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IMPACT OF FOREIGN DIRECT INVESTMENT ON INNOVATION IN THE CONSTRUCTION MATERIALS INDUSTRY

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Purpose: Although the impact of FDI on the Polish economy is relatively well recognised in the literature, analyses of sectoral differentiation of FDI in Poland are rarely undertaken, so the aim of this article is to establish the relationship between FDI inflows and the development of innovation in the construction materials sector.
Design/methodology/approach: The study employs a comprehensive desk research approach, analyzing statistical data on foreign investments This methodology allows for a detailed examination of the correlation between FDI inflow and innovation of construction materials enterprises in the construction materials industry.
Findings: The article identifies the nature of innovations generated in the surveyed entities and their penetration into the national environment.
Research limitations/implications: If research is reported on in the paper, this section must be completed and should include suggestions for future research and any identified limitations in the research process.
The article is an attempt to answer the question: how innovative are entities with foreign capital operating in the construction materials industry in the Polish economy and whether there are spillover effects, to the domestic environment. To be used in economic policy in order to increase the absorption of capital in the form of FDI and increase the innovativeness of the economy
Practical implications: Although the allocation of FDI is subject to market mechanisms that enforce innovation as a condition of competitiveness in order to remain competitive, the strengthening of the attractiveness of the capital allocation conditions indicated/identified in the article through a conscious government policy enhances innovation. To be used in economic policy in order to increase the absorption of capital in the form of FDI and thus increase the innovativeness of the economy.
Originality/value: Establishing the relationship and conditions between FDI inflows and innovation development in a specific low- and medium-technology sector.
Keywords: foreign direct investments, innovation, innovativeness, economic development, construction materials sector, spillover effects.
Category of the paper: Research paper.

1. Introduction

As a consequence of the exploitation of extensive sources of growth and economic development in Poland, such factors began to be identified that would allow the Polish economy to move from a traditional economy to a new economy - one based on knowledge, operating in a global environment, with a dynamic market in which innovation and knowledge become the source of competitive advantage. On the one hand, the technological gap, high costs of domestic innovations, insufficient internal savings and, on the other hand, sufficient capacity to absorb technology and knowledge became the driving force for the opening of the Polish economy to foreign investment - as a complementary way of raising capital and stimulating the development not only of the entire economy, but of specific regions or sectors (Jasek, 2017, pp. 63-64).

In the Polish economy, since its marketisation in 1989, there has been a systematic increase in the involvement of foreign capital in the form of foreign direct investment (FDI) and, consequently, a systematic increase in the number of entities established with foreign capital, the dynamics of which has only in recent years shown a downward trend. Available data and research results show that foreign investors have for more than thirty years perceived Poland as an attractive place to invest capital, both in the form of greenfield investments, i.e. new enterprises created from the ground up outside the investor's country, as well as brownfield investments involving beneficial takeovers and, in the next stage, restructuring of enterprises already operating in the market (Jasek, 2017, pp. 63-64).

There is considerable interest in the subject of foreign investment, but an analysis of the sectoral diversity of FDI in Poland is rarely undertaken, which would allow the identification of the precise relationship between FDI inflows and the development of innovation in specific sectors (in particular mid- and low-tech) and, subsequently, the whole economy, as well as forecasting the directions of further operation of a given sector and its impact on the environment.

The construction materials production and distribution sector is a specific area of foreign investment absorption, which is highly sensitive to economic changes, economic transformations and social conditions. Despite the high risk, foreign investors appeared in the sector relatively quickly (in the early 1990s) and the market for construction materials itself, has undergone huge/diametric changes. The presence of companies with foreign capital has fostered the transfer of knowledge and modern technology, which now results in advanced solutions that allow the sector to reduce the investment and innovation gap, as well as to modernise and improve competitiveness at regional and national level (Gorynia et al., 2006).

Undertakings implemented within the framework of FDI generate both direct effects - positive, negative - and indirect effects, the so-called spillover effects.

This article will present the results of an own study that identified the effects of FDI undertaken between 1990 and 2015 on the transfer and diffusion of innovations, including the mechanisms for their creation in the construction materials sector, with particular emphasis on the part of the sector that supports housing construction. The impact of FDI was considered primarily from the point of view of the host economy. It was also important to identify the motives behind the activity of foreign investors locating capital in enterprises producing construction materials used in housing construction in the context of the socio-economic conditions of Poland as a host country. This made it possible to determine the nature of the innovations transferred in terms of the scale of the changes, their degree of originality and their complexity. The subject of the study includes direct macroeconomic effects, intrasectoral spillover effects, transfer and diffusion of innovations to domestic firms and to the domestic environment, which occurred in the years 1990-2015, marking the timeframe of the study, which resulted from economic conditions, i.e. the opening of the economy and the legal enablement of FDI in Poland.

The research was conducted among executives of large and medium-sized FDI in Poland from the construction materials sector who started their operations between 1990 and 2015, and whose aggregate market shares in each subsector are approximately 15-50%. Most of the surveyed companies started before 2000 (64%), the others after 2000, with the oldest of the surveyed companies established in 1990 and the youngest in 2014. Among the surveyed entities were companies whose capital was sourced from Germany, Austria, Switzerland, France, the Netherlands, Denmark and the UK (7%). Greenfield investments dominated (64% of the surveyed companies), 21% of the companies were brownfield investments, 14% were investments defined as ‘other’ - not further defined.

Companies producing construction materials were classified in 6 product groups, i.e. chimneys and ventilation; wall, floor materials and ceilings; insulation materials; roofing; windows and doors.

2. Inflow of FDI into the construction materials sector

Poland's social and economic transformation initiated in 1989, resulting in the liberalisation and opening of the Polish economy internationally, also made Poland an attractive country for foreign companies to locate capital. Economic and legal conditions became new determinants, which generated effects in the economic field and allowed for safer and more profitable investments. This had a real impact on the number and volume of foreign direct investments in Poland (Figure 1), their spatial allocation or the dynamics of change in the motives for investment.

