GLOBALIZATION OF INNOVATION ACTIVITIES OF MODERN TNCs

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The division of labor within GVCs between developed and developing countries has is identified in the article. Innovation and the development of innovation systems, as well as the effects of companies entering GVCs in developing countries are analyzed. The level of innovation potential of developing countries (host countries-partners of TNCs), where TNCs from Europe and the USA located their production facilities are determined. As a consequence of globalization of innovation processes, TNCs subsidiaries also have economic advantages by gaining access to local "knowledge pools" and thus enriching their innovation process. The tendency of TNCs towards a global search for new scientific knowledge and technological capabilities, a significant part of which is embedded in local innovation networks and scientific human resources is revealed. It shows that the divergent ways of solving the tacit knowledge problem are associated with different modes of innovation organization, knowledge processes and learning orientations.

Global value chains (GVCs) and international fragmentation of production occupy an important place in the modern architecture of the world economy. Placing individual stages of production in different geographical locations allows not only to increase the efficiency of the production process as a whole, but also to strengthen the competitiveness of countries and TNCs participating in international fragmentation.

It is relevant to establish a connection between theoretical research on GVCs and practical actions: what national policies should be pursued in order to increase the various benefits from the country's participation in GVCs.

The division of labor within the GVC between developed and developing countries has a specific character. The increasing use of knowledge-based capital (brands, R&D, design, software integration in management, etc.) as a factor of production increases the uneven distribution of income along GVCs in favor of those countries or companies that have the most such capital. In 2017, World intellectual property organization published the report "Intangible Capital in Global Value Chains", which provided new insights and scientific results on the processes of income creation and appropriation in the context of GVCs, taking into account the contribution of intangible capital [5].

At every stage of the global value chain, value is created: by workers, production equipment and, increasingly, intangible capital. Intangible capital in the form of technology, design and brands (as well as worker skills and management know-how) penetrates GVCs and plays an important role in the competitiveness of companies in the market [5].

The share of intangible assets is especially high in such industries as the production of petroleum products (42.1%), chemical products (37.5%) and pharmaceuticals (34.7%). In addition, it is relatively large in the production of food products, as well as computer goods, electronics and optics [5].

There are different levels of participation of developing countries in GVCs: active involvement of Asian countries within the framework of the "Asian Factory", weak involvement of African countries and involvement of Latin American countries through trade interaction with the United States.

In 2019, under the auspices of the World Bank, the second report was released within the framework of multilateral international cooperation in the study of GVCs – "Technological Innovation, Trade within the Supply Chain: Measuring and Analyzing the Impact of GVCs on Economic Development" (GVC Development Report, 2019. Technological Innovation, Supply Chain Trade, and Workers in a Globalized World: Measuring and analyzing the impact of GVCs on economic development) [4]. The report raised some new topics in the study of GVCs, in particular, the consequences of the crisis for the promotion of GVCs not only in developing but also in developed countries, including the problem of reshoring; the impact of innovation processes on the dynamics of GVCs, employment, etc.

Modern publications analyze research on innovation and the development of innovation systems, as well as the effects of companies joining GVCs in developing countries.

The perspective of innovation systems experts is usually focused on the national level, while the approach of GVC specialists is inherently global. The main disadvantage of the GVC approach is that it does not take into account the influence of local institutions on the ability to upgrade individual enterprises in the GVC. There is actually more overlap between the two concepts than it seems, and the two approaches can be integrated.

Specific research questions are knowledge exchange in GVC clusters and regional and sectoral innovation

Table 1

GII 2023 rankings overall and by innovation potential, 2022 [3]

