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Processes of international technology transfer in theoretical conceptions of FDI

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Joanna Wiśniewska

PROCESSES OF INTERNATIONAL TECHNOLOGY TRANSFER IN THEORETICAL CONCEPTIONS OF FDIS

Observed for at least a decade intensified processes of integration in the field of economy promote relations between various entities and constitute the reason and result of mutual intertwining of various types of capital, knowledge and technology transfer. It shall be stated that we experience not only globalization of the economy but also globalization of technology. Those processes are formed as a result of various factors which can be presented in four basic categories¹:

- a) development of technology through the development of R&D zone as well as increasing significance of technology transfer;
- b) development of modern branches of production and services;
- c) international competition increasing demand for technologies by globally competing companies;
- d) increasing significance of economic policy including innovation policy of a country, region, company.

The transfer of technology is perceived as the transfer of technological knowledge and the ability to implement in the production process from one place to another². The transfer is conducted on the basis of various channels and by means of various mechanisms. Transfer of technologies in the international aspect often has

¹ See A. Pomykański, *Globalizacja technologii i jej wpływ na sytuację przedsiębiorstwa*, w: *Innowacyjne systemy, procesy i metody zarządzania międzynarodowego*, ed. M. Trocki, Wydawnictwo SGH, Warszawa 2008, p. 15.

² See S. Umiński, *Znaczenie zagranicznych inwestycji bezpośrednich dla transferu technologii do Polski*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2002, p. 45.

the form of purchase-sale transactions including, among others, material techniques in the form of machines and devices as well as direct foreign investments (FDIs). That is why the so far discussed transfer refers mainly to various theories of foreign trade and direct foreign investments and it has not become the subject of individual theoretical concepts.

Wide set of various theoretical approaches to FDIs includes numerous opposite definitions. Systematizing those approaches is problematic and thus, there are a number of classifications of theories, based on various criteria of typology. We shall mention the approach represented by J. Misala, who divides theories in that respect between two basic groups: macro and microeconomic ones. The first group explains FDIs from the perspective of the economy as a whole, whereas the latter approach analyses the phenomenon from the perspective of the entity undertaking the investment³.

Theories concerning FDIs may be categorized also with respect to the determinants of conducting that type of investment. In such a case one can point out to concepts referring to:

- a) financial incidents – theories of international flow of capital, international diversification of return rates, investment portfolio diversification, theories of currency areas;
- b) real incidents – theory of monopolistic advantage, international life cycle of a product, internalization theory and eclectic theory⁴.

Taking into consideration determinants of a country of investment and a company conducting the investment A. Stepiak presents two groups of theories:

- a) theories related to determinants of a country of investment: theory of profitability, output and market volume theory, product life cycle theory, theory of currency areas, localization theory;

³ See J. Misala, *Teorie międzynarodowej wymiany gospodarczej*, PWE, Warszawa 1990, p. 218. The main fault of such approach is the difficulty to include it in any of the mentioned categories as for instance the eclectic theory of Dunning. For that reason elaborated version of the mentioned classification includes also the set of so called mixed theories. See J. Misala, *Wymiana międzynarodowa i gospodarka światowa. Teoria i mechanizmy funkcjonowania*, Wydawnictwo SGH w Warszawie, Warszawa 2005, p. 118–121.

⁴ See K. Przybylska, *Determinanty zagranicznych inwestycji bezpośrednich w teorii ekonomii. Empiryczna weryfikacja czynników lokalizacji zagranicznych inwestycji zagranicznych w Czechach, Polsce i na Węgrzech*, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2001.

- b) theories related to determinants of a company: portfolio diversification theory, company operation theory, oligopolistic reaction theory, internalization theory, theory of property advantage⁵.

Other typology refers to the purpose of conducting FDIs in the form of achieving a certain form of advantage. According to that typology the theories can be divided into concepts concerning:

- a) innovation and technological advantage (for instance a model of monopoly benefits, internalization theories etc.);
b) absolute advantage (for instance currency areas theory, resources abundance theory);
c) localization advantage (for instance localization theory, oligopolistic reaction etc.).

The most popular FDIs theory in the context of transfer of technology goes along with the explanation of such a type of processes especially in case of innovation (technological) advantage and localization advantage. This set includes such theories as the theory of property advantage, appropriation, international life cycle of a product, technological gap, technological accumulation, internalization, eclectic theory, development cycles theory.