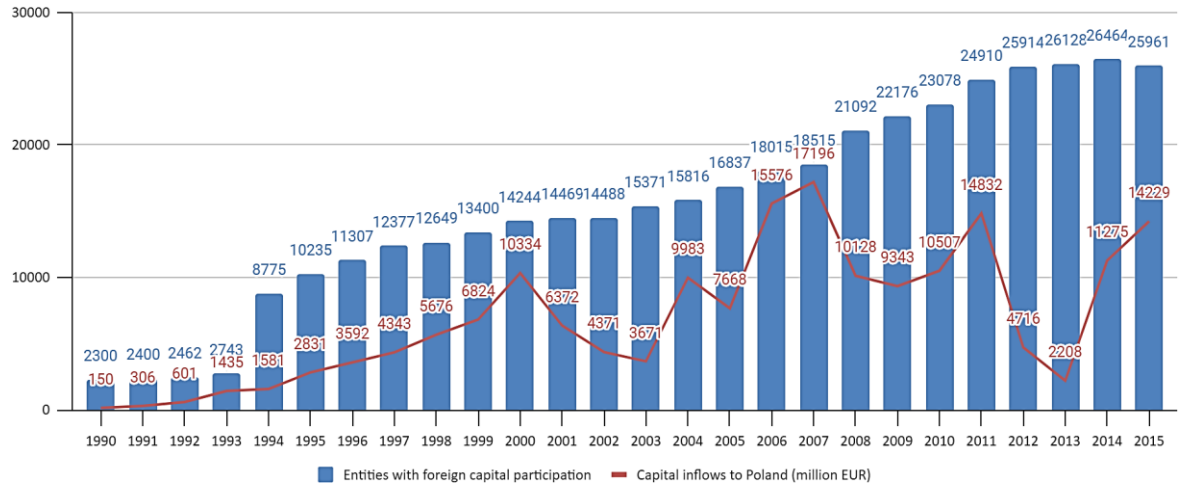


Figure 1. Inflow of foreign capital to Poland and number of entities with foreign capital in 1990-2015.

Source: Own elaboration based on Statistical Office data: Działalność gospodarcza podmiotów z kapitałem zagranicznym w latach 2005-2015, Warszawa and data from the National Polish Bank: Zagraniczne Inwestycje Bezpośrednie w Polsce 2003-2015.

Also the building materials sector, which finds its practical application in the area of single- and multi-family housing as well as non-residential construction, would not have developed so significantly without the inflow of capital from abroad. This sector, like the construction industry as a whole, is very much influenced by economic factors, cyclical developments, global economic changes and social conditions. It operates in close relation to the environment in which it is located. Hence, the study referred to the entire environment of the sector, in which a strong synergy effect can be observed, which means that 'the results achieved by the industry are not a simple aggregate of the results achieved by individual companies' (Dzierbunowicz, 2013, p. 29, cit. Jankowska, 2005).

The structure of the construction materials sector is quite diverse. As a result of incoming knowledge and changes in construction technology, the subsector of construction materials produced from clay, wood, concrete, expanded clay, perlite or steel has developed, with the consequent development of wood, brick, stone, concrete and steel construction. The main manufacturers in the building materials sector therefore include the manufacturers of: bricks, hollow blocks, wall materials, roofs, chimney systems, insulation materials, window and door joinery, finishing building products. These products differ from each other, taking the purpose of structures and buildings as the main dividing feature, which allows residential and non-residential construction to be separated, while construction materials can be divided into those used in single-family housing, multi-family housing or non-residential construction. The type of products produced and their performance characteristics define the subsector, its environment and its end customers.

In the early 1990s, when construction material manufacturers were oligopolistic or even monopolistic, it was they who began to form the construction material trade sector. At the same time, the development of building technology and techniques - the transition from basic-manual

technology to more and more developed products - resulted in the strong formation of two groups of customers, which became individual customers and institutional customers - investors, developers, contractors. The tremendous transformation in terms of both products and production and organization would not have been possible without the multinational corporations that decided to set up their operations in Poland. These investors were primarily interested in expanding their own markets, hence the importance of Poland's geographical location for foreign investors, as well as the increasing size and absorption capacity of the Polish market and the presence of national enterprises with their own resources of raw materials. Many of the state-owned enterprises that were taken over required recapitalisation and modernisation, but completely new investments also began to appear, intended to be a catalyst for change and a center for new profits. Consequently, many foreign companies invested in such construction material subsectors as wall materials, insulation materials, ceilings, roofing, chimney systems, finishing materials (windows, doors, etc.).

The capital transferred to the Polish market was mainly from Germany, Austria, France, the Netherlands, Belgium and Denmark, Switzerland, Sweden and Finland. At the moment, foreign concerns hold the largest market shares, amounting to up to 50-60 per cent of the total market.

A subsector of key importance in the entire construction materials sector is the wall materials one. The first foreign market player in this subsector was the Leier company, which appeared in Poland as early as 1988, i.e. before the period of great social and economic change. Investments in Środa Śl. were started in 1994 by L. Gumkowski, an emigrant from Germany, followed by the Röben company. (Wiśniewska, 2006, p. 94; Jasek, 2017, pp. 68-69). In the south of the country, a large producer of bricks and tiles was Biegonice company in Nowy Sącz, whose shareholders became the Belgian companies Vandersanden and Briqueteries de Ploegsteert. Leading the market for wall materials is the Wienerberger company. In Poland, the company was established in 1995. Its first investment was the purchase and complete modernisation of a brick factory in Lębork (Jasek, 2017, p. 69).

At the same time, one of the leaders in the production of cellular concrete, the Xella company, started its operations. The company was founded in 1995 under the name Ytong Ostrołęka Sp. z o.o. as the first company with foreign capital in the cellular concrete industry. The third company to enter the wall material market in 1995 is CRH Klinkier Sp. z o.o (Jasek, 2017, pp. 69-70).

In the area of plasterboard, the first foreign producer was Nida Gips, set up in 1990 by the Belgian Gyproc corporation. A large part of the plants in the wallboard subsector was and is still located in smaller towns, which is related to the existence of clay and gypsum resources. Not only the quality of the raw material was of great importance, but also the geographical location, which would be advantageous for the acquisition of markets - export of bricks and tiles to the East German market. Investments by entities already present on the Polish market

were not supportive of further entry into the Polish market of strong foreign producers so far absent in Poland.

The next subsector is the chimney systems one. Until 2015, it was divided into two product groups: steel and ceramic systems, with polypropylene chimney systems coming in later on. Due to the entry barriers, which are not as high as in the production lines of the other subsectors, this sector is characterized by a large number of players. In the area of steel systems, there are around 40 manufacturers, including four foreign-owned companies, holding around 33% of the total market in 2015. These are MK Żary, Jeremias, Pojoulat and Ontop, which was acquired by Schiedel Sp. z o.o. in 2021. There are no clear technological advantages in the market for steel flue systems. Production is relatively standardised, hence most of the players, in addition to their core production of flue gas systems, offer products made of stainless steel, not directly related to chimney systems. Much more diversified is the market for ceramic chimney systems, where there are currently around 80 companies competing, nine of which are foreign-owned and have held around 60% of the market share in recent years. Schiedel Sp. z o.o. was the first company to be established in 1995. Subsequently, German players entered the market: CRH Klinkier , Schreyer, Plewa Tona , Leier, Roosens, and two Danish companies IBF and Icopal (Icopal Danmark A/S).

