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# The proces of NIS internationalization and the involvement of corporate foreign subsidiaries

**External and internal liberalization of national economies implies cross-border flows of production factors, goods, services and international linkages, as well as growing impacts of some processes in the international environment which affect a national economy. Among the under-investigated questions concerning economic internationalization there are external impacts on innovation activity led in an open national economy.**

The innovation activity is increasingly conducted within a national innovation system (NIS), which is regarded as an effective way of coordinating and stimulating innovation processes in a given economy. Participants of NIS consist primarily of enterprises, research centers, universities and public administration. The increased participation of foreign-based entities in NISs is acknowledged, and particular significance is attributed to foreign subsidiaries of transnational corporations (TNCs) originating in other countries.

The article aims at presenting a study of the NIS internationalization process in an open national economy as well as roles of various innovating entities, with a focus on innovation activity led by subsidiaries of foreign TNCs and its possible effects in a host economy. It is hypothesized that the cross-border operations, flows and linkages underlying the innovation activity of TNCs' foreign subsidiaries make a key driving force of the NIS internationalization in a host country.

## NIS functioning in an open national economy

The significance of innovations for expanding growth of an economy was recognized by J.A. Schumpeter a hundred years ago, and the great idea has been extended by working out a much wider innovation concepts in the next decades. In course of time innovation definitions, processes, models and systems have been much developed by other prominent economists, including J. Schmookler, Ch. Freeman, E. Mansfield, P. Patel, K. Pavitt, R. Nelson, S. Winter, B.-A. Lundvall, C. Edquist, D. Archibugi, G. Dosi, E. von Hippel, J. Fagerberg, L. Soete, P.F. Drucker, H. Chesbrough, C.M. Christensen, A. Pomykalski, W. Janasz and many others. The concept of national innovation system (NIS) draws much attention at present, due to dynamics and evolving characteristics of innovation activity led in enterprises and national economies. Another reason for investigating NIS consists in the significance of innovativeness for fostering international competitiveness of economies.

When investigating innovation activity of enterprises and enabling institutions, some economists have emphasized a role of linkages forming a nation-wide system of entities engaged in developing some "field" of new knowledge, technol-

ogy, innovations. The concept of national innovation system – its essence, functioning, participants – has been expanding since the end of 1980s, with contributions of prominent Authors, such as Ch. Freeman, B.A. Lundvall, R.R. Nelson, C. Edquist, P. Hall, M. Miozzo, S. Metcalf, D. Soskice, V. Walsh, D.C. Mowery and M.A. Weresa. The emerging concept has developed from a simple set of entities and their linkages, towards a diversified and interactive complex of various entities with extensive linkages and relations. Since the 1990s., B.A. Lundvall has stressed a systemic character of cooperation and expanding linkages of various entities being engaged in production, diffusion and implementation of the new knowledge of economic use [Lundvall, 1992]. The Author indicates particular conditions – specific to a national economy and its institutions – which affect characteristics of NIS.

More attention to the role of national institutions has been drawn by J.S. Metcalf. He defines NIS as a set of cooperating and interlinked organizations (firms) and institutions, which contribute (jointly and individually) to developing and diffusing new technologies. The set of entities and institutions forms a kind of framework for implementing public policy aimed at fostering innovation activity in a given economy [Metcalf, 1998]. P. Patel and K. Pavitt pointed out a key role of national institutions, their incentive structures and their competences that determine dynamics and direction of technological learning (or the volume and composition of change generating activities) in a country.

Therefore, the macro-organization of economic activity and public policies, as well as access of firms to finance and R&D infrastructure, can much affect functioning of NIS and a level of national innovativeness in a country. The innovation-oriented learning (not only technological) is understood as inter-organizational (among firms), intra-organizational (within large firms and among its units), as well as among all other participants (including institutions) linked within innovation network or system.

The above-mentioned NIS concepts – and other discussed in the cited publications – focus on systemic linkages of various entities (organizations, institutions), their cooperation, interactions and learning, as well as they indicate some exposure to public policy stimulating the national innovativeness. Basically, the NIS was comprehended as an endogenous process in a national economy. The concepts did not incorporate key changes of conditions taking place under the internationalization of economic activity in enterprises (competing on local and foreign markets) and national economies, which have become open to cross-border flows of goods, services, capital, technology, personnel. Some Authors indicate selected aspects of internationalizing innovation activity, although a clear concept has not been put forward yet.

One of a few NIS concepts which partly consider the internationalization process of economic and innovation activity has been elaborated by the Polish Author recently. In a broad concept developed by M.A. Weresa [2012], a NIS is defined as interlinked groups of the following phenomena:

1. A complex and structure of entities seated in a given country (but also acting internationally) which participate in creation of new knowledge, its diffusion (in the country and abroad), as well as its commercialization, and also they share the emergent innovations development and implementation.
2. A complex of institutions framing environment for progress of science, technology and entrepreneurship, and their changes in course of time.
3. Mutual relations and interactions of the entities and institutions.
4. Knowledge resource accumulated in a given economy.