Theory of property advantage, formed by S. Hymer⁶, and developed by Ch.P. Kindleberger and F.T. Kinckerbrocker, implements widely the elements of the theory of the industry organization which assumes property advantage as general advantage over competitors. The assumption of operation in conditions of imperfect market constitutes the basis of this approach⁷. In the opinion of Ch.P. Kindleberger the market imperfection is revealed in the following spheres of operating⁸:

⁵ See A. Stępniań, *Integracja regionalna i transfer kapitału, inwestycje bezpośrednie w aspekcie klimatu inwestycyjnego w Unii Europejskiej*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 1996, p. 54.

⁶ For more about that theory see S.H. Hymer, *The International Operations of National Firms. A Study of Direct Foreign Investment*, MIT Press, Cambridge 1960.

⁷ If all the markets operated efficiently there would be no barriers for trade and competitors, products would be of the same character and foreign trade would make the only possibility for foreign relations. In such a situation that is in the context of perfect competition there would be no grounds for FDIs. see M. Jaworek, *Bezpośrednie inwestycje zagraniczne w prywatyzacji polskiej gospodarki*, Wydawnictwo Dom Organizatora, Toruń 2006, p. 31–32.

⁸ See Cz. Pilarska, *Bezpośrednie inwestycje zagraniczne w teorii ekonomii*, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2005, p. 17.

1. Imperfection in the product market – leading, among others to diversification of products, exclusiveness of a trademark, appearing of monopoly price.
2. Imperfection in the market of production factors appearing in a privileged access to the capital market, possessing a technological advantage protected with a patent or enjoying an advantage which concerns methods of management and production organization.
3. Scale of economic activity – which is the source of monopolistic advantage in case of big sized companies.
4. Economic policy of a country in such fields as for instance: customs, taxes, interest rate, currency rate.

According to the said concept a company must have certain specified primacies in order to compete effectively with local companies of a given country. The most important types of advantages constituting at the same time determinants of conducting FDIs include financial, technological, management and marketing advantages. Possessing such assets that other entities operating in a given market lack constitutes substantial grounds to conduct FDIs.

The definition of technological advantage is very complex and refers to all nonmaterial assets of a company very often defined as „modern factors of production” and including: knowledge, technology, organization, management, marketing, entrepreneurship and similar abilities. Having advantage within the field of mentioned factors allows the company investing in creating physically diversified products (as a derivative of technological abilities) or market diversified products (as a derivative of marketing abilities) to gain advantage over competitors. Thanks to the above mentioned aspects it is possible to control, to a certain extent, price levels and product sale volume which bring about economic surplus due to possessed knowledge assets. Undoubtedly, a certain weakness of that approach is related to the fact that terms of reference to the character of technological advantage are perceived rather in general terms and its is not explained how a technological advantage arises, moreover, FDIs geographic structure is not mentioned⁹.

The similar approach to property advantages includes **the concept of appropriation** by S.P. Magee. The main pillar of this theory is related to so called problem

⁹ See S. Umiński, *Znaczenie zagranicznych inwestycji bezpośrednich dla transferu technologii do Polski*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2002, p. 36; M. Jaworek, *Bezpośrednie inwestycje zagraniczne w prywatyzacji polskiej gospodarki*, Wydawnictwo Dom Organizatora, Toruń 2006, p. 31–33.

of appropriation stemming from the conflict which appears between public character of technological knowledge (innovation), and returns of the company -innovator. Popularization of technical knowledge and innovations is far against the interests of innovators who by increasing the costs of creating new technology and enjoying an advantage in that field expect maximum benefits. In order to protect the innovation against competitive companies such entities increase the range of implementation of the possessed technology by implementing it to their businesses abroad instead of having benefits from commercializing it in a national market, for instance by means of selling the license. Manners to protect technical knowledge against evolution are varied. However, the appropriation of each innovation is the higher the bigger benefits the investor-innovator may receive. Thus, the more complex the technology is the bigger is the potential rate of appropriation and better (easier) possibilities of profit protection for technologically leading entities. It can be popularized on an international scale with the mediation of foreign subsidies. The situation in case of simple technological solutions transferred with market mechanisms is a bit different. Appropriation in such a case is low as innovators do not express their interest in popularizing given solutions¹⁰.

A certain attempt to connect foreign transactions and FDI's theories is elaborated on the basis of the observation of the operation of American transportation corporations, the concept is called **the theory of international life cycle of a product**¹¹. Assuming that such a cycle is composed of three consecutive phases, in which the product has the innovation and standardized character, it is possible to define directions of changes in the form of technology transfer. In the first phase the production is localized in a well developed mother country and meets the domestic demand. The product manufactured by the company is constantly modified. Changes concerning design, production processes and marketing are introduced. Close contact with specialists of research and development institutions is required. The product is manufactured in small quantities for a market of a well developed country in which the company localized its production. When foreign demand appears exportation to other countries of the similar level of development takes place. In the second phase the features of novelty are gone and the product becomes mature. The manufacturer aims to obtain benefits through popularization of the production, reducing costs and

¹⁰ See J. Misala, *Wymiana międzynarodowa...*, p. 117–118.