The further sub-sector - roofing - has a wide product range from metal roofing, which represented about 33% of the market in 2014, through ceramic (28%), bitumen (22%), cement (7%), and membrane and other roofing (about 10%). The first foreign company to enter the Polish market was Braas. In the same period, in 1996, RuppCeramika Sp. z o.o. was established in Skrzyńsk near Przysucha. In 2004, just like Braas, the company was transformed into Lafarge Dachy Sp. z o.o., while in 2012 there was a complete merge of RuppCeramika and Braas brands into one Braas brand, currently BMI Icopal (after taking over Icopal's roof tile production) The history of another company - Creaton Polska - dates back to 1998. In 2011, Etex Building Materials Polska Sp. z o.o., based in Olkusz, is established in Poland as a result of the merger of three companies: Euronit sp. z o.o., CREATON sp. z o.o. and Etex Building Materials sp. z o.o. The rich clay resources in the vicinity of Środa Śląska, were the motive for Röben Polska's investment. Investment in Poland was also undertaken by the Swedish company Lindab, which opened a sales office in Szczecin in 1992. A large factory for coloured roof tiles was built on the premises of a brick factory in Kunice near Legnica by the German company BTS. The plant was then taken over by Wiekor Pokrycia Dachowe, later supervised by Wienerberger from Austria. Cembrit, a company focused on the production of fibre-cement corrugated panels and finishing accessories, has a long history in Poland. The company was founded on the basis of the state-owned company ZWAC, which had been in operation since 1968 and was renamed IZOPOL in 1971. Swisspor Polska also started its operations by purchasing Polmar in Jaworzno.

The last sub-sector is represented by numerous manufacturers of joinery (windows and doors), including manufacturers such as Lux Wood, Okfens company with plants in Czeladź, Spectus. Subsequently, companies such as Aluplast in Poznań (1995) were established. Currently, the largest window manufacturer in Poland is the VELUX Group, which belongs to the Danish VKR holding.

When analyzing the construction materials sector, it should be noted that the expansion of investments by foreign entities began in the mid-1990s. A large part of the investments were direct brownfield investments, consisting of takeovers of Polish state-owned enterprises, which were undertaken in order to gain access to raw materials (e.g. clay, sand, gypsum). After 2000, most of the investments were already greenfield investments, as the possibilities for privatization of state-owned enterprises had been run out. The inflow of new manufacturers with foreign capital depended on entry barriers and the capital needed to invest in a new production line. The result of the disparity between the advancement of technological lines was the development of a competitive market. In the case of capital-intensive production lines, competition grew more slowly and was actually limited to the majority participation of foreign-owned companies, of which the roofing sub-sector is an example. However, in sub-sectors with low barriers to entry (ceramic chimneys sub-sector, wall materials sub-sector, joinery sub-sector), there was a rapid increase in competitors. Mergers and acquisitions continued, but these mainly involved mergers of foreign-owned companies.

It should be noted that the majority of foreign direct investment was horizontal investment, which was based on the same activities as in the investor's country, i.e. investors introduced the same manufacturing methods and products - sometimes differentiated by assortment, adapting them to the development of building technology.

3. Factors and motives for undertaking FDI in the construction materials sector

An important factor in the spread of FDI is the opening up of economies to host new economic actors, who are driven by a number of motives that directly or indirectly affect the development of the country and local actors. Individual countries compete intensively for investor interest, creating a competitive environment fostering FDI inflows.

However, in addition to the country interested in attracting new investors, there remains another party - the direct investor, whose motives for expansion can vary widely. There are a number of theories that indicate the motives of the capital-holding enterprise. The roots of these theories range from the theory of international trade, location theory or directly from FDI theory.

Along with the legal and economic changes and the saturation of the market by FDI, the motives for undertaking foreign investments in Poland were changing. Between 1990 and 2015, systematic research on motives, including the investment climate in Poland, was undertaken by many institutions, including PAIZ, the Polish-German Society for Supporting the Economy, the American Chamber of Commerce in Poland, Price Waterhouse Coopers, the British-Polish Chamber of Commerce, Rödl&Partner, the Polish-German Chamber of Industry and Commerce, HSBK or Ernst&Young, as well as researches such as J. Witkowska, M. Stawicka (2007), M. Jaworek, W. Karaszewski, J. Różański, Przybylska (2001), Lizińska (2012) or Garlicki and Błuszkowski (2000).

Most studies emphasise the cost motive for locating FDI in Poland in the 1990s and the change after 1999 towards market motives, including to a large extent the growth prospects of the Polish market.

The own research carried out allowed, on the one hand, to identify the motives for undertaking investments in Poland and to assess the socio-economic situation in which decisions to set up businesses by foreign investors were made, and, on the other hand, to identify the discrepancies between the Polish economy and that of the parent company in terms of specific gaps, in order to finally identify the factors influencing the decision to invest in Poland. As many as 64% of the respondent-managers were involved in the direct establishment of a company in Poland, the research provided insight into the genesis of investment in the sector under study. The question on the objectives of the parent company suggested the twelve most common objectives in the literature for investors who undertake activities outside their own country. The following were suggested as potential objectives: seeking to increase profits, the possibility of gaining/expanding into new markets, maintaining a position in existing markets, lowering costs associated with product transport, lower production costs in Poland, ensuring stable access to manufacturing factors, geographical nearness of the Polish market in relation to the home market, similarity of buyer behaviour on the Polish and home market, lowering operating costs through the possibility of taking advantage of tax reliefs in Poland, securing the necessary raw material, increasing the company's exports, reducing risk through its geographical diversification, other (Jasek, 2022, pp. 176-177).

A detailed overview of the goals determining investment in Poland is presented in Figure 2.

In the analyzed sector, the main motives for taking the decision to invest in Poland therefore included: the possibility of gaining control/further expansion of new markets and the desire to increase profits. Other factors were of minor importance. Among the ‘other’ objectives, respondents mentioned: market development, gaining market shares, market consolidation through acquisitions of local producers and benefits resulting from Poland's entry into the area of market forces.