The definition should be complemented with explanation of key features and elements of NIS which influence its functioning and effects. The first one refers to innovating entities, which include enterprises, research centers, universities, R&D mediating organizations, as well as their many-sided linkages which form an innovation network or system. All the linkages enable extensive cooperation of the entities, their interactions and organizational learning (mostly in enterprises). Knowledge resource accumulated in a national economy often makes a kind of development path for new knowledge being further created within a NIS. Finally, connections of the system elements with the external environment are indicated, both including the influence of external environment (its global and regional processes) on a given NIS, as well as some possible impacts of a given national system (e.g. NIS of the USA) on the international environment [Weresa, 2012]. A new concept of the NIS internationalization has emerged by A. Zorska [2014].

The NIS functioning is based on innovation activity being conducted in a given national economy and led mostly by enterprises, R&D centers and labs, as well as other organizations and institutions. Leading the innovation activity by a business entity means its fixed involvement in creating and/or acquiring knowledge, applying new ideas and solutions (as technologies), introducing them as innovations, commercializing on a market and permanently searching for more novelties. Such activity is organized as a process which is usually formed of some stages, and namely: basic research (exploring new knowledge), applied research (finding out new technologies), introducing innovations in particular operations, commercializing innovations on the market (mostly as new or modernized products).

The innovating entities have passed from a linear model to much more complex, heterogeneous and interactive models of innovation processes what has resulted in much extended, networked and diversified innovation systems of enterprises and economies [Dogson *et. al*, 2014]. As a matter of fact, NISs differ much in particular countries because of specific domestic and other conditions: development level, resource endowment, R&D and educational infrastructure, technological capabilities, institutions, business clusters etc. And last but not least, of some significance is the opening of a domestic economy to international exchange and entering foreign firms (and their subsidiaries) to a local market.

The participation of foreign entities in the innovation processes conducted in a host country can be initiated at those stages, where all private firms enter the process and seek access to R&D results to turn them into technologies and innovations to be commercialized on many markets. On the other hand, foreign entities can provide a host economy with technologies or innovations transferred mostly with foreign direct investment (FDI) and implemented to launch production and sales on domestic and foreign markets. The transfer and diffusion of technologies delivered from abroad generate some effects in a domestic economy, in most cases to the advantage of a given host country.

The innovation activity is conducted by entities which are involved in carrying out the whole innovation process or its particular stages or activities. The set of innovating entities, their capability to generate commercially valuable knowledge, technologies, innovations as well to apply and diffuse them implies dynamics, robustness and significance of a given NIS. Four groups of innovating entities can be distinguished, and namely:

- National or local enterprises (domestic-capital companies).
- R&D centers and academic universi-

ties (science-related entities).
- Public administration entities and institutions.
- Foreign subsidiaries of TNCs originating abroad (foreign-capital companies).

In case of an open economy one group is of particular importance for the NIS internationalization, i.e. foreign TNCs and their subsidiaries. The corporations appear in various roles: as national enterprises (in home countries), as parents of R&D centers and foreign subsidiaries located in host countries, as well as foreign partners of public entities (in some ventures) and universities (in joint research or educational projects). Moreover, the TNCs' international business makes one of important forces in the international (global) environment, indirectly affecting NIS in host countries.

Under the present conditions in the world economy, the external opening of national innovation activity and its exposure to external conditions and forces is an obviously realistic approach. NIS concepts which basically referred to NIS as an endogenous part of a national economy, should be re-interpreted and take into account functioning of open or semi-open national economy, as well as its external flows and linkages. It implies some degree of integrating a domestic and the world markets, with cross-border operations, flows and linkages of local and foreign firms and their competition on a local market. Another change refers to public policy which is conducted to foster country's innovativeness and international competitiveness, by means of improving instruments of innovation policy and activity of NIS. To make innovation policy well-done and effective in an open economy, it is important to understand the essence of the NIS internationalization process and its influence on national innovativeness in a country.

## The external and internal conditions for the NIS internationalization

The NIS functioning and internationalization in an open market economy is shaped by a set of external and internal conditions, which exert direct and indirect impacts on decisions taken (or to be taken) by entities participating in the innovation system. The conditions underlay evolution of dynamics, structures and linkages of NIS, so to some extent they can influence actions of various entities to participate, cooperate and innovate in the system, as well as drive its internationalization and development.

