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Strategic Innovation as a Factor of Adaptation of National Economies to the Development of Global Value Chains

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Abstract: In age of sustainable development, strategic innovations have become the most important factor in the adaptation of national economies to dynamic global changes, encompassing trade and economic relations between the leading and developing countries of the World. At the same time, the task of this study was to reveal the complex and contradictory role of strategic innovations in the development of national economies against the background of the transformation of global value chains (GVCs). Main methods for solving the problem were empirical methods of comparative and structural analysis, as well as econometrics. The study analyzed 44 countries classified by the World Bank in the group of countries with per capita incomes below and above the average, as well as with high income. Results of the calculations made it possible to establish a highly differentiated relationship between the share of products manufactured by foreign companies operating in the host countries, on the one hand, and indicators of the dynamics of foreign direct investment (the number of researchers engaged in R&D, the number of technical specialists involved in research and development (R&D), the cost of research and development in the territory of the host countries), on the other hand. This made it possible to determine the role of strategic innovation in the adaptation of national economies. The established dependencies expand the understanding of the role of strategic innovations in the formation and further development of global value chains and their significance in evolution: from process and product innovations of individual companies to the formation of global innovation ecosystems.

Keywords: sustainable development; strategic innovation; adaptation factors; national economy; global value chains; transformation processes; sustainable development

1. Introduction

Global changes that have been taking place in recent decades have intensified the processes of adaptation of open national economies to increased competition in international commodity markets. In this regard, strategic innovations began to play a system-forming role in the formation of global value chains that ensure the free movement of capital and goods between countries around the world and exerting both stabilizing and destabilizing effects on their development. Consequently, the most important task of regional governments in age of sustainable development is the provision of the harmonious integration

of global value chains into the existing system of economic, social, political and cultural relations existing within national economies. Practice has shown that this leads to both positive and negative consequences. On the one hand, national enterprises acquire access to new technologies for a long time, guaranteed supplies of raw materials and a market for their products, and on the other hand, to the distribution of income from their activities is often carried out in the interests of companies with jurisdiction in other countries. Therefore, national governments are forced to implement economic policies taking into account the complex configuration of trade and economic relations of national companies included in international global value chains, embedding national innovation systems into global ecosystems. The results of the implementation of such a policy are highly differentiated and depend on a wide range of factors that determine the scale and content of innovation processes. All the above, in our opinion, necessitates a scientifically grounded theoretical understanding of these dynamically developing processes at the global and national levels on the basis of a comprehensive analysis of practice.

The hypothesis of this study is that strategic innovation is one of the key factors in the adaptation of national economies to the development of global value chains in age of sustainable development. Thus, the purpose of this work is assessing the impact of strategic innovations in the adaptation of national economies to the transformation of global value chains against the background of dynamic changes in the era of sustainable development.

2. Theoretical Review

2.1. Theoretical and Methodological Approaches to the Study of Strategic Innovation as a Factor of Adaptation of National Economies to the Transformation of Global Value Chains

The problem of the role and significance of innovations in the formation and development of global value chains is actively discussed in international studies only in recent decades. It should be noted that the overwhelming majority of publications are targeted at China and developing countries, which, in our opinion, adequately reflect the general trend of current trends in the development of global value chains. At the same time, strategic innovations in global value chains are characterized by a wide variety, including by type, geography, industries, importance, etc. [1]. It is generally recognized that innovation is the most important factor in the competitive advantage not only of individual companies, but also of global chains as a whole. [2]. Therefore, global business strategies are at the heart of the innovation management of leading companies in age of sustainable development [3].

The formation of global value chains has led to transformation, on the one hand, and to an increase in the role of traditional types of innovations, including process, operational, product, social, joint, etc. on the other. So, process or product innovations by sources of financing generally become joint, the essence of which is to unite the supplier and the consumer in the development and implementation of one or a set of innovations. At the same time, the supplier is responsible for the development and implementation of technological innovations, and the manufacturer is responsible for product innovations. This form of interaction between chain participants ensures their innovative leadership [4]. Using the capabilities of the Internet allows, when implementing operational innovations, to ensure the operational coordination of participants in the supply chain, the efficiency of their implementation and savings in transaction costs [5]. Similar in content to operational innovations as part of value chains are dynamic innovations that use indirect connection between the links of the chain and new pricing principles with the participation of all parties [6].

In the last decade environmental innovations have gained a particular importance in the development and expansion of the sphere of influence of global value chains in age of sustainable development. They have become the most important factor in ensuring competitiveness and the formation of competitive advantages [7]. At the same time, environmental competitiveness is becoming a major factor of innovation activities and cooperation in industries integrated into global value chains, subject to a green development strategy.

Thus, participants in global value chains, responding to environmental requirements, are actively working in the field of environmental innovations, attracting green investments

from partners, consumers, as well as specialized environmental funds. These processes are stimulated, and the growing competition leads to the further expansion of cooperation in the development and implementation of green innovations in global supply chains [8]. In order to integrate the advantages of individual companies and jointly solve environmental problems within the framework of green value chains, collaborative innovations have been developing [9], which is one of the types of joint innovations. It should be noted that in recent years, there has been a gradual transition from the concept of eco-innovation to eco-innovation models that cover a whole range of business processes performed by different participants in the global chain [10,11]. As practice shows, a large number of participants are involved in their implementation, and "green" energy becomes the beginning of the formation of chains [12]. Therefore, green (environmental) innovations have become one of the most important areas for ensuring sustainable development of global value chains and reducing the burden on the environment [13]. This naturally led to the fusion of sustainable development theory, enterprise theory and the theory of strategic innovation [14,15]. One can observe the integration of approaches to the management of process innovation, Industry 4.0., lean manufacturing and green supply chains, which leads to the development of various forms of cooperation between suppliers and consumers within the framework of environmental programs, which has a positive effect on production, economic and environmental performance [16].