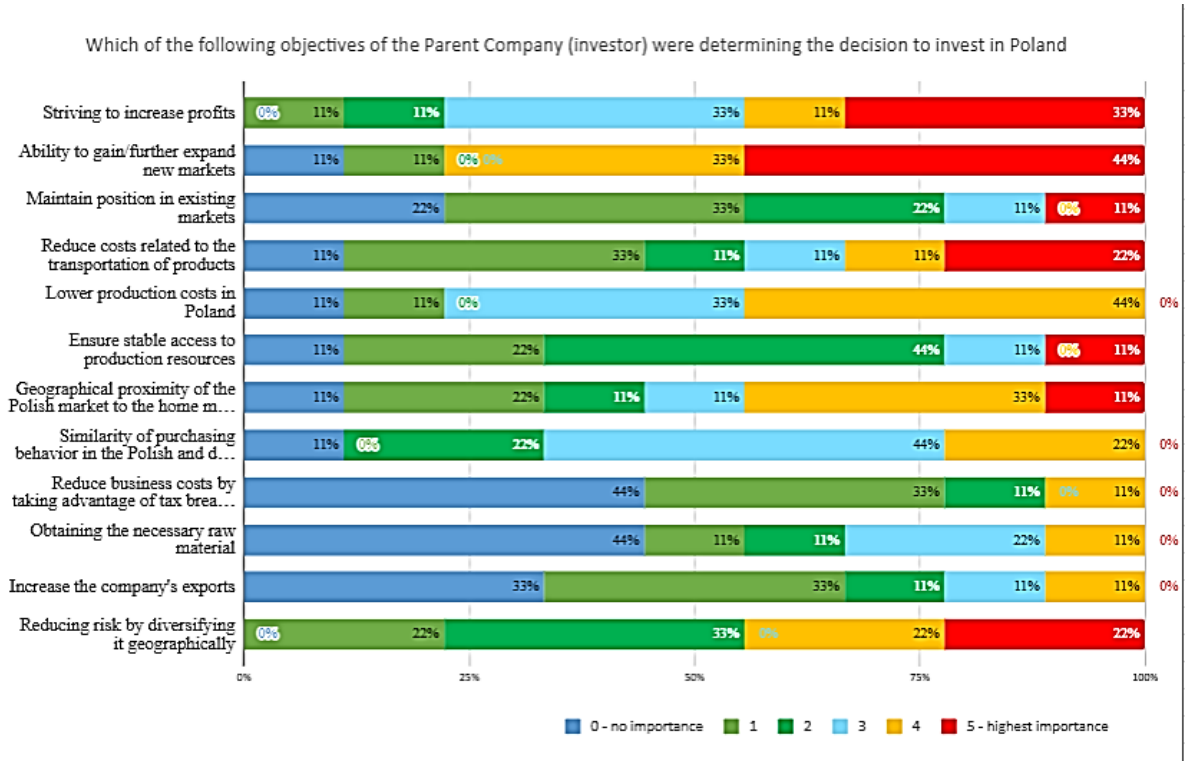


Figure 2. Parent company's objectives determining decision to invest in Poland.

Source: compiled from own research (Jasek, 2022).

The surveyed companies also assessed the degree of discrepancy between the investor country's economy and the Polish economy, based on the gaps defined earlier. The following gaps were included in the study: the conceptual gap - in terms of factors determining economic development, the skills gap, the technology gap, the pace of development gap, the capital gap - in terms of domestic capital, the entry barrier gap - defining how easy it is for a foreign company to enter the market in Poland compared to other countries, the cooperation gap in the economy, i.e. the the level of network links between enterprises, the research and development gap - characterized by the accessibility of research and development institutions, the science-business cooperation gap - the practice of cooperation between enterprises and scientific institutions, the social capital gap - the level of acceptance of FDI, the regulatory gap - the consistency of the law, and the institutional gap. The following were indicated as significant differences between the investing enterprise economy and the Polish economy: the regulatory gap, the technology gap and the capital gap. The following were indicated as medium differences: the conceptual gap, the pace of development gap, the research and development gap and the institutional gap. As very small differences between the economies, respondents indicated: the cooperation gap in the economy and the social capital gap (Jasek, 2022, pp. 177-178).

While many of the factors and considerations influencing the investment decision are fixed, there are some that are constantly changing over time. The literature uses catalogs of factors that overlap to a large extent. In the research conducted, the influence of individual factors on the decision to invest in Poland was also assessed. The analysis took into account factors that were divided into 6 categories, i.e. market factors, resource factors, competitive factors,

economic factors, socio-cultural factors and formal-institutional factors. Among the market factors, further market development prospects and market size and absorption were indicated as the most important in the decision to invest in Poland. Slightly lower importance was given to the degree of market development and specific consumer preferences. Of least importance among market factors were ease of market entry and market structure. Among the resource factors, access to labour/staff was of high importance. Of medium importance was the cost of labour force, the quality of labour force/staff, while of low importance was the cost of renting/purchasing land and facilities, the availability of technical infrastructure and the quality of available raw materials. Of very low importance in choosing Poland as an investment country were the and access to semi-finished products. Among the competitive factors, respondents indicated the technology gap as the most important, although the average response does not indicate that it was of very high importance compared to other factors. Other competitive factors such as the supplier network, low-intensity competition from local companies or low-intensity competition from foreign-owned companies were of little or no importance. Another group of factors examined were economic factors, among which access to regional markets was rated highest, although its importance should still be described as medium. Another factor was Poland's economic growth prospects. The remaining factors, i.e. membership in the EU, macroeconomic policy and the low level of investment risk, as well as access to global markets, had little or very little influence on the decision to invest. Among formal-institutional factors, none of the factors reached a sufficient average, which means that their influence on the decision to invest in Poland was very marginal and, in the case of many companies, played no role at all. Only one company indicated the political situation in Poland as the most significant factor. The last group of factors were socio-cultural ones, among which two of them stood out, i.e. friendly relations with Poland and cultural proximity. The remaining factors: social attitudes towards foreign investment, personal considerations and positive experiences of other companies with foreign capital were of less or little importance in the decision-making process.

Although the analysis of the parent company's motives and goals for investing in Poland seems to take place at the company - microeconomic level, it shows the existing macroeconomic background, which constitutes the socio-economic condition of the country, in which the company sees some potential (Jasek, 2022, pp. 179-185).

The opportunity to gain or further expand new sales markets was indicated as the most important objective by 78% of the surveyed companies. This is the objective that was also most frequently indicated in W. Lizińska's research (1991-2010), where 25%-27% of the surveyed companies considered it to be the primary motive for undertaking business in Poland in particular periods. This objective fits into the group of motives relating to market seeking investments, whose main objective is to gain access to the market and to maintain and expand market share. This means that the Polish economy has been positively assessed in terms of development opportunities and solutions offered to companies seeking expansion.

On the other hand, companies driven by the market-seeking motive try to follow market-driven needs, suppliers and customers, try to take advantage of the host country market, being close to customers while trying to set trends or trying to follow stronger and already existing competition. At the same time, respondents indicated as one of the highly rated motives the possibility of reducing risk through its geographical diversification, which shows that the Polish economy was also positively assessed in terms of opportunities arising from its location.

At the same time, it is not surprising that companies aim to increase profits (44% of companies surveyed). The motives of the respondents corresponded to the weight of the factors they indicated as important for the realization of their goals. The motive of being able to penetrate or further expand new markets is proportional to the factor of further market development prospects and the size and absorption capacity of the market. Lower production costs result from the cost of labour, which is significantly lower than in the country where the capital is sourced. Risk reduction through geographical diversification is possible through access to local markets, while the geographical proximity of the Polish market to the home market strongly influences the sense of cultural proximity.