By their nature, external conditions – i.e. global and regional – exert mostly indirect impacts which are transmitted from international to local markets. The impacts stem primarily from evolving cross-border flows of goods, services and production factors, implemented rules of international organizations and institutions, as well as changing international business. The external conditions are rooted in four crucial processes taking place in the global environment, actually in the world economy. These are the following four processes:
1. Globalization of economic activity.
2. Regionalization or regional, economic integration.
3. Growth of knowledge-based economy.
4. Growth of transnational business led by TNCs.

The processes advance and evolve in close interactions with a wave of technological, economic, institutional and social transformations which are driven by the present digital (information) revolution. Information and communication technologies (ICTs) change all spheres of human activity, and their particular impacts strongly affect the economy and business of enterprises. Discussing the essence and impacts of the processes remains beyond the article's

framework, so only some key issues will be mentioned below [Zorska, 2014].

The combined four processes create a kind of external framework and a complex set of conditions for emerging more chances and threats to innovativeness of national enterprises and economies. The emerging chances rooted in the external environment consist in: more space for international expansion of innovative firms, more consumers of innovative products on the global market, inflow of foreign capital (FDI, in particular), access to new foreign knowledge and technologies, more access to joint R&D investments and programs in various countries, ICT– enabled global contacts, deals and linkages with cooperating partners, more demonstration of new business practices abroad, participation in cross-border innovation networks, cross-cultural organizational learning, increased pool of talented staff in many countries, access to better or more friendly institutions, policies and modern infrastructure, participation in NISs of other countries, more cooperation and linkages in foreign business clusters, etc.

However, more international or external threats do appear as well, and potentially the most common include: much increased competition for advanced resources and capabilities, fierce rivalry on particular product markets, exposure to failures of some outcompeted foreign firms, capturing new knowledge and technologies, reverse transfer of technology by foreign subsidiaries, TNCs' acquisition of local innovative firms, employing or transferring high-skilled staff (and increasing its domestic wages), outcompeting domestic firms and innovators, impeding growth of new branches (if local innovations are captured) and exports, etc. Fortunately, not all threats do happen and some of them can be leveled off.

Referring to the article's subject, the significance of transnational business led by TNCs as entities competing on the global market, is put to the front and it stems from two main reasons: engagement in foreign direct investments (FDI) and conducting innovation activity. TNCs' engagement in FDI is motivated by seeking foreign sales markets, production factors, efficiency and strategic assets. In the age of knowledge economy, TNCs' penetration of foreign markets is more often motivated by access to resources of knowledge, advanced technologies and high skills, modern infrastructure, enabling institutions and policies, scientific achievements of universities, technological capabilities of local enterprises.

These are the main location advantages which attract the FDI inflows by corporations to host countries, and are used to establishing foreign subsidiaries or joint ventures, for both production and sales of goods/services as well as conducting innovation activity. All corporate units fulfill particular functions in the value-added chains (e.g. R&D), and are included in the corporate cross-border network structures and execution of various strategies, to compete successfully on the global market. To reach this aim, TNCs need strong competitive advantages and smart strategies, and the most sustainable are usually the ones based on knowledge, new technologies and innovations. The TNCs' competitiveness brings about results not only on the global product markets (their dynamics, new trends, structures, conditions, etc.), but also implies some changing conditions for the economic and technological development of local firms and host countries (their factor endowment, sales markets, innovation activity, institutions, etc.).

The innovation activity has become one of key processes in TNCs, owing to a fact that nowadays knowledge, technologies, innovations underlay competitiveness of enterprises on the global market. To create sustainable, innovation-based competitive advantages, the global corporations spend large sums on R&D con-

ducted in own research centers or laboratories, and also engage in technological cooperation or buy technologies on the market. A high-rate growth and important changes have been recorded in the corporate innovation activity in the recent decade, what implies new processes or adjustments to many other firms, sectors and economies all over the world. For the discussed topic one should mention the following processes and tendencies in TNCs' innovativeness:

- Large increase of significance attributed to innovations – knowledge and technology, in wider considerations – as a basis of sustaining specific and strong competitive advantages of firms and successful conducting their strategies on the global market.
- Decentralization of the extensive R&D activity and relocation of considerable parts of research work from corporate headquarters to so-called centers of excellence (in innovations) or other units in foreign locations.
- Internationalization of the R&D activity by means of foreign direct investments (acquisition of innovative firms or launching new projects of own research departments or centers), cooperation with local partners or buying research services.
- Transition to open-innovation model what implies more participation of other, independent (non-equity) entities in conducting TNCs' extensive, complex innovation activity, e.g. exchange of research results, collective R&D projects, joint ventures, etc.
- Expansion of research and innovation networks as an organizational basis for fulfilling specialized and dispersed tasks, with a leading role of TNCs as a coordinator and integrator of actions led by many units and entities in different countries.
- Outsourcing and offshoring selected R&D activities (to own units or non-equity entities) which are transferred to foreign locations with advanced knowledge resources and technological capabilities, and low-cost of executing research projects.
- Expanding innovation activity in corporate foreign subsidiaries and their so-called creative transition, what means own R&D efforts (initiated by unit's staff), as well as research cooperation with other TNCs' units (intra-firm linkages) or local partners.
- Expansion of local linkages (business or scientific) and relations (social) what results in a gradual permeation and inclusion of TNCs' units and their staff into a national R&D sector and NIS in a host country.
- Using corporate cross-border networks for activating a reverse transfer of knowledge, technology or innovations worked out or accessed by TNCs' subsidiaries abroad and delivering it to parents' headquarters for further development.