In addition, the literature analyzes green innovation in global value chains in the context of equity, inclusion, knowledge sharing and contribution to sustainable development goals. As practice shows, the perception of fairness promotes the involvement of supply chain participants in the development and implementation of green innovations, and the involvement creates favorable conditions for the exchange of experience and knowledge [17]. In the context of cooperation in the development and practical implementation of measures in the field of environmental preservation, the concept of co-innovation has been introduced, reflecting the mechanism of interaction between the developer of an innovation and its consumer-the manufacturer of a particular product [18]. Living laboratories and Do-It-Yourself laboratories are becoming elements of global innovation systems, acting as a kind of knowledge broker. They are research organizations within the ecosystem [19]. Eco-innovation is associated with sustainable social innovation aimed at solving social and environmental problems [20], thus, green innovation strategies become an effective tool for increasing the competitiveness of products and the sustainability of production systems, and the factors influencing the implementation of eco-innovation in value chains have become an independent subject of analysis [21].

Innovations play the most important role in the resource sectors of developing countries' national economies in the sphere of the influence of the activities of natural resources companies-users, which are links in global value chains, on the state of the environment and public health [22,23]. In recent years, low-carbon technological innovation has become a major driver of changes in global value chains in many countries in the manufacturing industry. The incentive for their introduction is modern instruments of state regulation [24]. At the same time, they formed the basis of strategies for the development of innovations, taking into account the risks of their implementation [25].

Sustainable social innovation is one of the areas for implementing innovation in global value chains in age of sustainable development. Their theoretical basis is the theory of social identity, the theory of change management and the theory of social exchange. When describing social innovation in most publications, the following main aspects are highlighted: first, the cooperation of companies in the development and implementation of social innovations, including the joint creation of a system of social values, as well as their role and contribution to the sustainable development of ecosystems [20]; second, taking into account the results of the implementation of social innovations in assessing the ongoing social changes and the results of the functioning of global value chains [26–28]; third, the formation of social partnership between all participants in innovation processes,

including researchers introducing innovations of employees of enterprises, managers and other stakeholders [29].

Open innovations replace simple innovations in individual enterprises in the context of global chains, which are the basis for the implementation of radical or breakthrough innovations, involving the introduction of profound changes in the applied technologies and production structure, the interaction of companies, products, as well as in strategic reconfiguration, which determine the prospect of the dynamic capabilities of networks [30]. In this regard, most researchers viewed open innovation (as opposed to operational innovation) as a strategic advantage [28].

The changes taking place in almost all sectors of the economy of most countries in the last decade require multidimensional innovations implemented in the areas of product output, technological processes, organizational structures and decision-makers throughout the supply chain, as well as partners and other stakeholders in society [31]. At the same time, the open nature of innovation is traditionally considered in the context of accelerating the technological progress of partner companies through the transfer of new technologies to them in order to improve the efficiency of the functioning and competitiveness of the chains as a whole [32,33].

Thus, open innovation has become the most important area of application of innovative practices and the subsequent formation of innovation chains as elements of national and regional innovation systems that ensure the exchange of knowledge, experience, research results, new technologies, as well as the basis for attracting investments in the modernization of production and international cooperation [34,35]. At the same time, national and regional innovation systems of the leading sectors of national economies are embedded in global innovation systems, where networking is playing an increasingly important role [36–39].

In the last decade, many of the processes taking place in global value chains could no longer be explained by the theory of open innovation [40]. On the other hand, the development of the theory of co-evolution of business systems has led to a transformation of values and a reconceptualization of the processes of innovative development of global value chains in the context of the role of strategic priorities in age of sustainable development. At the same time, a lack of theoretical and methodological study of the processes of forming innovative business networks was revealed [35,41]. All this became the prerequisites for the integration of theoretical concepts of open innovation, innovation systems and regional development, which made it possible to propose the concept of national, and later regional and global ecosystems. Against this background, a number of researchers, solving this problem, proposed a paradigm of holistic innovations, which are based on their four main types: “strategic”, “total”, “open” and “joint”, organically interconnected with the HI spiral and reflecting the peculiarities of national culture [42].

Within the framework of new approaches, transnational corporations are actively shaping their innovative environment for more effective use of external knowledge and experience, joint use of state infrastructure and fundraising [40]. As a result, in many large companies in recent years, strategies have significantly changed, which today are focused on the active formation of their own innovative environment for the effective use of interorganizational knowledge, personnel abilities, resources, etc. [40,43]. At the same time, the study of sustainable development, based on the analysis of human resource management practices and Industry 4.0 (I40), revealed promising directions for improving the strategic management of industry [44]. Moreover, a number of researchers note an emerging transition from regional innovation systems to global innovation centers, which is facilitated by many factors of the macro, meso and micro levels. The elements of new structures are: joint innovation, collective investment, mutual trust management of the participants in the chain, training and exchange of experience and knowledge [45,46].

Thus, the spatial development of regional innovation chains in age of sustainable development has created conditions for the formation of global innovation ecosystems based on models of efficient resource allocation, technological integration and knowledge

transfer at the national and federal levels [47]. Innovations are embedded in global value chains and at the same time are the result of their development, linking both suppliers and consumers of goods and centers of knowledge distant from each other. Global value chains are becoming the basis for the formation of global innovation networks and ecosystems that significantly reduce transaction costs [48].

The massive implementation of interconnected innovations implemented at different links of global value chains has led to the formation of open innovation platforms [49] that provide increased productivity, efficiency of logistics and transport, reduction and optimal distribution of costs between participants in value chains [50]. At the same time, innovative platforms became the basis for the further development of innovations and the formation of innovative networks and systems [51], requiring new approaches to their management, which was a prerequisite for the development of network management [52]. The creation of multilevel innovation platforms, firstly, sharply increased the flow of new knowledge exchanged between the participants in the chains [53]; secondly, it stimulated the development and implementation of innovations; thirdly, it increased the efficiency and productivity of their functioning [54]. Against this background, the role and the need to improve, on the one hand, the general corporate culture and corporate values has increased [55]; on the other hand, training knowledge and communication management systems [56]. All of this has contributed to the formation of an architecture for sustainable management of global value chains, ensuring alignment of the innovation platform and the business ecosystem [57,58].

Thus, the evolution of the implementation of innovations in global value chains has gone through several stages of transition from operational innovation implemented in individual enterprises to open innovation, innovation models [43] and innovation networks, and then to innovation platforms and global innovation ecosystems.

2.2. Factors Influencing the Implementation of Innovation in Global Value Chains

In the literature dedicated to the study of global value chains in age of sustainable development, a wide range of works is devoted to the analysis of the influence of various factors, which are classified according to certain criteria. The main feature of these studies is the identification of groups of factors that influence the implementation of innovations not in an individual company, but in a chain of interconnected companies. As practice has shown, network interaction of firms has a positive effect on the diffusion of innovations, which is most clearly manifested in conditions of scarcity of resources [12,59].