4. Innovativeness of the construction materials sector

The thesis that the rational use of material resources was the main objective of management until recently was dominant. However, the industrial sector so far has been systematically replaced by the knowledge sector, tending towards the development of a knowledge-based economy. This approach is mentioned by Etzkowitz and Leydesdorff, who write about a breakthrough taking place on the basis of the operation of the 'triple helix', i.e. science, industry and the government, which through their interactions influence the economic development of the country (Cai, Etzkowitz, 2020, p.11). The driver and source of innovative activity and innovation creation therefore becomes knowledge in its broadest sense as the primary factor. As a result of good quality relations and cooperation between market actors, i.e. organizations producing, distributing and sharing knowledge (primarily scientific, technological, market, economic, organizational or management knowledge), as well as needs expressed by users, innovation is produced and technology transfer influencing technological progress takes place. The cooperation and contacts of individuals and organizations with the environment allow the diffusion of knowledge, which influences the innovative activities of other entities, sectors, and finally the entire economy (Baruk 2016, pp. 91-94).

Innovation process models have been evolving over time, involving more and more actors and their changing role in the innovation process.

The contemporary models (fifth and sixth generation) that have developed in the 21st century are highly integrated and networked models. The main driver in the simultaneous (fifth-

generation) model is collaboration, which includes strategic alliances of companies and cooperative links in R&D and new product development. Open innovation model (6th generation) - is based on an open networked innovation process. According to Chesbrough - the author of the model - the search for, creation, accumulation of knowledge and its transfer should go outside - beyond the framework of the enterprise. Great importance is attributed to the processes of learning, obtaining and managing knowledge and the use of research and development activities, resulting in the creation of a system that learns on its own and takes advantage of opportunities arising in the environment.

M. Noga even defines science, knowledge and innovation (scientific knowledge capital) as long-term indirect third-order determinants of economic development (Noga, 2008, p. 6).

Construction materials present on the Polish market until the second half of the 1980s were very simple materials, produced even manually, with a simple structure, using little developed technological lines. In the first years of the inflow of FDI to Poland, unknown products flowed in with the capital, which required, on the one hand, a change of mentality on the demand side and, on the other hand, the training of people who were to handle and use them in the construction process. Foreign companies entering the market introduced products that were new on the host country's market, and thus innovative. The source of product innovation in the building materials sector for the construction of buildings can be found on the demand side. The second half of the 1990s was marked by major qualitative changes in the area of construction materials, resulting in a change of market structure. The implementation of modernized technological processes, which at the same time improved and accelerated building construction techniques, even forced manufacturers into high demand. As R. Kania emphasizes: 'It was precisely the need to eliminate time-consuming and outdated solutions originating from building traditions and, at the same time, fast assembly time and solidity that founded the invention of the "new" (...) necessity is the mother of invention' (Kania R., 2009, p. 195). Unfortunately, regressive innovations have also started to appear among the solutions, which 'may be regressive and cause economic losses or bring no benefit to either the company implementing the new solution or its environment. This applies mostly to domestic imitator companies that, seeking favorable cost effects, deform the products that are the right medium for consumer benefits' (Kania, Nowak, 2015, p. 74).

Thus, the entry of the first FDIs in Poland - chimney manufacturer: Schiedel, roof manufacturer: Braas, wall material manufacturer Leier, etc. resulted in the establishment of a group of trend-setters of the new technology and apostles of the rapid diffusion process. Bricks began to be replaced by hollow blocks, there was a transition from single-wall to four-layer walls, brick chimneys gradually began to be replaced by chimney blocks, and finally single-, double- and even triple-wall systems were implemented. In the area of roofs, the development of roof coverings and tiles determined by the needs of the consumer took place, also in the following years, technologies based on wood or plastics (joinery, insulation materials, finishing materials) gained in importance. Wooden windows began to be replaced by plastic windows,

and metal pipes were also replaced by plastic pipes (Bolkowska, 2003, p. 311) . Prefabrication to speed up construction processes became common.

Innovation in the construction materials sector was therefore based on the adoption of foreign construction techniques, which was associated not only with the adoption of modern products, but also with a huge transfer of knowledge into the environment of the entire sector, including construction companies, which triggered further technical and organizational changes. In later periods, as a result of intensively developing competition, innovation took on a multiple role. In order to maintain their high market shares, the existing FDIs were still forced to introduce further improvements, new management methods, improved production processes, as Polish companies, in order to survive on the market, took over and used the knowledge of foreign companies, imitating products with similar properties, but at a later stage also looking for their own new solutions. In Polish companies, due to less bureaucracy in comparison to international companies, innovations started to be introduced faster and on a larger scale. Unfortunately, there were also opinions that the technologies introduced, innovative for the Polish market, were old technologies from a global point of view. This can be illustrated by the example of the technological tree of the dust exhaust systems. In the 1960s, a two-layer prefabricated chimney with a ceramic insert was already used in Germany or Austria, while a three-layer chimney appeared as early as in the 1980s. Until 1995, brick chimneys dominated the Polish market, and it was only with the arrival of the Schiedel company in Poland that the so-called system chimney was introduced. And although it was an innovative product from the point of view of the Polish market, from the point of view of general technological development, it was not a new product. We are therefore talking about regional (national) product innovation against an international background.

For many years, the construction materials sector benefited from solutions that emerged in Poland in the 1990s. In the following years, as a result of the diffusion of knowledge, innovation took on an imitative character. Competition caused domestic companies to produce better and cheaper, stimulating their own resources to look for similar, cheaper solutions that met similar requirements.

The phenomenon of technological spillovers had a strong impact not only horizontally, but also vertically, being part of feedback occurring in other sectors or in the area of building construction services.

Analyzing the above changes caused by the inflow of FDI, the question that arises is what form innovation has taken in the construction materials sector.

From the research perspective, therefore, an important point was to determine the nature of innovations occurring in the enterprises against the background of the entire construction materials sector. In the surveyed companies, as well as in the sector as a whole, small innovations definitely dominate, although medium innovations are also important. As construction materials companies do not belong to the high-tech sector, it is definitely difficult to speak of large or disruptive innovations (Jasek, 2022, p.195)

In terms of the degree of originality, the surveyed enterprises look slightly different compared to the sector as a whole. Creative innovations, i.e. completely new innovations, dominate among the surveyed enterprises. The surveyed companies did not show the occurrence of regressive solutions, i.e. disruptive changes creating danger, as well as pseudo-innovations, where 72% of respondents strongly or rather disagreed with the existence of such innovations in the company. The situation is slightly different in the sector as a whole, where a greater share was attributed to imitative innovations, i.e. those that are replications of existing solutions. Creative innovations are another group, followed by pseudo- innovations, i.e. changes that are not really innovations. In the case of these innovations, as many as 71% of respondents had no opinion on the occurrence of this type of innovation, similarly, in the case of imitative and creative innovations, it was 43% of respondents each. Both in the group of surveyed enterprises and in the entire sector, investment innovations represent the largest share. The last question on the nature of innovation referred to the complexity of the innovations being implemented. The survey aimed to determine whether the innovations occurring are bundled innovations, i.e. forcing innovation activity on co-operators, or perhaps isolated innovations, i.e. not involving additional innovation among partners. Among the surveyed companies, bundled innovations have a higher share. For the sector as a whole, 29% of respondents agreed with the existence of bundled innovations, the remaining respondents disagreed or had no opinion.