The above-listed processes and trends in the corporate innovation activity imply more presence and impacts of foreign TNCs in the NISs of those host countries which are well-endowed in new valuable knowledge and/or promote growth of knowledge, technology, innovations as well as stimulate knowledge-enhancing capabilities and infrastructure. It can lead to opening up NIS to foreign entities and next to their entry and expansion in the system.

The national innovation system is localized and immobile – embedded on country's territory – so internal conditions for the NIS functioning in a given country play a crucial role. All the NIS participants gain access to territory-based production factors, technological capabilities and some context conditions (e.g. social or institutional) that are not available elsewhere [Palaskas, Tsampra, 2003]. However, the internal (domestic) condi-

tions are not fixed and unchanging. They evolve under the activating domestic processes and circumstances (e.g. knowledge and technology development, government policy) but also foreign ones which complement country's endowment (e.g. FDI inflow), impact processes or stimulate various changes (e.g. forced by new international regulations) [Parsons, Rose, 2010]. External liberalization and opening the economy imply some impacts of external processes and trends on internal conditions for entrepreneurship and innovativeness.

Internal conditions for the NIS functioning can be aggregated in different ways, depending on a specific concept as well as attached significance and roles. The model of NIS elements which is based on the concept of triple helix includes a broad element which is named "Domestic conditions and institutions". A model developed by E. Arnold and S. Kuhlman contains a general element "Conditions for conducting economic activity", with two sub-elements: "Political system" and "Education and research" [Weresa, 2012]. The OECD concept puts to the front "Country's performance" (including growth, employment, macroeconomic and regulatory issues, etc.) which also refers to innovation-specific factors, e.g. research and technological capabilities, education and training system, communication infrastructure, conditions on product and factor markets. Many authors stress significance of institutions or institutional framework (and its improving) in a given country that underlay the national R&D and innovativeness, entrepreneurship and innovation policy making.

To explain the process of NIS internationalization it is also necessary to distinguish the following four groups of internal, national conditions existing in a given country:

- Economic conditions.
- Institutional conditions.
- Knowledge resource.
- Technological capabilities.

A wide interpretation of the internal conditions should not exceed the article's framework, so only few comments are put down. At present, the economic conditions combine not only development level, sector structure and growth rate of national economies, as well as their resource endowment. Much more attention is drawn to the technologically advanced resources (valuable knowledge, high technology and skills, in particular), modern infrastructure, dynamics of economic and other changes, growth of knowledge clusters, openness of the economy and external linkages, vulnerability to external shocks, etc. Institutional conditions are assessed from the viewpoint of modern business and include regulations aimed at stable and safe business conduct, competitive markets, protection of intellectual property rights, financial security, fiscal incentives, public agencies for innovation policy, assistance to foreign firms, fair business practices, etc. The knowledge resource accumulated in a particular country is important as its advantage, especially if it can be valued for its uniqueness, technological specifics and commercial potential. Moreover, the accumulated knowledge makes a kind of prerequisite for technological development path and NIS formation in a given country.

For foreign firms, national knowledge resource (its price as well) and its potential for further development have become one of key location advantages for attracting FDI, and establishing foreign subsidiaries or research centers. For domestic enterprises, the creation of knowledge and technologies by local entities (supported by public policy) and its wide diffusion, means more opportunities for increasing innovativeness and international competitiveness. However, much depends on their technological capabilities that enable absorption of new

knowledge and its further development. The level of technological capabilities – supported by modern communication infrastructure – of domestic firms, is critical to forming local linkages and innovation networks with the participation of incoming innovative foreign entities.

Taking advantage of the chances and avoiding the threats is not only a problem of domestic enterprises, but also governments. The latter ones can to some extent stimulate positive impacts of external forces and protect from negative ones. It is usually done with an aid of various policy instruments, which refer mostly to advancement and protection of domestic high-tech production factors, competition and innovativeness in the country. Good results of effective and "innovative" governments' actions (plans, instruments, assistance), can foster both national innovativeness and international competitiveness of the economy, as well as enhance dynamics of its growth and social welfare.