¹¹ The concept is believed to be created by M.V. Posner and R. Vernon.

prices which brings about increased demand. This stage is characterized by reducing production in a mother country and transferring it to economically developed countries (in form of FDIs) as well as the beginning of importation to the mother country. In the last phase the product is thoroughly standardized. The company is forced to set the production in well developed countries where prices of production factors are lower and products are imported from those countries to the mother country and other developed markets¹². Model of international life cycle of a product explains several important issues concerning FDIs, among others geographical structure and material structure of international exchange, especially within the field of processed goods, additionally it justifies the choice of a given form of a transfer (foreign trade, FDIs). However, this theory in spite of the fact that it is perceived as one of the most adequate for explaining launching a product into a foreign market in form of FDIs does not explain all the questions related to that type of investment and technology transfer. This theory may not be applied to explain so called investment in reverse order¹³. Undoubtedly, the weakness of this type of model is its limited range. It is most useful for the explanation of the foreign expansion of the entities functioning in the manufacturing industry, which by nature is characterized by the higher level of innovation. It cannot, however, be used for the explanation of the natural resources trade¹⁴.

A far as transmission of knowledge and skills is concerned, **the theory of catching up with the product's lifecycle** (so called "flying geese paradigm") is of great importance. According to this theory, the underdeveloped countries keep causing demand for the high-tech knowledge by importing products and FDIs until they gain the necessary production knowledge from abroad. Having the proper background, they start their own production for the home market at the beginning and further for the international markets, e.g. to the countries from which they originally imported goods.

¹² See K. Przybylska, *Determinanty zagranicznych inwestycji bezpośrednich w teorii ekonomicznej*, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2001, p. 75.

¹³ Such investments focus on installing most modern technologies beyond the mother country. See S. Umiński, *op.cit.*, p. 44.

¹⁴ Cz. Pilarska, *op.cit.*, p. 24; M. Kuzel, *Rola bezpośrednich inwestycji zagranicznych w dyfuzji wiedzy i umiejętności na przykładzie gospodarki Polski*, Wydawnictwo Dom Organizatora, Toruń 2007, p. 77.

With reference to the flying geese paradigm of Akamatsu and M.V. Posnera i R. Vernona concept – K. Kojima claims that in the course of time, the highly developed countries loose the comparative predominance in the production of the relatively laborious goods because of the high cost of the manpower. By hand of FDIs they transfer the production of such goods to the underdeveloped countries where the manpower is cheaper and together with the export of capital, ensues the export of technology. In this way the development of the industry takes a roundabout way by going from the import of the finished goods, through the home production of these, further export and ending with the export of capital in a form of FDIs, what further leads to the renewed export of the product from the foreign subsidiary of the transnational corporation. Such development cycle exists not only in the industrialized countries but also in the underdeveloped countries that are able to take the opportunities created by the inflow of FDIs. The example of catching up with the leaders is „the Asian Tigers” that from the importers of goods and capital altered into world leaders in export of goods and capital¹⁵.

Contrary to the assumptions of the theory of the international lifecycle of the product, **the theory of technological gap** assumes the uneven disposition of technology (various levels of technological development, diverse speed and directions of technological development, limited possibilities of fast and free acquisition of technological knowledge) what leads to creation of gaps in this field. These gaps may become the basis for the arising of the competitive predominance used for the expansion (in a form of the export of the high-tech goods, sale of technologies (e.g. licenses), and FDIs) onto foreign markets. In accordance with this theory, two groups of countries can be isolated: innovators (countries where new products and technological solutions are created) and imitators (take over solutions created I other countries). Countries and companies characterized by the lower technological development aim at decreasing the distance that separates them by the use of imitations of the innovative processes. Gradual mastering of the technology

¹⁵ Kojima points however to the fact that the scenario he describes concerns Japanese FDI's in the neighboring countries and is different from the operation scheme of the international American corporations. The last ones are mostly focused on the production of high-tech goods in the countries of sale. According to that the inflow of capital from the USA is usually a substitute of trade. E. Czarny, J. Menkes, *Napływ kapitału bezpośredniego do krajów rozwijających się – wybrane zagadnienia ekonomiczne i prawne*, „Bank i Kredyt” 2007, No. 8–9, p. 64; K. Kojima, *Transfer of Technology to Developing Countries – Japanese Type versus American Type*, „Hitosubashi Journal of Economics” 1977, Vol. 17, p. 1–14.

leads to the enrichment of the export offer of the underdeveloped countries or entities and at the same time becomes the reason for the changes of the current exchange directions.