Firstly, cooperation and involvement of various stakeholders, as well as the creation of research laboratories based on universities and research institutes, are mentioned as the most important factors of sustainable innovation in value chains on the example of the manufacturing industry. Through this, sustainable innovation creates the social, environmental and economic values necessary to achieve long-term sustainability in the supply chain [60,61].

Secondly, the following group of factors influencing the implementation of sustainable innovation include cooperation, strategic orientation, culture and politics [21]. Added to these are knowledge and creativity, closely linked by their respective ecosystems and environment [62]. This group, in our opinion, can also be attributed to the trust manifested in inter-firm and multi-level cooperation and investments of all interested parties [63–65]. It should be noted that, according to many authors, trust in global value chains is closely related to the competitiveness of companies through joint innovation, training and knowledge exchange aimed at reducing uncertainty and risks in the field of interaction of partners within the chain [66–68].

Thirdly, research has shown that supplier innovation has a positive effect on information sharing and value chain flexibility in age of sustainable development [69].

Fourthly, a special group is made up of factors influencing the management and communication processes in value chains, as well as their configuration. These include the environment, communication networks and the main actors [52]. In the same regard, digital

globalization is becoming a key factor in the development of global value chains and the implementation of innovations, linking countries, companies and employees of companies, creating a new basis for the development of global ecosystems and digital platforms [23,70,71]. In addition, it is noted that information technologies increase the efficiency of the search for innovations, change the outdated methods of their implementation and transfer [70] and also provide super-transparency of the situation in the markets [72]. At the same time, participants in global value chains define their own ecosystem strategies for implementing digital technological innovations [23].

The fifth group of factors can be attributed to the proactive and innovative nature of the economic activity of small and medium-sized enterprises, which are built into the functioning of the global value chain [48,73]. In this regard, the positive role of entrepreneurial orientation is noted in terms of stimulating innovation, training and flexibility of the behavior of firms when they embed technological and logistics chains for creating added value [73,74], as well as generating new ideas, developing new products and bringing them to the market [75]. In addition, the large role of small and medium-sized businesses in the development of breakthrough innovations, which are a strategic means of achieving sustainable growth and competitiveness [76], as well as their dynamic capabilities for knowledge management, allowing, in conditions of limited resources, to adapt to science-intensive rapidly developing global value chains, are noted [77]. Thus, entrepreneurship is mainly seen, on the one hand, as an important element of strategic orientation and strategic flexibility of participants in the field of innovation, on the other hand, as a source of strategic and breakthrough innovations that are introduced into the activities of the global chain, ensuring its competitiveness.

The following are usually named as barriers to the implementation of strategic innovations in global value chains in age of sustainable development: the qualifications of company personnel, lack of research and innovation potential, high initial investments, psychological fear and lack of flexibility in management thinking, as well as the complexity of the process generating innovations [78]. In addition, cultural diversity is a factor that has a negative impact on the implementation of strategies for global value chains, which plays a positive role in research alliances and negative in production. [79]. In addition, environmental uncertainty is cited as a major constraint on innovation and collaborative learning, according to a survey of Taiwanese e-vendor executives [80].

Currently the national value chains of many countries are undergoing a new round of large-scale restructuring. This is happening against the background of increasing differentiation in the participation of industries in different countries in these processes and the emergence of new players [81]. This is facilitated, on the one hand, by the organizational decomposition of the innovation process, and on the other, by the growth of innovative potential in dynamically developing Brazil, India, China, etc. [54]. The main factors in the transformation of global value chains in recent years have been the introduction of digital technologies [82,83], "green innovations" [9,84], effective cooperation, the adoption of sustainable strategies that have significantly influenced the direction and nature of the ongoing changes in business systems and the formation of modern ecosystems.

The introduction of digital technologies naturally leads to the transformation of traditional forms of business organization by integrating into new online and offline models, which leads to its strategic renewal, covering all areas of their activities [85] and all links of value chains [71]. Thus, digital transformation tools make a great contribution to the processes of generation, exchange and management of knowledge, the formation of new values and the creation of added value.

The role of the environmental factor is traditionally considered in the context of the management of green supply chains in various sectors of the economy of states in age of sustainable development. The peculiarities of these processes are, firstly, the coverage of all links with green innovations; secondly, the release of new products and services, taking into account the established requirements and expectations of the consumer; third, the use of environmentally friendly technologies and qualified personnel of companies; fourth,

reliance on the constructive interaction of participants with government agencies. All this should form the basis of the developed innovative strategies [86,87]. In addition, green innovation is considered in relation to lean manufacturing practices and process innovation in the context of ensuring the efficiency of green supply chains [88].

In addition, it should be noted that the ongoing transformational changes require both cooperation within global value chains and appropriate actions on the part of consumers, the population, decisions of government agencies [89]. The impact of innovations on global networks is reciprocal; therefore, in the literature, one of the goals of restructuring value chains is the dissemination of knowledge and sustainable innovations, which should subsequently ensure their diffusion throughout the entire network, network cooperation of its participants and transparency [90].

The transformation processes of innovation systems required their deep understanding and building of appropriate missions and strategies, identification of driving forces and existing barriers [91]. Sustainable strategies implemented in the management of global value chains are receiving increasing attention. At the same time, technological, product, organizational and other types of innovations based on the allocation of resources, joint investments and cooperation contribute to the achievement of economic, social and environmental results [92].

2.3. Theoretical and Institutional Aspects of the Study of Adaptation of National Economies to the Development of Global Value Chains

The problems of adapting national economies to changing conditions are traditionally considered on the examples of developing countries, which are most affected by the expansion of global value chains. In connection with the scale of the social and economic consequences of embedding national sectors of the economy in vertically integrated ties formed by transnational companies, the term transformational adaptation appeared in the literature, reflecting, on the one hand, the importance of economic hegemony, and on the other, its social aspects. The content of the concept of transformational adaptation is related; with ongoing irreversible fundamental changes; with economic, socio-political, cultural, institutional processes that cause vulnerability and risks for national economies; their social stability and adaptive capabilities. In this regard, the dynamic opportunities for adaptation and implementation of innovations in a transforming economy are highlighted, which include, first, adaptive dynamic capabilities, reflecting the types, methods and scales of natural resources development; second, the dynamic opportunities for innovation associated with the search, development, testing and implementation of innovations, as well as their risks and financing. The results of adaptation of the national economy to changing conditions also depend on the implementation of these dynamic capabilities.