In order to analyze changes in sector innovation, respondents were asked about perceptions of the concept of innovation itself. The surveyed were asked what they think supports innovation in the sector studied. An important part was the analysis of their own advantages over companies with Polish capital and the factors that allow them to achieve this advantage, including in terms of introducing innovations to the Polish market (Jasek, 2022, pp. 196-198).

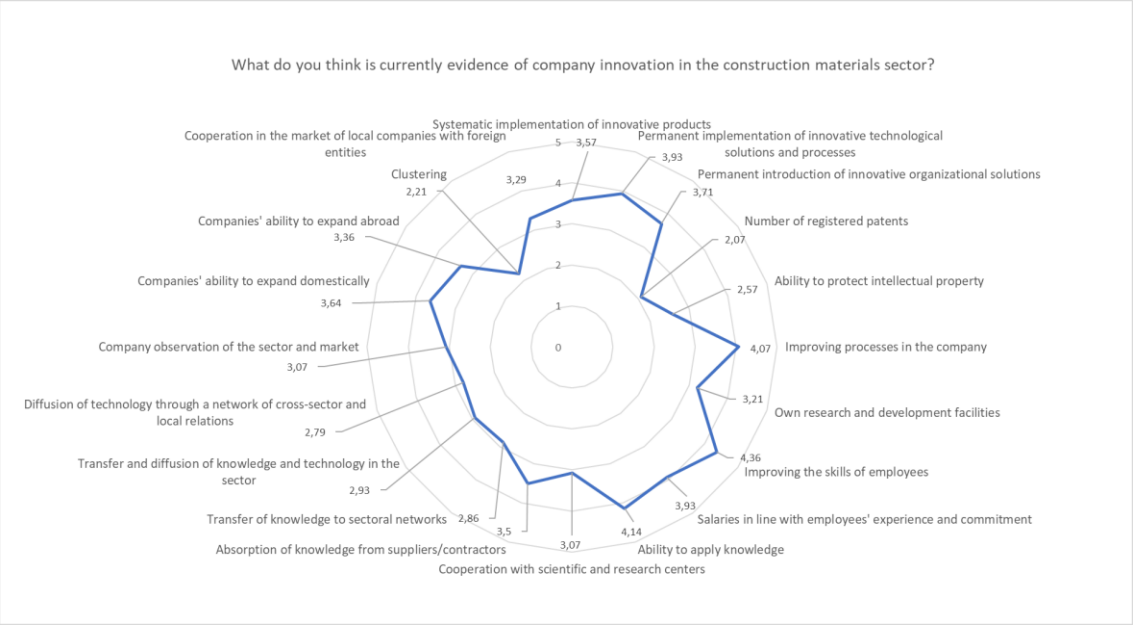
Respondents defined the characteristics or indicative features of innovative enterprises. Of the 20 proposed characteristics, three factors were rated highest, i.e. the improvement of employees' qualifications, the ability to use knowledge and the improvement of processes in the enterprise. Slightly lower rated were another 11 factors, i.e. continuous introduction of innovative solutions and technological processes, salaries adjusted to the experience and involvement of employees, continuous introduction of innovative organizational solutions, systematic introduction of innovative products, ability of companies to expand domestically, absorption of knowledge from suppliers and cooperators , ability of companies to expand abroad, cooperation on the market of local companies with foreign entities, having their own research and development facilities, cooperation with scientific and research centres, monitoring of the sector and market by companies.

The remaining factors can be regarded as those that respondents generally did not consider significant in assessing innovation, i.e. knowledge transfer to sectoral networks, knowledge and technology transfer and diffusion in the sector, technology diffusion through inter-sectoral and local networks, ability to protect intellectual property, clustering , number of registered patents.

When analyzing the highest rated characteristics, i.e. improving the qualifications of employees, the ability to use knowledge and the improvement of processes in the company, it can be seen that they all carry an element of ‘knowledge’ which makes it possible to undertake any innovation process. The lowest importance was attributed to clustering, the number of registered patents and the ability to protect intellectual property, which confirms observations that the construction materials sector as a low- and mid-tech sector does not need legal protection for its products. However, the factor: transfer and diffusion of knowledge and technology in the sector was surprisingly low rated. Among others, one respondent mentioned ‘creation of system solutions’ (Jasek, 2022, pp. 186-188).

The results (with the average of the scores on a scale of 1-5, where one - don't agree at all, 5 - fully agree) are shown in radar chart (Figure 3).

Figure 3. Average characteristics of innovative companies as seen by survey respondents



Source: Own research (Jasek 2022).

The study attempted to demonstrate the advantages of the surveyed companies with foreign capital over companies with Polish capital. Respondents assessed to what extent individual factors were sources of advantage. Respondents indicated the following as decisive advantages: quality of launched products, access to intra-group financing, organizational know-how. Among the advantages of high importance, the following were indicated: experience and education of the management, technological skills in introducing, developing and improving products and technologies, group purchasing within the group , own distribution network, cooperation with research centres in the home country. Other factors were reported by respondents as either difficult to assess or of low advantage: speed of launching new products to meet changing consumer needs, marketing expertise, speed of innovation, investment in research and development, access to research facilities in the home country.

Respondents also indicated factors that support innovation in their own companies. Staff training and support from the parent company, cooperation with national buyers, were rated as the highest. Among others, respondents mentioned: own project groups consisting of employees from different departments , and personal ambitions of employees. Other factors, i.e. international cooperation with suppliers, the possibility of using internal sources of financing, and innovation, education and tax policy in Poland were found to be of little importance in supporting innovation or difficult to assess. However, it is important to note that in the case of employee training, as many as 79% of respondents considered this factor to be the most important, and 57% of respondents indicated international cooperation with both domestic buyers and international cooperation with suppliers, which on the one hand indicates a desire to satisfy the product needs of one's own buyers, and on the other hand to provide products of the highest possible quality (Jasek, 2022, pp. 190-191).

5. FDI effects in the construction materials sector

FDI is mainly focused on those industries where foreign investors expect the highest returns and to meet their own objectives. However, their inflow always has an economic impact on the host economy. First there is the impact at the micro level, i.e. the appearance of a new company or the restructuring of an existing one, then at the meso level, where the new investor has a significant impact both on the sector in which it appears and its links in the environment, and also often on the local dimension, to finally, through the multiplier effect, have an impact on economic growth, and even more often and to a greater extent on the development of the country - the macro level. Hence, some of the analyses are purely quantitative, but more and more importance is being given to qualitative analyses based on descriptive models. Analysis of the effects of FDI on host countries implies a distinction between its direct and indirect effects. Both have a huge impact on development and the transformations taking place. The literature distinguishes between many types of effects associated with FDI inflows. The importance of differentiating between externalities, spillovers and linkages is emphasized. Externalities refer to the effects of foreign investors' actions that are made available to other economic actors (e.g. domestic firms) at no cost. Spillovers are externalities that pass from one company to another in the process of transferring broad knowledge and learning by the receiver company, as a result of formal or informal linkages between these entities. The term is also referred to the ‘spillover effect’. Spillovers are also described in the literature as side effects of investments that affect local partners, sub-suppliers, cooperators, both within the sector itself and in other vertical linkages (Weresa, 2012; Domanski, 2008; Golejewska, 2008).