Of a slightly similar character is the concept of K. Pavitt, known as **theory of technological accumulation**¹⁶. According to this concept, the differences in innovativeness between individual companies result from the level differences of the possessed technology, which further becomes the initiating factor of the direct foreign investments. This theory underlines the significance of both technological predominance and location factors for starting such foreign business¹⁷.

Among the theories explaining the transfer of technologies and at the same time relating to the innovative predominance, often mentioned is **the internalization theory**, which is mainly based on the theory of transaction costs¹⁸. This approach is based on the thesis that all direct investments come down to the problem of market imperfection and external effects emerging from that fact. These issues have a special meaning as far as the markets of semi products, patented technological knowledge, and human capital, where the market imperfections lead to the decision about internalization¹⁹, for example in the sphere of R&D. Due to the fact that the possession of knowledge constitutes a specific predominance, problem of avoiding the dispersion gains new meaning. Internalization of the knowledge in the company is one of the ways to avoid knowledge disclosure to other users with the simultaneous assurance of the monopoly rents. The theory of internalization explains thus horizontal flows of knowledge and technology within FDIs, which constitute response for the market imperfections to the knowledge.

¹⁶ For further information search K. Pavitt, *Technological accumulation diversification and organization in UK companies, 1945–1983 (DRC discussion paper)*, Science Policy Research Unit, University of Sussex, Sussex 1987.

¹⁷ T. Pakulska, *Podatność innowacyjna Polski na napływ kapitału technologicznie intensywnego*, Oficyna Wydawnicza SGH, Warszawa 2005, p. 157; M.A. Weresa, *Wpływ handlu zagranicznego i inwestycji bezpośrednich na innowacyjność polskiej gospodarki*, Monografie i Opracowania nr 504, SGH, Warszawa 2002, p. 25.

¹⁸ Many authors dealing with the problem of transfer of technology refer to this theory, e.g.: T. Pakulska, M. Kuzel, S. Umiński, Cz. Pilarska, J. Szpakowski, W. Karaszewski et al.

¹⁹ The internalization process can be defined as creating the internal market, the market within the company, what leads to the replacement of the regular external market by interception of the allocation function and performing the division using the administrative writ instruments. A.M. Rugman, *Inside the Multinationals – the Economics of Internal Markets*, New York 1981, p. 28.

It should be noticed that the theories, which explain conduct of FDI and which refer to the absolute predominance, raise the issues of the transfer of technology only indirectly. Their main motives are usually connected with aiming at achievement of high profitability of the investment. Technology or innovativeness can be the only factors leading to the achievement of such aim.

On the other hand, the theoretical concepts of FDI, built on the basis of achieved location predominance, both directly and indirectly refer to the process of the transfer of technology, which accompanies this type of investments.

Although only in combination with other theoretical concepts (the theory of internalization, or the theory of monopoly predominance), still **the localization theory** points to some factors related to technology, which at a certain stage of development determine conducting FDI. Among main elements determining the attractiveness of a given localization (apart from basic productive resources: natural resources, cheap manpower) we should mention technological capability – provision of advanced productive factors, e.g. modern technologies, high quality specialists, modern communication and information infrastructure, and R&D background²⁰. Due to the fact that the importance of technological capability in attracting FDI is increasing, it should be considered a significant location factor.

From the synthesis of the existing fragmentary FDI concepts, J.H. Dunning developed **the eclectic theory of international production** considered to be one of the most complex theories explaining the reasons of foreign expansion²¹. According to this theory, the basis for the undertaking of the foreign investment is possibility of gaining at the new market one of three kinds of predominance²²:

- one connected with the company's specification (e.g. the technological level of production, modern production management;
- one resulting from internalization of activities;
- and the last one resulting from the defined location.

Among the specific types of predominance connected with technology and to which this approach refers are: provision of advanced (protected) technological solutions,

²⁰ See Cz. Pilarska, *Bezpośrednie inwestycje zagraniczne w teorii ekonomii*, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2005, p. 39–40.

²¹ This concept is also known as “OLI paradigm” – from the abbreviation of the names of the three groups of factors, which have to arise simultaneously in order to undertake BIZ (O – Ownership, L – Localization, I – Internalization).