Against this background, transformational leaders stand out, implementing a wide range of innovations both in internal integration, including the sphere of management, production technologies, manufactured products and in external integration, including in relationships with partners. This made it possible to determine the forms and signs of leadership behavior [93]. It should be noted that, according to a number of researchers, economic modernization of value chains is critical for developing countries, since it increases the efficiency of interaction between suppliers and consumers, employment and economic growth [94].

According to many authors, the key role is played by existing institutions and their effectiveness, that form the institutional framework in a developing economy; in narrow terms, they establish the rules that the exploitation of local natural resources will be carried out in the interests of the national economy and the population of the country. Therefore, the focus of the policy pursued by the national government should be directed to economic growth and social welfare of the population. The condition for solving this problem is to ensure transparency of the functioning of the raw materials sector of the national economy, the distribution of income from their activities. At the same time, it will reduce opportunities for corruption and ensure open dialogue between civil society, the national government, extractive companies and other stakeholders. Thus, the conditions

for adaptive embedding of the raw materials and processing sectors of the economy, taking into account national interests in global value chains and the ecosystems that form them, are possible under the following conditions: firstly, the formation of an effective institutional environment, its adequate perception by all parties, including national governments, populations and participants in global value chains; secondly, embedding the national innovation system into the global innovation ecosystem.

As a consequence of the above aspects government policy is traditionally based on the sectoral principle and is aimed at protecting national market sectors and manufacturers. In the context of the dynamic spread of global value chains, the solution of these problems is significantly complicated, since national companies and the distribution of profits are embedded in global processes, no longer controlled by national governments. In this regard, the features of state policy are as follows.

Firstly, companies in global value chains, in essence, being conductors of the interests of key links in value chains, seek to influence the policies implemented by national governments in order to create an enabling environment for themselves to carry out research and development in the interests of the chain as a whole [40].

Secondly, the participants in the chains take into account social challenges in the context of a new wave, the so-called systemic innovation policy 3.0, which presupposes a system-wide transformation of the interaction of the interests of actors, networks and institutions [95].

Thirdly, the role of the state lies in the participation of national governments in the formation of a global innovation system in the formation of a multi-level strategic structure that ensures the development of international technological cooperation in the field of global value chains.

Fourthly, the government should comprehensively represent the entire volume of the consequences of the expansion of global production networks in the country, which have a diverse impact on the national economy. This requires a careful policy of regional development [96].

Fifthly, many countries in recent years are moving towards active industrial policies. In this regard, the development and implementation of technological innovations in the areas of energy conservation and emission reduction, especially in dynamically developing industries, become the targets. As practice has shown, technological innovations have a significant stimulating effect on the efficiency of energy use in industries strategically important for the national economy, therefore, a combination of restrictive and stimulating measures of state policy in this area is necessary [97].

Sixthly, an important direction in the implementation of industrial policy in developing countries is resource industrialization, which provides a close strategic relationship between the strategies of leading companies related to the involvement of local natural resources and the socio-economic development of regions. At the same time, the benefit of the state depends on the place in the global value chain from the use of local resources, on the one hand and on the consistency of the national industrial policy with the strategies of specific firms-users of natural resources, which are links in global chains, on the other [98]. Moreover, as practice shows, firms in developing countries themselves initiate modernization processes provoked by ineffective government policies [99].

In conclusion, it should be noted that global supply chains do not eliminate competition, but rather, on the contrary, form the preconditions for the phenomenon of hypercompetition, which requires participants to be innovative and strategically flexible in behavior and interaction with partners. That form competitive advantages [100,101]. State policy is a sphere of implementation of innovations in the literature is examined from two sides: from developed countries, which implement innovations in the activities of participants in global value-added networks and receiving income from this; on the part of developing countries, which are mainly suppliers of raw materials, and technologically dependent on the former.

3. Materials and Methods

To solve the problem, some empirical methods were used. So the key research methods were selected: content analysis of scientific articles published in Russian and foreign libraries (1st stage of the methodology); analysis and generalization of research by domestic and foreign scientists, as well as international organizations (2nd stage); descriptive analysis, which allows to make a retrospective and complex analysis of the main trends in the dynamics of the processes and phenomena considered in the study (stage 3); econometric (correlation) analysis, which allows to establish the degree and nature of the interdependence of the analyzed processes and phenomena (4th stage); the method of comparative analysis, that is used for conducting a comprehensive assessment of complex systems of the same type by their nature-regions of the World (5th stage); comparative analytical analysis, which allows to formulate the main conclusions of the study, revealing some patterns of development of the object considered in the work (6th stage).

The informational basis of this study was the data characterizing the ongoing global changes, the adaptation processes of the national economies of developing countries and the implementation of strategic innovations, presented in the official reviews and databases for the period from 2005 to 2016 of the World Bank, OECD, EAEU etc.

The analytical sources of the research were databases: AMNE (the Analytical AMNE database (https://www.oecd.org/sti/ind/analytical-amne-database.htm, accessed on 4 June 2021) and DataBank The World Bank (https://databank.worldbank.org/home, accessed on 15 May 2021).

The object of the research-calculations was carried out for the 56 national economies with different levels of gross national income per capita, detailed analysis is limited to four types of economic activities, which, according to a number of experts, are mostly included in the GVC, namely, production: chemical and pharmaceutical products; computer, electronic and optical products; electrical equipment; cars, trailers and semi-trailers.

The study included six successively performed stages (Figure 1).

At the first stage the types of strategic innovations based on the analysis and generalization of practice were identified as well as their role in the development of global value chains in various countries of the world was determined, a theoretical and methodological approach to the study of the role of strategic innovations in national economies in the context of transformation of global chains of cost creation was substantiated. At the same time, special attention is paid to identifying factors, government policy and the stages of evolution of innovation ecosystems from process and product innovations of individual companies to the formation of global innovation ecosystems.