Country	Overall GII	Institutions	Human capital and research	Infrastructure	Market sophistication	Business sophistication	Knowledge and technology outputs	Creative outputs
Republic of Korea	10	32	1	11	23	9	11	5
China	12	43	22	27	13	20	6	14
Slovenia	33	38	25	20	68	26	27	48
Malaysia	36	29	32	51	18	36	37	37
India	40	56	78	84	20	57	22	49
Poland	41	76	40	47	67	41	40	35
Thailand	43	85	74	49	22	43	42	44
Romania	47	74	75	34	75	51	35	38
Brazil	49	59	96	58	50	39	52	46
Ukraine	55	100	47	77	104	48	45	47
Mexico	58	111	63	55	57	79	57	45
South Africa	59	88	84	68	65	61	56	63
Indonesia	61	70	85	69	37	77	61	68
Tunisia	79	107	46	89	98	119	50	72
Egypt	86	103	95	90	88	100	77	73

systems. The main issues studied by the GCS school:

1. How does the nature of the chain affect the developing country firms that participate in it?

2. How does the nature of the chain affect the distribution of rent within its different links?

3. Does integration into GVCs of developing countries have a positive effect on their development?

Optimists argue that developing and least developed countries simply have no other alternative than GVCs.

A main policy focus of the innovation organizational restructuring in recent years has been to enhance global coordination and integration of the geographically distributed research laboratories into the global knowledge networks.

A major contribution to the development of the GVC concept was made in the work of Gereffi, Humphrey & Sturgeon: the authors focused on the theory of transaction costs, seeing that the type of GVC management depends on it. According to their opinion, the type of GVC management is explained by the following factors: completeness of information and the possibility of knowledge transfer; the degree of possible codification of information; supplier capabilities [2].

This suggests that companies have the power to change the type of GVCs in which they participate. Accordingly, companies from developing countries are encouraged to join those GVCs where there are fewer barriers to entry, and then, due to learning, rebuild into more profitable GVCs.

In the USA, the approach of national innovation systems (NIS) is understood quite narrowly – these are innovations in hi-tech industries, but in Europe they look at it more broadly – these are innovations in any industry, including process improvement, etc. Researchers from Europe are especially interested in the effects of the spillover of knowledge and innovation from TNCs to other sectors and the role of national infrastructure. TNCs are unique knowledge creating organizations because of their structural position spanning diverse institutional contexts and their ability to transfer knowledge across national borders.

According to the 2022 Global Innovation Index report, the world's most innovative economies are Switzerland, the United States of America, Sweden, the United Kingdom and the Netherlands, with China close to the top ten. Other emerging market economies continue to demonstrate strong performance [3].

TNCs have sought to develop external network ties with the local scientific communities in order to tap into the local scientific knowledge base.

Author analyzed the level of innovative potential of developing countries (host countries-partners of TNCs), where TNCs from European countries and the USA have located their production facilities (table 1).

Table 2

Knowledge and technology outputs, 2022 [3]

Country	Knowledge creation		Knowledge impact		Knowledge diffusion	
	Score/ Value	Rank	Score/ Value	Rank	Score/ Value	Rank
Republic of Korea	61,6	5	45	22	48,8	19
China	71,9	3	65,5	3	47,2	20
Slovenia	42,3	22	29,6	58	41,4	32
Malaysia	14,5	66	37,7	36	44,3	24
India	23,6	44	53,3	9	41,1	29
Poland	25,3	39	34,5	43	35	40
Thailand	24,2	42	33,9	45	35,8	38
Romania	13,5	68	39,6	31	46,9	21
Brazil	21,2	53	37,4	37	22	67
Ukraine	32,9	28	25,3	71	31,8	48
Mexico	11,2	78	31,3	51	31,5	51
South Africa	23,5	45	31,9	49	19,8	75
Indonesia	9,5	82	41,4	28	20,2	73
Tunisia	26,2	37	26,7	65	28,4	54
Egypt	22,2	73	31,1	53	16,2	90

Recent research has emphasized the learning and knowledge creating aspects of foreign direct investment and overseas subsidiaries as sources of competitive advantage.

Especially in the high-technology sectors, one notable recent trend has been the extension of firms' research and development (R&D) activities on a global scale to augment their knowledge base. It has been noted that one of the main changes in the innovation strategies of TNCs since the early 1990s has been the move towards 'international learning companies', and the utilization of overseas laboratories as 'knowledge incubators' to generate new scientific knowledge that can underpin their technological distinctiveness.