## The NIS internationalization process: networks and entity roups, especially TNCs' foreign subsidiaries

The process of NIS internationalization means, that functioning and development of the system in a particular open national economy is influenced by the processes in external environment, by means of cross-border flows of knowledge, technology, innovations, as well as the participation of foreign entities, including subsidiaries of TNCs' from other countries. In this context the subsidiaries are treated as foreign-capital companies which are dependent (in terms of finance, knowledge and technology, value chain, organization, strategy) on decisions and activity of their parent corporations seated abroad.

The advancement of NIS internationalization process consists in the increase of:

- Number of foreign participants and/or their units – TNCs' foreign subsidiaries, in particular – as well as density of their cross-border and local linkages, and relations.
- International (cross-border) transfer of knowledge, technology and innovations as well as complementary production factors, goods, services.
- Resource of new knowledge created jointly by domestic and foreign entities, and featured with a high value and commercialization potential on the global market.
- Domestic diffusion of the transferred knowledge, technology, innovations and their application by local enterprises to upgrade their innovativeness and competitiveness.

The opening of national economy makes a kind of initial condition for entering a particular domestic market by foreign innovative entities, their networking and cooperation in the NIS, cross-border exchange of innovation-related production factors, goods and services, as well as their "creative" application in the national economy. As mentioned, it can result in exposure of the domestic economy to diverse impacts of the external processes and trends.

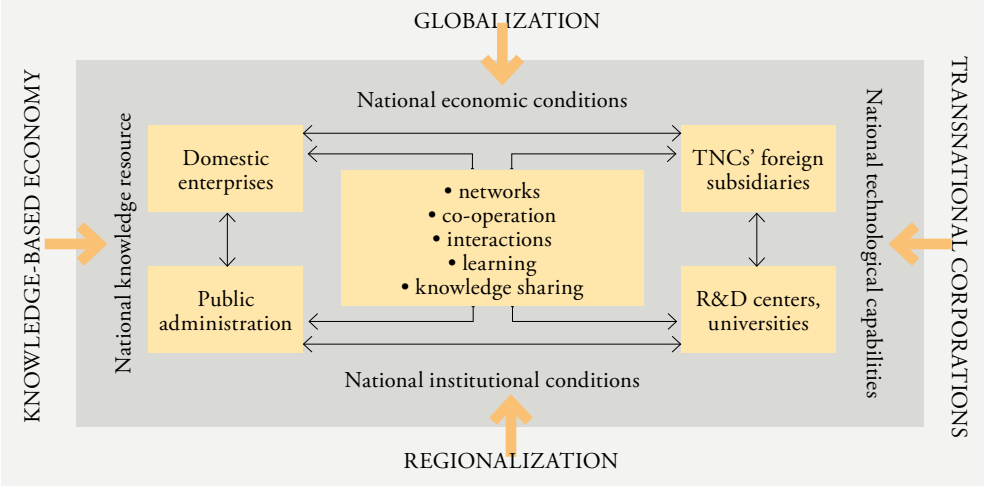
The symptoms of NIS internationalization consist in increasing number of foreign participants and density of their cross-border linkages, expanding international linkages of domestic entities, growing resource of new knowledge jointly created by domestic and foreign entities, intensifying international transfers of knowledge, technology and innovations, spreading local diffusion and application of imported knowledge, technology, innovations. The increasing NIS internationalization influence innovativeness of national enterprises and the economy, although both favorable and unfavorable effects can be expected.

The NIS internationalization can be also conceptualized in another way, as opening of the country's innovation system to international exchange of knowledge and technology, as well as linkages in cross-border innovation networks. The level of NIS opening is indicated by the intensity of cross-border innovation linkages of all its entities and elements [Weresa, 2012]. In case of TNCs' foreign subsidiaries embedded in the NIS – which are networked in global corporate systems – international exchange of knowledge, technology and innovations is usually much more intensive than that of domestic NIS participants. Therefore, the cross-border activity of subsidiaries led in TNCs' innovation networks is of particular significance for the NIS internationalization process, and for impacts on national innovativeness, in a host economy.

The presentation of the NIS internationalization concept should be – and it was, in fact – initiated with discussing four processes in the external (global, regional) environment. It should be noticed that whereas impacts on NIS by the processes of globalization, regionalization and developing knowledge-based economy are mostly indirect – transmitted by the mechanisms of market – the case of transnational business activity is different. The impacts of TNCs can be indirect ones when their activity concerns the global market, and some general issues of their foreign expansion led in the world economy. However, if TNCs are approached as foreign direct investors which place FDI in a given country, then their impacts can be also direct ones as far as so-called investment package is transferred. It means imports of goods and services as well as inflows of some production factors and transfer of capabilities replenishing endowment of a host economy. Much depends on FDI motives and value, forms and industry structure of the investments, penetration of product and factor markets, set-up local linkages (horizontal or vertical), strategies conducted on the local market, etc. Anyway the combined indirect and direct impacts of foreign TNCs and their subsidiaries can be quite strong in particular domains of a host economy.