At the second stage, based on the results of the analysis and generalization of the works of domestic and foreign scientists, as well as experts of international organizations, a list of industries that are mostly included in the GVC is established. An assessment of the mutual impact of strategic innovations and the transformation of global value chains in the economy, as well as by the types of economic activities in the context of four industries (according to the international standard industrial classification of all types of economic activity-ISIC Rev 4.) has been held, which are to the greatest extent included in the GVC according to the report of the World Bank experts: chemical and pharmaceutical products (C20T21); computer, electronic and optical products (C26); electrical equipment (C27); automobiles, trailers and semi-trailers (C29) [102].

Figure 1. Research methodology for the phenomenon of strategic innovation as a factor in the adaptation of national economies to the transformation of global value chains (compiled by the authors).

To assess the degree of interdependence between the level of involvement of national economies in GVCs and the dynamics of the implementation of strategic innovations, a set of indicators was proposed. Thus, the level of involvement of national economies in the GVC was determined by us as the share of products manufactured by foreign companies in the total volume of products manufactured in the country. In turn, the indicators describing the dynamics of the development and implementation of strategic innovations of individual states were selected: first, the net inflow of foreign direct investment into the national economy; second, the volume (as a percentage of GDP) of gross domestic expenditure on research and development (R&D), which includes both capital and operating costs in four main sectors: public, higher education, commercial and non-profit organizations; third, the amount of grant funding for the transfer of technical and managerial skills or technologies to build overall national capacity without reference to any specific investment projects, as well as the amount of investment-related technical cooperation grants that are provided to strengthen the capacity to implement specific investment projects. projects (grants for technical cooperation); fourth, the number of researchers engaged in research and development (R&D); fifth, the number of technicians involved in research and development (R&D). The choice of these indicators was determined by the following conditions: their adequate reflection of the selected factors, as well as the availability of complete and systematic data on indicators in open official sources for a long period of time. These indicators are tradition-

ally used by the World Bank DataBank (https://databank.worldbank.org/home - accessed on 15 May 2021) to assess innovation and investment processes in national economies.

At the third stage, based on the statistics of the World Bank and OECD, the following were determined (for the economy as a whole and in the context of each selected type of economic activity): firstly, the total volume and share of products produced by domestic and foreign companies for the period from 2005 to 2016 (period available for analysis on the official website of the OECD) in 56 analyzed countries and one special administrative region-Hong Kong; second, the dynamics of volumes: net inflow of FDI into the national economy; gross domestic expenditure on research and development (R&D); grant funding for the transfer of technical and managerial skills or technologies; the number of researchers engaged in research and development (R&D); number of technicians involved in research and development (R&D).

At the fourth stage, using the method of correlation analysis of time series, the degree and nature of the interdependence between the growth rate of the share of products produced by foreign companies on the territory of host countries and indicators numerically characterizing the dynamics of the development and implementation of strategic innovations in national economies of the countries considered in this work were established.

We considered a possibility of using the regression analysis method when formulating the hypothesis. However, we rejected this proposal due to the existing limitation of the available data, namely the length of the time series and the number of analyzed independent variables.

At the fifth stage, based on the generalization of the results of the fourth stage of the study on the identified groups of countries, the main trends and determinants of adaptation of national economies to the transformation of global value chains were identified through the management of development processes and the introduction of strategic innovations.

The results of the fifth stage were presented in the context of two groups of countries, identified by the World Bank, which are characterized by the level of their well-being: with high income (countries with GNI per capita of USD 12.5 thousand or more), as well as with per capita income. the population below (GNI per capita from 1.04 to 4.05 thousand US dollars) and above (GNI per capita from 4.05 to 12.54 thousand US dollars) of the average.

At the sixth stage, on the basis of the study, the main conclusions were drawn about the relationship and influence of strategic innovations on the adaptation of the national economies of the two groups of countries to the transformation of global value chains.

4. Results

Assessment of the Relationship between Global Value Chains and Strategic Innovation as a Factor of Adaptation of National Economies to the Transformation of GVCs

In a course of the research, in accordance with the set goal, we assessed a relationship between global value chains and strategic innovation as a factor in the adaptation of national economies to the transformation of GVCs.

The calculation was made for the countries that, according to the World Bank's calculations using the Atlas method (World Bank Country and Lending Groups 2021) are classified as "high-income" countries. These are countries with GNI per capita of USD 12.5 thousand or more. For these countries the Formula (1) was used.

Using Formula (1) made it possible to reveal the presence of a noticeable and high ($R > |0.5|$ on the Chaddock scale) degree of interdependence between the level of involvement of national economies in GVCs and the dynamics of the implementation of strategic innovations (Table 1-in general by branches of national economies and separately depending on types of economic activity).

$$\hat{R}(x_{n_i}, y) = \sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y}) / \sqrt{\sum_{i=1}^{n}(x_i - \overline{x})^2 \sum_{i=1}^{n}(y_i - \overline{y})^2} \quad (1)$$

H0: R = 0 (by the values of the t-criterion).

y-dynamics of the share of products manufactured by foreign companies in the total volume of products manufactured in the country;
x_{n_1}- dynamics of the net inflow of foreign direct investment into the national economy;
x_{n_2}- dynamics of volumes (as a percentage of GDP) of gross domestic expenditures on research and development (R&D)
x_{n_3}- dynamics of the volume of grant funding for the transfer of technical and managerial skills or technologies to build overall national capacity without reference to any specific investment projects, as well as the volume of investment-related technical cooperation grants that are provided to strengthen implementation capacity specific investment projects (technical cooperation grants);
x_{n_4}- dynamics of changes in the number of researchers engaged in research and development (R&D); fifth, the number of technicians involved in research and development (R&D).

The estimation of the statistical significance of the calculated correlation coefficient $\hat{R}(x_{n_i}, y)$ is carried out using the t-criteria calculated by the formula (2).

$$t_{\text{estimated}} = \hat{R}(x_{n_i}, y)\sqrt{n-2}/\sqrt{1-\hat{R}(x_{n_i}, y)^2} \quad (2)$$

where,

$n-2$-the number of degrees of freedom.

On condition $t_{\text{estimated}} > t_{\text{critical.}}$–the calculated correlation dependence is statistically significant.

The results of testing the statistical significance of the calculated correlation coefficient are presented in the Appendix A, Table A1.

The main calculations were performed on the whole for the national economies of 56 countries of the World with different levels of gross national income per capita, the detailed analysis is limited to four types of economic activity, which, according to a number of experts, are mostly included in GCC, namely the production of: chemical and pharmaceutical products; computer, electronic and optical products; electrical equipment; cars, trailers and semi-trailers.