As a consequence of globalization of innovation processes, TNCs subsidiaries also have economic advantages by gaining access to local "knowledge pools" and thus enriching their innovation process. Over the past ten years, the innovative potential of the countries discussed above has grown significantly.

Author consider in more detail the component of the innovative potential "Knowledge and technology outputs" of the countries where TNCs in Europe and the USA have relocated their production facilities (table 2).

TNCs pursue global knowledge sourcing in search of emerging new scientific knowledge and technological capabilities, a large part of which is embedded in local innovation networks and scientific human resources.

TNCs face a distributed organisational learning problem in general but the problem becomes especially complex in the case of innovation activities which involve the collaborative creation and sharing of tacit knowledge.

When TNCs seek to tap into locally embedded scientific knowledge and capabilities, they have to develop close external network relationships with a variety of local actors and manage the interaction between innovation communities in the home country and the host region [1].

The global dispersion of innovations has increasingly been driven by firms' needs to acquire new knowledge and capabilities, and gain access to unique human resources.

TNCs have to manage the interaction between the innovation communities at home and those in the host country The ability of a parent multinational to access local sources of knowledge depends on its integration into the host country context and the social networks of technological innovation. Proximity between home-based institutions and the host context may facilitate the local embeddedness of TNCs and their ability to harness local knowledge.

Advantage of cooperation is reinforced when TNCs locate their innovation units in an environment where the institutions governing knowledge production are congruent with those at host country.

The duration of innovation operation overseas is another factor that could affect firms' learning capabilities, given that international experience is a primary source of organizational learning in TNCs [1].

Home-based institutions influence TNCs' transnational social spaces for learning, and their abilities to use different types of situated practice and forms of social interaction to support tacit knowing across organizational and societal boundaries. It shows that the divergent ways of solving the tacit knowledge problem are associated with different modes of innovation organization, knowledge processes and learning orientations.

The sharing and transfer of seemingly universal scientific and technical knowledge also requires tacit knowing.

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ASSESSMENT OF INVESTMENT AND INNOVATION ACTIVITY OF HIGH-TECH TNCs

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The work is devoted to the analysis of modern trends in the investment and innovation activity of high-tech TNCs. The key factors of the intensive development of TNCs in the global economy are outlined. It was established that innovations play an ever-increasing role in the competitive advantages of TNCs in modern conditions. The results and dynamics of investments in R&D of leading TNCs are analyzed. It is emphasized that the increase in international competition in the conditions of growing techno-globalism determines the need to improve the innovative activity of TNCs through its internationalization. The peculiarities of the creation and functioning of international strategic alliances in the innovation sphere are considered.

The rapid development of TNCs falls on the III stage of transnationalization of world economic processes (second half of the 19th – 21st centuries). Modern TNCs of the III and IV generations have concentrated more than half of world industrial production and about 2/3 of world trade flows. TNCs control more than ¾ of the world market of grains, coffee and tea, iron ore, copper, and hydrocarbons. The amount of revenue from the sale of products of individual TNCs exceeds the national budgets of entire countries and regions (table 1).

The intensive development of TNCs at the current stage is due to the effective functioning of such business entities within the framework of the global economy, which is associated with the following key factors (table 2):

The ICT services sector is led by the US whose R&D in this sector has more than tripled over the last 10 years. China is in second place but with less than one quarter of the US's R&D, even though its R&D in this sector has increased by almost ten times over the decade. The EU has just over half of the R&D of China with Japan in fourth place with around two-thirds of EU R&D.

The biotech sector is also led by the US with over two-and-a-half times the R&D of the EU in second place. Japan is in third place with less than half of the EU's R&D and China follows with around half the R&D of Japan. The US is particularly strong in biotechnology and several US pharmaceutical companies have enhanced their pipelines of new drugs by acquiring biotech companies.

The ICT producers' sector is again led by the US with more than twice the R&D of China. The EU has around two-thirds of China's R&D in this sector with Japan around two-thirds of the EU's.

The automotive sector is led by the EU with nearly twice the R&D of Japan. The US has around two-thirds the R&D of Japan with China following with about half of Japan's R&D.