A difference should be made between spillovers to companies in the same industry/sector - so-called horizontal spillovers (intra-industry spillovers) - and spillovers to companies in related industries/sectors - vertical spillovers (inter-industry spillovers). Intra-industry spillovers of FDI affect companies (competitors) in the same industry. These effects arise, for example, from product and process imitation, competitive effects and labor market impacts. Intersectoral FDI externalities, on the other hand, are economic and technological spillovers generated by vertical linkages between companies in different industries. (Eden, 2009, p. 1067; Szczepkowska-Flis, 2008, p. 172). Vertical linkages with suppliers and customers are considered the most effective channel for positive spillover effects in the host economy, although empirical studies investigating the occurrence of vertical spillovers of FDI technologies are still limited.

The literature also points to so-called agglomeration spillovers (agglomeration effects). These refer to the financial and technological intra- or inter-sectoral effects that arise from the cooperation of enterprises within clusters and networks (Eden, 2009, p. 1067).

In the analysis of FDI effects, the internal market formed by the parent foreign investor and the subsidiary or affiliate located in the host country cannot be overlooked either. According to internalization theory, in addition to capital flows, there is a flow of technology and know-how in this system, which are direct ownership effects of FDI (own-plant effect, direct effect) (Szczepkowska-Flis, 2008, p. 172). It is this type of effect that drives the impact on other actors within and outside the sector. The potential FDI effects resulting from FDI inflows are illustrated in Figure 4.

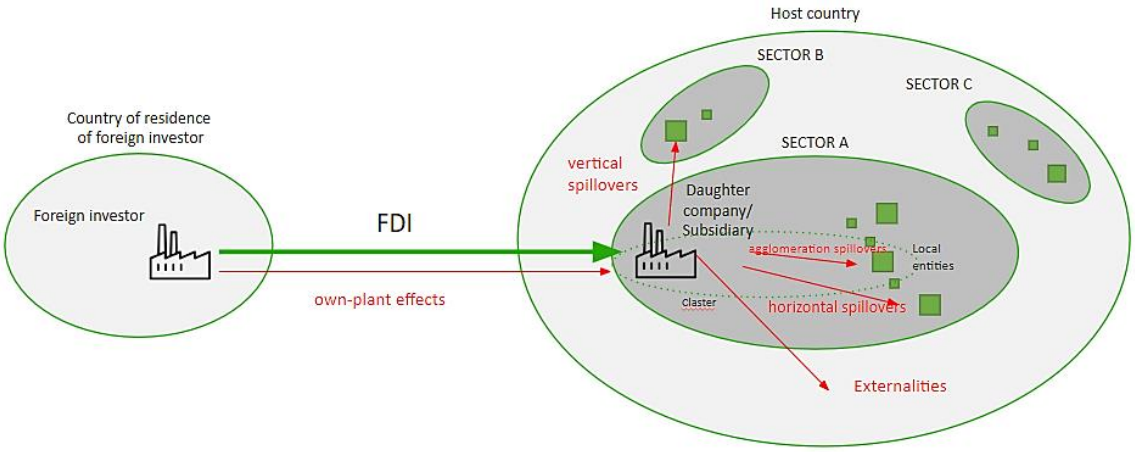


Figure 4. Types of foreign direct investment effects.

Source: own elaboration.

The survey questioned respondents about the impact of their companies (FDI) on the performance of competing Polish companies and also on the performance of their environment, in particular their cooperators and suppliers. This allowed an analysis of the forms of impact and effects of FDI (positive and negative) on their environment.

In the case of the impact of FDI on the performance of competitive Polish enterprises, i.e. enterprises with only Polish capital, an intensification of competition between companies in the sector was indicated as the most frequent impact. As many as 79% of respondents agreed with the statement that competition between companies in the sector has intensified. As a result of the inflow of FDI, local companies have restructured their operations in order to cope with foreign competition - 71% of respondents responded positively to this statement, which is at the same time linked to the acceptance of another statement according to which the productivity of competing local companies has increased (57% positive responses). A large proportion of respondents (64%) responded positively to the statement that the quality of products and services provided in the market has improved and 57% said that local companies have started to introduce innovative products previously unknown on the Polish market.

Some of the FDI effects described in the literature have not been confirmed among respondents from the construction materials sector, e.g. the two-way transfer (foreign companies - Polish companies) of skilled and semi-skilled staff. Also in the area of R&D, respondents did not notice companies increasing their R&D investments or building their own R&D centers. Most surprising was the negative response to the statement that the entry of FDI into the market had pushed out competing local firms.

In terms of the impact of the respondents on the environment (cooperators and suppliers), the respondents strongly agreed that their activities and cooperation with the environment resulted in the flow of knowledge and modern technology (79% of the respondents), while as many as 86% of the companies required their cooperators to adapt and improve their technology, which was reflected in an increase in their productivity. More than half of the surveyed companies responded positively to the statement that the scope of cooperation has increased, the co-operating companies have increased development expenditures, undertaken new investments and the cooperation has forced the business partners to innovate. One of the surveyed companies indicated that ‘In many areas there are very limited possibilities to cooperate with co-operators - raw material limitations - like cement, sand’. Significantly, among those surveyed, no company with which FDI collaborated broke off cooperation due to the lack of adaptability.

One of the questions in the survey concerned the influence of Polish and foreign-owned companies on the shaping of innovation in the sector. In accordance with respondents' answers, as many as 64% agreed with the statement that their company, together with other foreign-owned companies, determines the direction of the sector's activities, 57% of companies agreed and strongly agreed with the statement that both Polish and foreign companies have a similar impact on shaping innovation in the sector. 57% of respondents tended to agree that their company dominates innovation in the sector due to continuous development. Only 7% of respondents said they fully agreed with the statement that Polish companies have taken control of innovation in the sector.

Respondents also pointed to other additional effects, i.e. owners of Polish companies that have been taken over by foreign companies invest in companies with a similar business profile and FDI has contributed to eliminating overuse/waste of natural resources and improving the environment.

When analyzing the set of 23 statements relating to the impact of FDI on the sector and its environment and comparing them with the impact of the surveyed FDI, it can be seen that most of the statements follow the general trends and impacts of other companies with foreign capital. Competitiveness increased/strengthened, the quality of products and services offered increased, FDI became a kind of role model for companies with Polish capital, which was reflected in the implementation of innovative products. The negative impact described in the literature, such as a decrease in employment, introduction of outdated technologies, overexploitation of raw materials or mere imitation of foreign companies, was not noticeable (Jasek, 2022, pp. 199-216).