²² T. Pakulska, *op.cit.*, p. 159–160.

exclusiveness or privilege in the access to these, R&D potential, qualifications and creativity of the personnel, comparative benefits resulting from the international specialization. The OLI concept was modified and developed to a cohesive and formalized capture of the model of capital, based on knowledge (*knowledge – capital model*) J.R. Markusen²³.

Taking into consideration the possibility of explaining the transfer of technology phenomenon, **the theory of the development cycles** of T. Ozawa is worth mentioning. According to this approach, there are four stages of the economy development, which are based on²⁴:

1. Productive factors – specific for the underdeveloped economies, which do not possess developed technology.
2. Investments – relevant to the situation of the mid-developed countries, which are able to offer FDIs themselves, done mainly for the purpose of gaining the resources.
3. Innovations – arising in the highly developed countries, where the modern and advanced technologies are used in the process of production. Such countries are administrators of FDIs and their aim is to recruit cheap manpower and at the same time they become FDIs receivers and create highly developed production technology.
4. Prosperity – specific for the economies of the highly developed countries that possess the newest and the most modern production technologies supported by the national works of R&D. Such countries are DFIs administrators, which search the developed production technologies and rich markets and are also administrators of the investments that use the excess capital.

According to T. Ozawa, in practice there is an evolution of geographical directions and sector structure of the FDI flows while changing from the lower to the upper stages of the national economic development of the individual countries.

Presented theories justifying undertaking of FDIs refer to the problem of technology and its transfer as a precondition in the country (entity) of the administrator and receiver of the investment. It should be underlined that there are not any

²³ See J.R. Markusen, *Multinational Firms and the Theory of International Trade*, MIT Press, Cambridge (2002); J.R. Markusen, K.E. Maskus, *Discriminating Among Alternative Theories of the Multinational Enterprise*, “Review of International Economics” 2002, Vol. 10, p. 694–707.

²⁴ T. Pakulska, *op.cit.*

theoretical concepts concerning the process of international transfer of technology in the professional literature, which point to the existing causes and mechanisms. One of the reasons of this status quo may be diversity of forms and methods of the transfer, among which FDIs become of significant importance. Opinions concerning this type of investments in the process of the transfer of technology to the hosting countries have gradually evolved. In the 70s of the 20th century, the negative aspects of the inflow of direct foreign investments were underlined. These aspects were connected with dependence of the hosting countries on the policies of big transnational corporations. As far as technological aspects were concerned, the negative aspect can be seen e.g. in the import of old-fashioned technologies, seizures performed in order to eliminate the competition, forcing protecting operations (influence over strategies and competitiveness of the companies), so called “brain washing” or the cancellation of existing connections of the corporation with the related and supporting industries. Such critical attitude has gradually been gentled due to the observation of positive results of foreign investors’ activities in the economies of the home countries. These positive results are, among others connected with the transfer of technology, e.g. improvement of the manpower qualifications, diffusion of new technologies, improvement of technical infrastructure, creation and popularized of different kinds of innovations (products and standards of service), establishment of strong and numerous cooperation relationships and high requirements against cooperating sides.

As a sum up, we should state that the increased interest in the problem of innovations and international transfer of technology, resulting from the intense efforts to built economy based on knowledge, require understanding of the existing mechanisms and correlations. Despite the existence of rich set of the FDIs theoretic models and the foreign trade, it should be stated that their explanatory force is not sufficient for the full understanding of the existing correlations and require further theoretic studies and empirical research in order to create a cohesive theory of international transfer of technology.

PROCESY MIĘDZYNARODOWEGO TRANSFERU TECHNOLOGII W TEORETYCZNYCH KONCEPCJACH BIZ

Streszczenie

Intensywne wysiłki zmierzające do stworzenia gospodarki opartej na wiedzy to jeden z powodów wzmożonego zainteresowania problematyką innowacji oraz międzynarodowego transferu technologii. Procesy transferu technologii dotychczas nie doczekały się odrębnych koncepcji teoretycznych, umożliwiających poznanie występujących uwarunkowań i powiązań. Celem artykułu jest ocena istniejących teorii bezpośrednich inwestycji zagranicznych (BIZ) pod kątem możliwości wytłumaczenia mechanizmów międzynarodowego transferu technologii. Pomimo istnienia bogatego zbioru teoretycznych modeli BIZ i handlu zagranicznego, należy stwierdzić, że ich moc wyjaśniająca jest nadal niewystarczająca do pełnego zrozumienia występujących relacji, a co za tym idzie, wymaga dalszych studiów teoretycznych i badań empirycznych w celu stworzenia spójnej teorii międzynarodowego transferu technologii.

Tłumaczenie Joanna Wiśniewska