Table 1

Top 10 TNCs according to sales revenue, profits and assets in 2022, mln (compiled by the author according to [2])

№	Company	Country	Industry	Revenuers	Profits	Assets
1	Wal-Mart Store, Inc	USA	General Merchandise	572,754	13,673	244,860
2	Saudi Aramco	Saudi Arabia	Mining, Crude-Oil Production	400,399	105,369	576,134
3	State Grid	China	Utilities	460,617	7,138	735,430
4	Amazon	USA	Internet Services and Retailing	469,822	33,364	420,549
5	China National Petroleum	China	Petroleum Refining	411,69	9,638	660,008
6	Sinopec Group	China	Petroleum Refining	401,314	8,316	380,675
7	Exxon Mobil	USA	Petroleum Refining	285,640	23,040	338,923
8	Apple	USA	Computers, Office Equipment	365,817	94,680	351,002
9	Shell	USA	Petroleum Refining	272,657	20,101	404,379
10	United Health Group	USA	Health Care: Insurance and Managed Care	287,597	17,285	212,206

Table 2

№	Name of the company	Country	Industry	RD		Net sales		Employments	
				euro million	1 year growth rate (%)	euro million	1 year growth rate (%)	N of employees	1 year growth rate (%)
1	Alphabet	USA	ICT service	27866,8	14,5	227273,9	41,2	156500	15,7
2	Meta	USA	ICT service	21768,5	33,7	104122,3	37,2	71970	22,8
3	Microsoft	USA	ICT service	21642,2	18,3	175057,3	18	221000	22,1
4	Hiawei Investment holding	China	ICT service	19533,8	0,7	121786,3	-1,4	195000	-1
5	Apple	USA	ICT service	19348,4	16,9	322988,6	33,3	154000	4,8
6	Volkswagen	DE	Automobiles other transport	15583	12,2	250200	12,3	643297	2,9
7	Intel	USA	ICT service	13416,6	12,1	69772,2	1,5	121100	9,5
8	Johnson and Johnson	USA	Health Industries	12991	21	82796,2	13,6	141700	5,4
9	Phizer	USA	Health Industries	10239,3	20,6	71771,1	95,2	79000	0,6
10	Bristol-Myers SQUIBB	USA	Health Industries	9283,1	1,9	40954,4	9,1	32200	6,4

Overall, the EU companies lead the automotive sector. They have much larger R&D investment, larger sales, larger profitability and more employees than their competitors. There are 9 EU companies among the top 20 companies by R&D investment, and 4 EU companies among the top 9 companies by EV sales.

15 different companies appear in the top 10 of both the 2012 and the 2022 years. At first sight, this shows a rather high turnover, with 5 new companies in the top 10 in 2022. However, apart from Facebook/Meta the same 9 companies have populated the top 10 since 2017 [1].

Furthermore, their investment share of the 2 500 companies is rather stable and has even increased slightly. This points to a stability in R&D investments of the key R&D investors. Their total R&D investment was EUR182.2 billion in 2012, which represents a compound average growth rate of 9.3% since 2012, higher than that was 7.2%. The highest compound average growth rate was registered by Facebook/Meta (52%), followed by Apple (25%), Huawei (20%), and Alphabet (20%). Acquisitions made by these companies played a significant role in this impressive growth. The other companies of the top 10 had single digit R&D growth.

Facebook (Meta), Apple and Huawei have seen the greatest improvements of their rankings during the assessed period, with Meta encountering the sharpest increase in its ranking, starting with a jump from the 297th position to 105 in the 2013 and to rank 55 in 2015 from the 101st rank of the previous year.

TNCs of the IV generation participate in the creation of inter-corporate technological alliances to conduct joint scientific research and knowledge-intensive production, more actively use the opportunities of global scientific and technical outsourcing.

The creation of inter-corporate strategic alliances allows TNCs not only to maintain competitiveness, but also leads to the emergence of new regional clusters of economic cooperation in the global economy. The modern form of such transnational cooperation is the creation of flexible business networks, the members of which closely cooperate, while remaining independent and self-sufficient in the process of their financial and economic activities.

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