The external and internal conditions of the NIS internationalization make a general background for discussing actions of all entities involved in the process, characteristics of the system and new phenomena. The basic NIS structure and linkages are sketched on Chart 1.

Chart 1 **Internationalization of NIS in an open national economy: conditions, participating entities and linkages**




Source: own study.

The NIS significance, ongoing processes and development dynamics depend on a set and characteristics of the participating entities, i.e. their number, structure, network density, talented staff and managers, growth of knowledge cluster, potential of knowledge creation, etc. Moreover, of great importance is the synergy that can emerge out of the entities' collective innovation activity. The knowledge and innovation synergy means some additional "output" which cannot be accomplished, if particular entities work individually. The synergies arise from the NIS characteristics which concern the following actions:

- Network organization of collective activity.
- Cooperation within a heterogeneous group of entities.
- Interactions in combinations of two or more research partners.
- Organizational (and staff) learning in a collective process of knowledge creation, application and diffusion.
- Knowledge sharing which is based on mutual exchange of own knowledge or some parts being created and integrated in "a bundle" of technologies or innovations.

Knowledge sharing means that particular entities make some "input" to a collective resource, and in return they gain access to research results or some knowledge of other participants. So, a new wave of generating and accumulating knowledge, technologies, innovations can be initiated and possibly the further NIS development will be triggered.

Each group of the NIS entities acts in a different way in the system. It implies their different contributions to the NIS internationalization and varied impacts of the process on their innovativeness. Not all domestic enterprises can create and exchange knowledge or technology, and engage in innovation cooperation. As far as the group of local firms is usually heterogeneous, their involvement in the process of NIS internationalization depends on firms' competitive strategies and innovativeness, business linkages with TNCs' foreign subsidiaries and perceived advantages from innovation cooperation with foreign entities [Crescenzi *et al.*, 2015]. The heterogeneity of domestic enterprises, their different innovation behavior and NIS participation should become a matter of consideration for innovation policy.

The key NIS domestic participants are usually large firms that conduct R&D and strain to improve its results. Another sub-group is made of small innovating firms which can grow at high rates owing to their research accomplishments, or they are acquired by large businesses. The domestic enterprises (but not each firm), are usually networked to other national entities and take advantage of their contribution within the NIS, what concerns mostly their relations and linkages with public administration, as well as universities and research centers. The local enterprises can also acquire technology abroad, so the national innovativeness will be replenished with new technology transferred from outside. Some domestic firms can improve their innovativeness and competitiveness much enough to start or speed up their foreign expansion.

However, favorable results of upgrading innovativeness by means of participating in a NIS are not obvious and guaranteed. They depend on ability to absorption of knowledge and technology by local firms, as well as their creativity in further implementation. It happens that the ability is more stimulated by linkages with international innovation leaders than by cooperation with local innovators [Palaskas, Tsampra, 2003]. To implement new knowledge a firm should possess advanced capabilities in a given technology field, should own or access required resources and capabilities, and should be able to commercialize innovations. And it

should have a determination to appropriate and make use of new knowledge before competitors can do it. Coming back to the NIS internationalization it can be summed up that the activity of local enterprises usually does not make a driving force of the process, but they can rather be influenced by its development.

The public administration entities do not lead innovation activity but rather support it, in close relation to the national institutional conditions. The group of public entities starts at a macro level and concerns government or nation-wide institutions working out and implementing innovation policy. The policy is implemented by variety of committees, offices and agencies (on macro and middle levels) which are devoted to many tasks, e.g. supporting R&D programs and expenditures, assisting in development of contacts and cooperation, attracting foreign investors and seeking suitable locations for them, developing knowledge clusters and technology parks, promoting particular technologies, setting up industry chambers, agencies of regional business, etc.

In the EU-member countries there have been established common institutions assisting the implementation of innovation programs and distribution of R&D funds. The activity of public administration entities usually does not initiate the NIS internationalization but can influence its pace of development and structure. The active innovation policy conducted by government can exert some influence on the NIS internationalization by implementing instruments to increase inflow of FDI, as well as transfer and absorption of foreign technologies by national enterprises. Then final impacts are indirect and depend on enterprises themselves. If public entities – authorized by their governments – are focused on attracting TNCs, it strengthens the role of corporate foreign subsidiaries to contribute directly to the NIS internationalization.

Particular significance is attributed to universities and research centers as entities creating new knowledge (and high-skill staff), driving the NIS development and country's innovativeness. They are usually recognized as the main actors engaged primarily at the early stages of innovation activity, i.e. basic and applied research. The group of entities is divided into two sub-groups which are research-devoted centers, laboratories, departments, etc., and the other sub-group consisting of universities and other higher-education institutions. Goals of the second sub-group are focused on education and training whereas scientific work sometimes makes a second-rank activity. Anyway, the leading universities are also famous for their accomplishments in technical and life sciences, so knowledge created by them can be a valuable "input" to the NIS and raise interest of foreign entities.

