with Provision (Standard) of Accounting Number 8. Therefore, we collected data on revenues and other operating expenses of the VENTS Financial Statements over the last 13 years [13].

In the Table 2 revenues and other operating expenses figures over the last 13 years are given.

On the Figure 2, we can see the dispersion of the given numbers along the regression line.

Table 2 - Source data for regression analysis between revenues and R&D expenditures of the PJSC «Ventilation System», thousand UAH [13]

Year	Revenues	Other operating expenses (including R&D expenditures)
2016	121146	622224
2015	109607	833991
2014	52243	1066757
2013	33230	619283
2012	32923	132632
2011	27118	130837
2010	17164	106748
2009	-43874	118659
2008	2660	36863
2007	9335	574
2006	8484	320
2005	2387	139
2004	1286	42

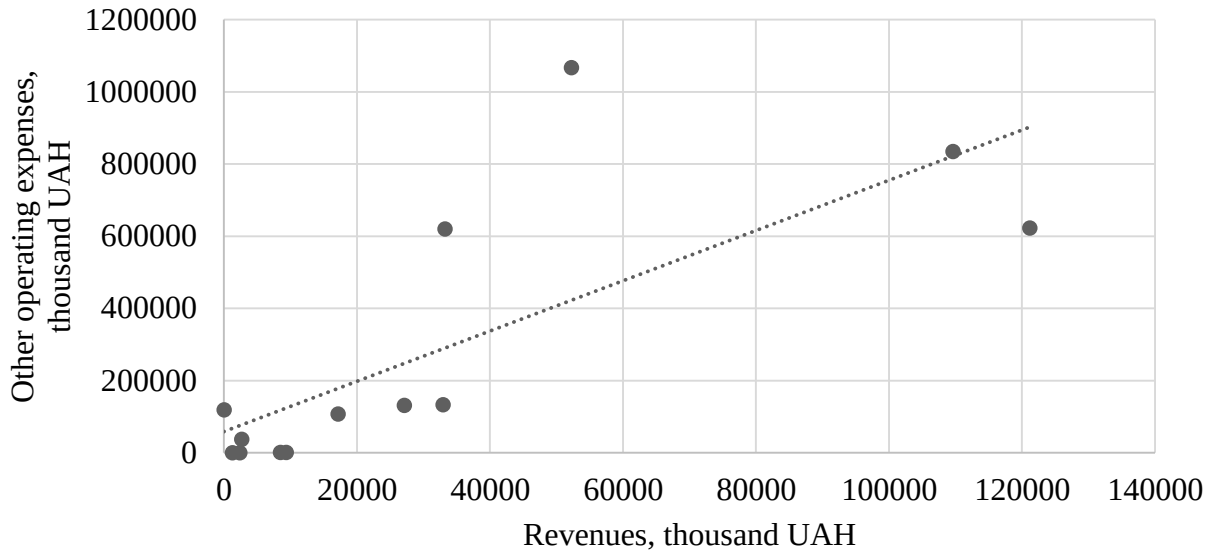

Figure 2 - Regression Model: relation between Revenues and Other operating expenses (including R&D expenditures) of PJSC «Ventilation System», Kyiv

The regression analysis, using Excel, can show the dependence of two given variables. The correlation between revenues and other operating expenses is very strong, around 0,76, which means that when some changes in the R&D expenditures occur, it can lead to the changes in the revenues.

Conclusions. In this article, we covered some main notions and views on the causality of innovations and export performances. Many researches argue that there is a strong connection between exports and innovation performances. Moreover, other include third dimension to the causality - R&D. And yet, it should be clear that not all innovation is supported by R&D; some firms undertake R&D and do not innovate; and exporting does not necessarily require R&D/innovation beforehand, nor result in R&D/innovation post-entry [6]. In the future, there should be more profound investigation and research on whether there are (causal) links between R&D/innovation and exporting. In addition, import and Direct Foreign Investments impact on the firms` growth should be considered and examined.

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