6. Conclusions

The economic transformation of the Polish economy and its opening up to international cooperation have enabled a systematic inflow of foreign capital into Poland.

The inflow of foreign capital into the construction materials sector began relatively early.

Among the parent company's objectives determining the approach of investments in Poland were the possibility of entering new markets, further expansion and the desire to increase profits, which covers the main objectives found in most economic sectors.

Among the wide range of location factors (market, resource, competitive, economic, socio-cultural and formal-institutional), respondents indicated further development prospects of the Polish market and its size and absorptive capacity as being of greatest importance, i.e. market factors.

By assessing the degree of divergence between the economy of the investor's country economy and the Polish economy, on the basis of the previously defined gaps, as those which the most significant differences between the two economies, respondents indicated the regulatory, technological and capital gaps.

The effects of the inflow of construction material manufacturers were observed both at the micro level, where the impact occurred on the basis of ownership effects resulting from the transfer of knowledge and technology from the parent company to the subsidiary, but also at the meso level. This was reflected in the level of development of technological progress, the transfer of knowledge between individual foreign and domestic entities, the impact on the labor market, as well as far-reaching effects and outcomes resulting from relations with the sector's environment. The in-depth metamorphosis of the entire sector has transformed the

operation of both the market itself (change in its structure, product quality, development of consumer awareness), but also within the entities dependent on its operation (subcontractors, suppliers), generating a wide range of spillover effects - spreading to the entire environment.

Thus, the opening of the construction materials sector to foreign competition, and the purchase of state-owned enterprises by foreign investors, enabled changes to take place within the framework of inter-entity linkages and the implementation of adaptation processes in the construction industry to the needs of a modern market economy. Although FDIs have been a factor in creating the sector and influencing technical and technological progress in the entire construction sector, they have also had an impact on the occurrence of negative effects such as the reduction of employment or the increase in the number of Polish imitators, offering products that do not always meet standards or current trends.

Based on the empirical research carried out, the assumption that the inflow of foreign capital in the form of direct investment was a factor stimulating innovation in the construction materials sector and, consequently, in a part of the Polish economy, was verified. Poland's socio-economic situation between 1990 and 2015 and the technology gap in the residential construction materials sector determined the inflow of FDI. The analysis of the problems related to the impact of FDI on the economic development of the country allows us to conclude that this type of investment (mainly through the transfer of capital and modern technologies) effectively contributes to accelerating economic development and increasing the competitiveness of the economy. Foreign direct investment in the construction materials sector should be considered as an effective catalyst for raising the level of innovation in the Polish economy.

References

1. Baruk, J. (2016). Rola wiedzy w procesach tworzenia i wdrażania innowacji. *Marketing Instytucji Naukowych i Badawczych, no. 3(21).*
2. Bolkowska, Z. (2003). Rynek materiałów dla budownictwa. *Annales Universitatis Mariae Curie-Skłodowska. Sectio H, Oeconomia, 37*.
3. Cai, Y., Etzkowitz, H. (2020). Theorizing the Triple Helix model: Past, present, and future. *Triple Helix Journal,* 1-38.
4. Chesbrough, H. (2006). *Open Innovation: Researching a New Paradigm.* New York: Oxford University Press.
5. Domański, B., Działek, J., Górecki, J., Gwosdz, K., Janas, K., Jarczewski, W., Kocaj, A., Micek, G., Padło, T. (2008). *Inwestycje zagraniczne w Małopolsce 2007.* Kraków: Urząd Marszałkowski Województwa Małopolskiego.

6. *Działalność gospodarcza podmiotów z kapitałem zagranicznym w latach 2005-2015 (coroczne raporty).* Warszawa: GUS.
7. Dzierbunowicz, E. (2013). *Międzynarodowa konkurencyjność branży na przykładzie branży odlewniczej w Polsce w latach 1995-2010.* Rozprawa doktorska. Poznań: Uniwersytet Ekonomiczny w Poznaniu
8. Eden, L. (2009). Letter from the Editor-in-Chief: FDI spillovers and linkages. *Journal of International Business Studies, 40*.
9. Golejewska, A. (2008). *Bezpośrednie inwestycje zagraniczne w procesie restrukturyzacji gospodarki.* Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.
10. Gorynia, M., Bartosik-Purgat, M., Jankowska, B., Owczarzak, R. (2005). Zachowania przedsiębiorstw lokalnych a ekspansja inwestorów zagranicznych w Polsce. *Przegląd Organizacji, no. 9*.
11. Jasek, S. (2017). Bezpośrednie inwestycje zagraniczne na polskim rynku materiałów budowlanych na przykładzie rynku materiałów ściennych oraz systemów odprowadzania spalin. *Przegląd Nauk Stosowanych, no. 16,* Opole: Politechnika Opolska.
12. Jasek, S. (2022). *Bezpośrednie inwestycje zagraniczne jako determinanta innowacyjności polskiej gospodarki na przykładzie sektora materiałów budowlanych w latach 1990-2015.* Unpublished doctoral dissertation. Opole: Uniwersytet Opolski.
13. Kania, R. (2009). Pomiar dyfuzji innowacji metodą BASS na przykładzie trójwarstwowych, ceramicznych systemów kominowych. In: R. Kania (Ed.), *Nowoczesne systemy odprowadzania spalin w zjednoczonej Europie. Fakty, trendy, argumenty.* Opole.
14. Kania, R., Nowak, R. (2015). Innowacje regresywne, pozorne i ułomne. In: R. Kania (Ed.), *Szkody kominowe.* Opole.
15. Lizińska, W. (2012). *Klimat inwestycyjny jako czynnik bezpośrednich inwestycji zagranicznych w Polsce (studium na poziomie układów terytorialnych)*. Olsztyn: Wydawnictwo Uniwersytetu Warmińsko-Mazurskiego w Olsztynie.
16. Lizińska, W. (2012). Zmiany motywów podejmowania bezpośrednich inwestycji zagranicznych w Polsce. Wyzwania gospodarki globalnej. *Prace i Materiały Instytutu Handlu Zagranicznego Uniwersytetu Gdańskiego, no. 31*.
17. Noga, M. (2008). Co decyduje o rozwoju gospodarczym. In: *Wzrost gospodarczy a innowacje.* Wrocław: Wydawnictwo Politechniki Wrocławskiej.
18. Szczepkowska-Flis, A. (2008). Wewnątrzbranżowe efekty spillover bezpośrednich inwestycji zagranicznych. *Ruch prawniczy, ekonomiczny i socjologiczny, vol. LXX, no. 1*.
19. Weresa, M.A. (2012). *Systemy innowacyjne we współczesnej gospodarce światowej*. Warszawa: PWN.
20. Wiśniewska, K. (2006). Röben uruchomił drugą dachówczarnię w Polsce. *Materiały Budowlane, no. 1(401)*.
21. *Zagraniczne Inwestycje Bezpośrednie w Polsce 2003-2015 (annual reports).* NBP.