The performed correlation analysis made it possible to establish a number of statistically significant relationships between, on the one hand, the share of products manufactured by foreign companies and operating in the host countries, on the other hand, indicators characterizing the dynamics of the development and implementation of strategic innovations.

The analysis performed for high-income countries (countries with GNI per capita of 12.5 thousand US dollars or more) allowed us to draw the following conclusions, presented in the context of indicators characterizing the dynamics of the implementation of strategic innovations.

The inflow of foreign direct investment. In seven countries with a high level of income per capita considered in this study (Iceland, Ireland, Belgium, Poland, Spain, Romania), there is a positive relationship between these indicators. At the same time, the revealed direct interdependence (unidirectional dynamics of both indicators over time) is characterized by the following national characteristics: for the countries-Spain and Belgium, a positive relationship was established between the analyzed indicators for the economy as a whole; for Spain, Romania, Poland, Ireland, Iceland was established a relationship between the indicators under consideration in the context of individual industries-computer, electronic and optical products–in Spain and Poland; chemical and pharmaceutical products-in Ireland; the automotive industry-in Iceland and Romania.

An inverse relationship ($R < -0.5$) between the analyzed indicators is observed in two countries-Switzerland and Israel. The economies of these countries are characterized by a decrease in the level of FDI with a positive growth in the volume of products manufactured by foreign companies in certain industries: for Israel this is the automotive industry, electrical equipment, computer, electronic and optical products; for Switzerland-chemical and pharmaceutical products.

The number of researchers involved in R&D. In the analyzed countries with a high level of per capita income (Singapore, Finland, Denmark, Lithuania, Estonia, Croatia, Malta), an inverse relationship has been established between these indicators. At the same time, in Singapore indirect connection was revealed in general for all sectors of the economy, while in other countries this relationship is typical for individual industries-chemical and pharmaceutical products-in Estonia; automotive industry-in Sweden and Malta. A direct link that determines the decline in the number of researchers engaged in R&D with an increase in the share of products of foreign companies is established in 8 high-income countries-Canada, Chile and Latvia. Of these, for individual industries under consideration, a direct link was established in-chemical and pharmaceutical products-in Sweden and Chile; computer, electronic and optical products in Iceland and Canada; production of electrical equipment-in Latvia, Romania, Chile.

At the same time, in the two countries considered in the study, different directions of the relationship between the considered indicators for the national economy as a whole and for individual industries were established. France-a direct relationship for the industries of computer, electronic and optical products, the production of electrical equipment and the automotive industry, the opposite-for the chemical and pharmaceutical industries; Sweden-direct link for the chemical and pharmaceutical industry, reverse link for the automotive, trailers and semi-trailers industry.

The number of technicians involved in research and development (R&D). In six high-income countries, the link under consideration was direct: Singapore-overall by economy; Chile and Slovakia-in the chemical and pharmaceutical industry; Iceland and Estonia-computer, electronic and optical products; Malta-electrical equipment manufacturing; Slovenia-chemical and pharmaceutical products, production of electrical equipment. In four countries of the group, the considered relationship is the opposite-Hong Kong-in the industries of electrical equipment; Ireland-cars, trailers and semi-trailers; Croatia-chemical and pharmaceutical products; Lithuania-electrical equipment.

The cost of research and development in the territory of the host countries. The reverse relationship exists in four countries-Canada, Hong Kong, Norway and Croatia, that is, with an increase in the share of products manufactured by foreign companies, the volume decreased (as a percentage of GDP) gross domestic expenditure on research and development (R&D). At the same time, in Belgium and Norway the results obtained are valid for the economy as a whole, Denmark and Hong Kong-the automotive industry, Canada-the computer, electronic and optical products, Croatia-the chemical and pharmaceutical industries, computer, electronic and optical products ... In two countries the considered connection was direct-Iceland and Chile. In Iceland the result is valid for economic activities-chemical and pharmaceutical products, as well as computer, electronic and optical products; Chile-computer, electronic and optical products.

Different directions of communication for the economy as a whole and for individual industries are revealed in three countries of the considered group of states: Japan-direct relationship for the economy as a whole, the reverse in the industry-chemical and pharmaceutical products; Cyprus-direct relationship in the industry of chemical and pharmaceutical products, reverse-computer, electronic and optical products; Estonia-direct in the industry of chemical and pharmaceutical products, reverse-in general for the sectors of the economy.

The dynamics of grant support for technical cooperation (technical cooperation grants designed to finance the transfer of technical and managerial skills or technologies to build overall national capacity without being tied to any specific investment projects, as well as investment-related technical cooperation subsidies which are provided to strengthen the capacity for the implementation of specific investment projects).

Table 1. Analytical data assessing the relationship between the level of involvement of national economies in GVCs and the dynamics of the implementation of strategic innovations in high-income countries.

Country	Direct Foreign Investments					Technical Cooperation Grants					Number of Researchers In R&D					Number of Equipment in R&D					Research and Development Expenditure (% of GDP)				
	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26
Japan																					0.6		−0.68		
Ireland					0.61												−0.59								
Denmark												−0.56										−0.52			
Singapore											−0.59					0.6									
Iceland		0.59											0.98		0.96					0.92			0.83		0.77
Norway																					−0.67				
Canada															0.58										−0.65
Hong Kong, China																				−0.72		−0.63			
Cyprus																							0.79		−0.59
Lithuania																			−0.82						
Malta												−0.67							0.76						
Belgium	0.62																								
Portugal															−0.85										
France												0.60	−0.69	0.74	0.77										
Sweden												−0.63	0.62												
Estonia													−0.61							0.59	0.59		−0.64		
Great Britain																									
Germany																									
Israel		−0.81		−0.83	−0.66																				
USA																									

Table 1. *Cont.*

Country	Direct Foreign Investments					Technical Cooperation Grants					Number of Researchers In R&D					Number of Equipment in R&D					Research and Development Expenditure (% of GDP)				
	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26
Finland												−0.77													
Switzerland			−0.68																						
Spain	0.75				0.60																				
Latvia														0.61											
Slovenia																		0.7	0.76						
Slovakia																		0.6							
Poland					0.66																				
Croatia											−0.69							−0.62					−0.65		−0.66
Romania		0.67																							
Saudi Arabia																									
Chile													0.64					0.86							0.64

For the 13 countries considered in this study, classified by the World Bank as a group of countries with per capita incomes below (GNI per capita from US $ 1.04 to 4.05 thousand) and above (GNI per capita from 4.05 up to 12.54 thousand US dollars) of the average, the presence of a noticeable and high degree of interdependence between the level of involvement of national economies in GVCs, characterized by the indicator of the share of products produced by foreign companies operating in the host countries and the dynamics of the implementation of strategic innovations (Table 2), represented by the growth rates of the following indicators.