It should be stressed that the group of academic entities is much diversified and undergoes the process of adjustment to evolving conditions of knowledge-based, open and competitive economy [Deiaco *et al.*, 2012]. Universities have become – or have to become – more oriented towards needs of the modern economy, in terms of developing skills and knowledge required by competitive and expanding business. At present some universities focus on applied research which is worked out to orders of established firms (TNCs' foreign subsidiaries including). A new task of universities consists in establishing own business based on their research results, as spin-offs or start-ups experimenting with new technologies and innovations. They can enter NIS as domestic companies and newcomers. Traditionally, R&D centers and universities develop research linkages as knowledge or technology providers to other NIS entities.

In most cases the internationalization of R&D activity at universities consists of exchanging ideas (e.g. at conferences), and

undertaking scientific cooperation with foreign partners in joint research projects and implementing research results. International research cooperation gains momentum with the involvement of various partners in the EU-sponsored projects. Another case is the cooperation in applied research led with foreign TNCs or their subsidiaries, usually resulting from their initiatives and contributing to corporate knowledge resource. If the national research centers or universities can create knowledge of global potential, then their outstanding results can attract TNCs to locate close to the knowledge source and cooperate in further resource development. It triggers the NIS internationalization process, although its benefits to the national economy cannot be guaranteed.

The group known as TNCs' foreign subsidiaries includes two subsets of entities which are established with FDI located by their parent firms. The first one consists of subsidiaries acting as factories engaged in procurement, production and sales of products, in fact being foreign-capital companies in manufacturing or service sectors. Factories are often equipped with research departments or labs. The second group is devoted entirely to R&D function and we call them corporate research centers. The presentation of growth and characteristics of TNCs' foreign subsidiaries and their evolving innovation activity exceeds the problem discussed in the article, but further reading on the subsidiaries can be recommended [Zorska, 2007]. For the NIS internationalization two questions relating to the innovation activity of corporations' subsidiaries are vital, i.e. subsidiaries in corporate networks and embeddedness of subsidiaries in host countries.

At present a cross-border network makes a basic organizational structure of TNCs and it is formed of focal units and their robust linkages, all functionally linked within the parent's value-added chain. The corporate innovation network (sub-network, precisely) includes all units engaged in particular, technologically specific tasks or projects contributing to the whole innovation process which are organized, coordinated and integrated by the parent firms. The population of subsidiaries in innovation networks is diversified, what results from different growth patterns and factors shaping them. The factors affecting knowledge, technology and innovation development in subsidiaries include [Zorska, 2013]:

- External factors rooted in the global and regional environments.
- Internal factors stemming from the corporate system.
- Endogenous factors acting in a given subsidiary.
- Local embeddedness of a given subsidiary in a host country.

Among the internal corporate factors, intra-firm network is very important, as far as it provides a structure for cooperation conducted by numerous innovating units (in many foreign locations), which are linked in a firm's joint program, e.g. of launching a new product. The linkages enable transfer of knowledge, interactions, intra-firm learning and transition to a new "wave" of innovations. Much depends on endogenous factors in a particular subsidiary, where its potential for developing knowledge and innovations is sustained with own, complex efforts to absorb transferred knowledge, conduct own R&D and implement valuable, specific innovations. In the recent decade, many TNCs' foreign subsidiaries have strained to create new knowledge by own research efforts, to use and upgrade corporate knowledge resource, and engage in research or technology cooperation with local entities in host countries. Such a process of knowledge and technology advancement in corporate units is called a creative transition of foreign subsidiaries

[Manolopoulos *et al.,* 2005]. It depends to some extent on developing local linkages of the subsidiaries and their access to the national knowledge resource, as well as their ability to actively participate in the country's NIS.

Foreign subsidiaries can develop extensive local linkages (business) and relations (social) to penetrate domestic markets of technologically advanced goods and factors, and host country's economies, in general. It leads to establishing "local embeddedness" of foreign subsidiaries, which enables them to capture more benefits from penetrating local markets, accessing national resources and capabilities, as well as participating in NISs. As the access to country's knowledge resource has become one of key motives for the FDI expansion of TNCs in foreign countries, so nowadays their foreign subsidiaries spare no efforts to expand linkages and relations with local innovating entities, i.e. firms, research centers, universities. The fact is acknowledged as "a dual embeddedness" of foreign subsidiaries, meaning their presence, activity and linkages in both parents' cross-border networks, as well as innovation networks in host countries [Collinson, Wang, 2012].

Due to their embeddedness in a host economy, TNCs' foreign subsidiaries can take advantage of the NIS internal (national) conditions in a host country for enhancing corporate innovativeness. At the same time the subsidiaries are engaged in TNCs' cross-border innovation activity as focal units linked to other innovating units, what enables them learning and knowledge sharing in the corporate system. Some knowledge is transmitted by foreign subsidiaries to the NIS (and the host economy), but on the other hand a new knowledge is created in the system and it can be captured by some subsidiaries for further development or reverse transferring to the parent firm. For that reason the activity of TNCs and their subsidiaries in a NIS is described – as confirmed by some research – as potentially parasitic rather than symbiotic [Mazzucato, 2014].

For some host countries, like Spain, unfavorable effects of foreign participation in the country's innovativeness consist in blunting innovativeness and competitiveness of local firms, when TNCs' foreign subsidiaries made use of technology created by other units in the corporate global innovation network [Garcia *et al.,* 2013]. On the other hand, very positive results of foreign TNCs' involvement in expanding NIS have been generated in case of China. The innovativeness and international competitiveness of Chinese enterprises and the whole economy have been enormously raised with an aid of Western TNCs, their FDI, technology transfer and joint ventures or subsidiaries set up in the country [Schwaag Serger, 2006]. One of key reasons for quite different effects of the TNCs' participation in the countries' NISs consists in characteristics of the governments' innovation policy.

## Summary and conclusions

The transformation of word economy in the age of globalization and technological revolution has put to the front significance of knowledge, technologies and innovations as essentials for the international competitiveness of enterprises and national economies. In order to make the application and diffusion of knowledge more effective and successful, there have emerged national innovation systems – NISs. Under the opening of national economies and increasing influence of the processes rooted in the global environment, in course of the NIS development a new problem of its internationalization has gained momentum.

The NIS internationalization means that development of the system is influenced by the external conditions, cross-border flows of advanced production

factors, goods and services, as well as the participation of foreign entities, mostly TNCs' and their foreign subsidiaries. The symptoms of NIS internationalization consist in increasing number of foreign participants and density of their cross-border linkages, expanding international linkages of domestic entities, growing resource of new knowledge jointly created by domestic and foreign entities, intensifying international transfers of knowledge, technology and innovations, spreading local diffusion and application of imported knowledge, technology, innovations. It is possible that the NIS internationalization can result – but not necessarily it must happen – in fostering the innovativeness and international competitiveness of national enterprises and the economy.

The NIS internationalization depends on the activity of foreign entities, mostly TNCs and their foreign subsidiaries (acting as factories, research centers, labs). If the involvement of foreign subsidiaries in a given system is considerable enough, than they become a key group of entities responsible for the process of NIS internationalization. The expansion of local linkages and relations by corporate subsidiaries results in their increasing local embeddedness in a given host economy, permeation into national innovation activity and active participation in a NIS. It makes possible for foreign subsidiaries to tap to new local knowledge and other advanced resources and capabilities, and finally to take advantage of them, often by reverse transferring knowledge or technology to parent TNCs. Examples of some countries show unfavorable – e.g. in Spain, and very favorable, first of all in China – results of the NIS internationalization. Much depends on internal conditions for the NIS development and internationalization, as well as government innovation policy.

Some conclusions can be drawn from investigating the NIS internationalization, possibly to be considered in government innovation policy. Firstly, due to heterogeneity of domestic enterprises, their participation in a NIS is diversified and it can bring about different results for fostering national innovativeness. For that reason instruments of country's innovation strategy and policy should be diversified, nuanced and targeted to a particular sub-group of innovating entities. At the same time, the set of instruments should form a "tool kit" of a coherent innovation policy.

Secondly, due to particular features of TNC's subsidiaries as entities in a NIS, their involvement and expansion in the system should be carefully monitored. The innovation-oriented FDI inflow should be stimulated by instruments of relevant investment policy, but for the promotion of R&D led by foreign subsidiaries other instruments can be used, in line with the Government innovation policy.

Thirdly, not only higher education and R&D activity should be encouraged at universities, but also international relations and business linkages in order to push skill and knowledge or technology creation, as well as their diffusion to a higher level and make a larger input to national innovativeness and competitiveness.

Fourthly, activity of institutions and public administration in a NIS seems more and more important for fostering national innovativeness. Their network, functions and tasks should be well-tailored to the conditions and requirements of open market economy, being integrated regionally and globally, and for that reason influenced by external forces and conditions.

Fifthly, in a wider context the problem of NIS development concerns government activity conducted in an open national economy. The innovation policy, strategy and instruments should not only promote national innovativeness (considering its evolution, complexity and heterogeneity),

but also stimulate its internationalization (monitoring and channeling the process, to some extent), with a focus on protection of national interests.

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