Attracting foreign direct investment. The correlation was confirmed in 4 out of 13 (31%) countries in the group. At the same time, in three countries this relationship was reversed (i.e., with an increase in the share of products manufactured by foreign companies, a decrease in the dynamics of FDI growth was observed): in Colombia and Mexico -in the economy as a whole; in Malaysia by industrial-electrical equipment, as well as the manufacture of computer, electronic and optical products. In one country of the group-In China, in terms of the economy as a whole the relationship was positive (i.e., with an increase in the share of products manufactured by foreign companies, there is a positive trend in attracting FDI to the country).

The number of researchers involved in R&D. In three out of four countries for which a statistically significant correlation was obtained, the relationship was negative: in Bulgaria as a whole by sectors of the economy; Brazil-as a whole by industry and separately by chemical and pharmaceutical products; in China-in all four considered industries (computer, electronic and optical products, electrical equipment, chemical and pharmaceutical products, automobiles, trailers and semi-trailers). In Costa Rica, a direct relationship has been established for the automotive industry.

The number of technicians involved in research and development (R&D). The relationship was established in one country of the group-Brazil for the electrical industry.

The cost of research and development in the territory of the host countries. The interdependence is revealed in two countries of the group: Malaysia and Russia. At the same time, for both countries, the connection is defined as a direct one: Russia-for the chemical and pharmaceutical industry; Malaysia in the context of the automotive industry, chemical and pharmaceutical products.

Grant support for technical cooperation. A direct connection is defined for two countries: China-for the sectors of the economy as a whole, Mexico-for the chemical and pharmaceutical industries. Indirect connection is also defined for two countries: Colombia for the chemical and pharmaceutical industry and South Africa for the computer, electronic and optical industries.

Table 2. Analytical data assessing the relationship between the level of involvement of national economies in GVCs and the dynamics of the implementation of strategic innovations in countries with per capita income below (GNI per capita from 1.04 to 4.05 thousand US dollars) and above (GNI per capita per capita from 4.05 to 12.54 thousand US dollars) average (compiled by the authors based on the analytical databases AMNE (the Analytical AMNE database) and World Bank Country and Lending Groups).

Country	Direct Foreign Investments					Technical Cooperation Grants					Number of Researchers in R&D					Number of Equipment in R&D					Research and Development Expenditure (% of GDP)				
	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27 C26		Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27 C26	
Bulgaria											−0.56														
Brazil											−0.72		−0.64						−0.70						
China	0.62					0.65						−0.66	−0.8	−0.74	−0.79								0.68		
Colombia	−0.58							−0.65																	
Malaysia				−0.73	−0.81																	0.93	0.84		
Mexico	-0.58							0.66																	
Thailand																									
Turkey																									
South Africa					0.97						−0.71														
Hungary																									
Costa Rica												0.72													
RF																							0.76		
Philippines																									
Morocco																									

5. Discussion

Depending on the significance of the established correlations and the income of the population, countries with a high, as well as below and above the average level can be conditionally divided into four main groups, namely, countries in which:

- there is no relationship between strategic innovation and the development of global value chains;
- the relationship is direct;
- the relationship is the opposite;
- the relationship can be both direct and reverse.

In this aspect, high-income countries have the following features. the United Kingdom, Germany, the United States and Saudi Arabia this is the group of countries in which there is no interconnection includes, which are traditionally the home countries of leading multinational corporations that form global value chains. A number of countries in Eastern (Latvia, Slovenia, Slovakia, Poland) and Western (Iceland, Belgium, Spain/) Europe, as well as Chile, have a direct relationship between strategic innovation and the development of global value chains. Some of these countries have opened their markets in recent decades. The countries where this relationship is negative are industrially developed Denmark, Norway, Portugal, Finland, Switzerland, Lithuania and Croatia, as well as Israel and Hong Kong. In Japan, Ireland, Canada, Cyprus, Malta, France, Sweden and Estonia, this relationship can be both positive and negative.

Similarly, was following groups are established in countries with lower and higher middle income.

In Thailand, Turkey, Hungary, the Philippines and Morocco, which are characterized by a high share in the GDP structure of services and agriculture, as well as poorly involved in global value chains, there is no relationship. In Russia and C/osta Rica, there is a direct relationship, but it is present only in relation to the indicators of the number of researchers in the field of R&D and the costs of research and development. The countries in which this relationship is reversed include Bulgaria, Brazil and Colombia, which have a low level of development of the scientific and innovative sectors of the economy. The countries in which this relationship can have both a direct and reverse character include China, Malaysia, Mexico and South Africa.

Thus, summarizing the presented analysis results, the following conclusions can be drawn.

Firstly, for countries with a high level of income to the greatest extent (55%), in contrast to countries with per capita income below and above the average (39%), there is a direct relationship: with an increase in the level of involvement of the national economy in GVCs (considered as a specific the weight of products manufactured by foreign companies operating in the territory of host countries) there is a positive trend in the implementation of strategic innovations through additional attraction of FDI. For a group of countries with per capita incomes below and above the average, this relationship is inverse in more than 60 % of cases, that is, with an increasing degree of involvement of the country's economy in GVCs, a decrease in the rate of FDI growth is observed. At the same time, in countries with a high level of income, the highest direct degree of relationship is observed in the industry of computer, electronic and optical products (the value of the correlation coefficient is about 0.71), while the indirect connection takes the greatest values (also about (-) 0, 71) in the automotive industry. In countries with lower and upper average per capita incomes, the highest forward and reverse linkages are found in the computer industry.

Secondly, the countries of both groups are characterized by a decrease in the number of researchers in the field of R&D with an increase in the level of involvement of the national economy in GVCs. However, in countries with high per capita incomes, this relationship is more indicative of the economy as a whole, as well as the automotive industry, while in countries with per capita incomes below and above the average for the computer, electronic and optical products industry.

Thirdly, high-income countries are characterized by an increase in the number of technical specialists involved in research and development (R&D) with a positive dynamics of growth in the involvement of the national economy in GVCs, while for countries with per capita income below and above the average, this relationship most often (60%) it is the opposite-with the growth of the involvement of the state economy in the GVC, the number of specialists working under the supervision of researchers and performing scientific and technical tasks decreases.

At the same time, for the first group of countries (with a high level of income), this relationship is most reflected in the industry of computer, electronic and optical products, and the inverse relationship-for the automotive industry. For the second group of countries (lower and upper middle income), the inverse relationship is most typical for the electrical equipment industry.

Fourthly, for groups of countries with high per capita income, it is characteristic (about 30%) of a decrease in the share of expenditures directed to research and development with an increase in the level of involvement of the national economy in GVCs, while for countries with per capita incomes lower and above average (20%), this relationship is direct-with an increase in the level of involvement of the national economy in the GVC, the government's expenditures on research grow. At the same time, in countries with a high level of income the direct and inverse relationship is most characteristic of the chemical and pharmaceutical industry (correlation coefficients are more than 0.80 and less than 0.65), and in countries with per capita incomes lower and higher than average the highest direct relationship is observed i//n the automotive industry.

Fifthly, in contrast to countries with high per capita income, for which no relationship has been established between the degree of involvement of the national economy in GVCs and the level of grant support for technical cooperation, in countries with per capita incomes below and above the average, this interdependence is inverse. At the same time, this relationship is manifested to the greatest extent when analyzing the industry-computer, electronic and optical products.

Accordingly, the greatest influence of innovative factors on the development of global value chains is exerted by foreign direct investment and the size of the research sector (number of researchers), and the least-by the technical support of R&D. The established dependencies in 78% of countries are observed for 1-2 types of innovations, in 19% of countries for 3-4 types of innovations. Wherein, about 60% of the number of identified relationships is determined by such factors as the number of researchers in R&D and Research and development costs (% of GDP). At the same time, the impact of strategic innovations on the development of GVCs in countries with lower and upper middle-income levels is very low (it is of a random nature) due to the low volume of R&D funding by them.

According to the authors, taking into account the significant differences in the specialization of industries in the countries of the world, this complex of research needs to be continued in other countries and industries in order to further expand the understanding of strategic innovation as a key determinant of adaptation of national economies to the development of global value chains in age of sustainable development.

6. Conclusions

Based on the presented results, it can be concluded that the degree of relationship between the level of involvement of national economies in GVCs and the dynamics of the implementation of strategic innovations is quite differentiated for different countries and depends, on the one hand, on the level of welfare, and on the other, on the sectoral structure of the national economy.

The reliability of the results obtained is determined, on the one hand, by the use of a set of methods that mutually complement each other, on the other hand, by the use of data from international organizations prepared in a unified methodology as an information base for research, which ensures their comparability.

The theoretical significance of the research results is to expand the theoretical understanding of the development processes of global value chains and adaptation of national economies to them, as well as factors affecting their implementation in the context of embedding economic sectors in the GVC in age of sustainable development.

At the same time, the findings allow national governments to determine the directions of state economic policy in the direction of increasing the effectiveness of the participation of strategic innovations in the formation of global value chains, as well as to substantiate the provisions of state policy on adapting national economies to the transformation of global value chains in age of sustainable development.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Assessment of the statistical significance of the correlation coefficient (using Student's *t*-test [1]).

Country	Direct Foreign Investments					Technical Cooperation Grants					Number of Researchers in R&D					Number of Equipment in R&D					Research and Development Expenditure (% of GDP)				
	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26
Japan																					2.47		3.88		
Ireland					2.72												2.37								
Denmark																									
Singapore											2.52					2.51									
Iceland		2.37											31.3 [2]		11.04					5.39 [3]			5.65 [4]		3.63 [5]
Norway																					2.98				
Canada															2.27										3.34
Hong Kong, China																				4.83		3.02			
Cyprus																							7.36		2.42
Lithuania																			4.00 [6]						
Malta												3.66							6.33						
Belgium	2.84																								
Portugal															11.24										
France												2.56	4.12	5.55	6.72										
Sweden												2.98	2.83												
Estonia													2.66							2.36	2.37		3.05		
Great Britain																									
Germany																									
Israel		8.89		9.63	3.48																				

Table A1. *Cont.*

Country	Direct Foreign Investments					Technical Cooperation Grants				Number of Researchers in R&D					Number of Equipment in R&D					Research and Development Expenditure (% of GDP)			
	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27 C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26
USA																								
Finland Switzerland			3.79																					
Spain	5.94				2.53																			
Latvia													2.68											
Slovenia																	4.25	6.06						
Slovakia																	2.60							
Poland					3.53																			
Croatia										5.49							2.78					3.23		3.40
Romania		3.73																						
Saudi Arabia																								
Chile [7]												2.41					9.55							2.46
Bulgaria										2.36														
Brazil [8]										3.71		2.37						3.39						
China	2.75					3.38					3.40	7.74	5.54	7.28								3.97		
Colombia	2.92							3.21																
Malaysia				5.14	8.32															11.9 [9]		4.7 [10]		
Mexico	2.28							3.45																
Thailand																								
Turkey																								

Table A1. *Cont.*

Country	Direct Foreign Investments					Technical Cooperation Grants					Number of Researchers in R&D					Number of Equipment in R&D					Research and Development Expenditure (% of GDP)				
	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26	Everything industries	C29	C20T21	C27	C26
South Africa					73.43					4.70															
Hungary																									
Costa [11]												3.32													
RF																							6.09		
Philippines																									
Morocco																									

[1] The table shows the values of the calculated t-criterion. Critical values of the t-criterion at the significance level 0.05 = 2.26. [2] t- critical (0.05) = 4.30. [3] t- critical (0.05) = 4.30. [4] t- critical (0.05) = 2.57. [5] t- critical (0.05) = 2.57. [6] t- critical (0.05) = 2.78. [7] t- critical (0.05) = 2.36. [8] t- critical (0.05) = 2.36. [9] t- critical (0.05) = 2.78. [10] t- critical (0.05) = 2.78. [11] t- critical (0.05) = 2.45.

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