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REVIVAL OF UKRAINIAN REGIONS: SCIENCE, BUSINESS, MUNICIPAL GOVERNANCE. THE EXPERIENCE OF SOUTH KOREA

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Abstract. The article explores the issues of revival of Ukrainian regions through the synergy of three key elements – science, business and municipal governance. The experience of South Korea is taken as a basis, in particular, the creation and development of Innopolis Deadeok.

The methods of analysis and synthesis are used in the study.

On the basis of the study relevant recommendations are provided for local authorities, businesses and universities on maintaining the necessary responsibilities and expected steps to create technoparks in Ukraine in which the entire cycle of innovation activity should be carried out – from the emergence and development of an idea to the release of finished knowledge-based products.

Prospects for further research consist in the necessity to legislate the powers of local governments in the field of promoting the innovation activities of technoparks.

Key words: technopark, science, business, municipal governance, innovation, network clustering, economics, regional innovation cluster.

Introduction. As of today, the issue of revival and development of Ukrainian regions is more relevant than ever. The relevance of the chosen research topic is due to the need to form new approaches to the development of Ukrainian regions based on the synergy of three key elements – science, business and municipal governance.

The works of such domestic scientists as Adamchuk V.V., Antipov I.V., Prodius A.I., Doroshko O.O. are devoted to the technoparks development. The article analyzes the works of foreign scientists of Poland (Stanisław Łobejko, Alicja Sosnowska), in particular, on the issue of the management model of science and technology parks, and South Korea (Deog-Seong Oh, Insup Yeom) – research on the creation and development of Innopolis Daedeok.

The purpose of the article is to propose a model of innovative regional development of Ukraine based on the synergy of three components – science, business and municipal governance. The normative base of the study is the Law of Ukraine «On the special regime of innovative activity of technology parks» dated July 16, 1999 No. 991-XIV, the Law of Ukraine «On industrial parks» dated June 21, 2012 No. 5018-VI and the Provision on the procedure of the creation and functioning of technoparks and innovative structures of other types approved by Resolution of the Cabinet of Ministers of Ukraine dated May 22, 1996 No. 549. When writing the article and conducting the study publications of the Trade, Investment and Innovation Division of ESCAP, publications of Ukrainian, Polish and South Korean scientists, as well as information taken from the International Association of Science Parks and Areas of Innovation, Joint Research Centre of the European Commission and the Korea Innovation Foundation were used.

Presentation of the main material. The methods of analysis and synthesis are used in the study. The objectives of the study are:

- to propose a model of innovative regional development of Ukraine based on the synergy of three components – science, business and municipal governance the platform for which should be technoparks;
- to define the theories of origin of technoparks;
- to define the concept of technopark;
- to determine the relevant Ukrainian legislation governing the activities of technoparks in Ukraine;
- to define the differences between technoparks and industrial parks;
- to describe linear and interactive approaches of discussing the role of science technology parks in regional development;
- to determine the expected steps from local authorities, business and universities in order to implement the idea of developing technoparks in Ukraine in which the entire cycle of innovation activities should be carried out;
- to determine the relevance of the network technopark model and network clustering;
- to determine the experience of South Korea in the construction of Innopolis Daedeok;
- to provide a proposal on the model of regional development of Ukraine.

Technology parks (hereinafter referred to as «technoparks») which can also be named «science and technology parks» should become a platform for joint interaction between science, business and local authorities. It is worth noting that science and technology parks have different names in the world: research park, STP, business innovation centre, innovation park, techno-city, technopole, technopolis, and innovation and technology centre (Publication by the Trade, Investment and Innovation Division of ESCAP, 2019: 14).

In accordance with Guidebook «Establishing Science and Technology Parks: A Reference Guidebook for Policymakers in Asia and the Pacific guidebook» published in 2019 (hereinafter referred to as the Guidebook) and produced by the Trade, Investment and Innovation Division of ESCAP, the following essential components of a science technology park (hereinafter referred to as STP) are defined:

- Area and infrastructure: An STP should occupy an area that may or may not be fenced.
- A management team as a landlord: A dedicated team to manage the STP. The functions of the team may vary, but will at least need to cover property management as the landlord.
- Multiple firms as tenants: These firms are the tenants of the STP. The key activities of the firms need to cover R&D and innovation.

– Promoting R&D and/or innovation as a key objective: An STP should target management strategies for promoting knowledge exchange, technology diffusion and innovation. To this end, an STP may promote and facilitate R&D collaboration and also encourage and support the start-up and incubation (Publication by the Trade, Investment and Innovation Division of ESCAP, 2019: 16).Also the Guidebook explains the origin of STPs based on the following theories: clusters, «triple helix» model and growth pole. The content of these theories is as follows:

1) Cluster theory is considered in the context of clusters, which are geographic concentrations of interconnected companies, specialized suppliers, service providers, and firms in related industries and associated institutions in specific fields. Clusters may offer the benefit of knowledge spillovers, resulting from the informal transfers of knowledge and exchange of ideas among firms located in the same STP (Publication by the Trade, Investment and Innovation Division of ESCAP, 2019: 17).

2) «Triple helix» model provides for the collaboration between a Government, private firms and universities. Universities can offer R&D experience, research methodologies, and access to expensive testing and research equipment. Private firms and entrepreneurs offer business experience, regional knowledge about gaps in the market, and an opportunity to commercialize the research being cul-

tivated inside the universities. Governments can play a vital role in incentivizing R&D and knowledgeintensive environments by channelling specific domestic innovation strategies into their STPs (Publication by the Trade, Investment and Innovation Division of ESCAP, 2019: 17-18).

3) Growth pole theory suggests that STPs are often rationalized as a critical physical setting for promoting indigenous R&D capabilities and for spearheading urban and regional economic growth. STPs can contribute to regional economic growth in two ways – internally within an STP and externally beyond the STP. Internally, an STP markets itself as a place for start-ups and an incubation programme. Externally, technology plays a self-reinforcing role in developing regions that respond to the rise of the informational economy (Publication by the Trade, Investment and Innovation Division of ESCAP, 2019: 18).

The International Association of Science Parks and Areas of Innovation provides the following definition of science parks: «A science park is an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities» (International Association of Science Parks and Areas of Innovation).

In Ukraine the issues of the activity of technoparks are regulated by the following legal acts: Law of Ukraine «On the special regime of innovative activity of technology parks» No. 991-XIV dated July 16, 1999 (hereinafter referred to as the Law on Technoparks) (Law of Ukraine, 1999), Provision on the procedure of the creation and functioning of technoparks and innovative structures of other types approved by the Resolution of the Cabinet of Ministers of Ukraine dated May 22, 1996 No. 549 (Resolution of the Cabinet of Ministers of Ukraine, 1996).

It is important to note that the Law on Technoparks defines the legal and economic foundations for the introduction and operation of a special regime of innovation activities of the list of technoparks clearly defined in this Law. The Law on Technoparks defines a technology park (technopark) as a legal entity or a group of legal entities (technological park participants) acting in accordance with an agreement on joint activities without creating a legal entity and without pooling contributions in order to create the organizational foundations for the implementation of technology park projects on the industrial implementation of science-intensive developments, high technologies and ensuring the industrial production of competitive products on the world market (Law of Ukraine, 1999).

Also, technoparks should not be confused with industrial parks (hereinafter also referred to as «IP»). The main difference between technoparks and IP is that technoparks contribute to the development and implementation of new technologies into production, they require the presence of a research component in the form of scientific institutes, centers, universities. In contrast to them, industrial parks provide enterprises with the infrastructure to carry out their main activities (Benovska, 2014: 511).

In accordance with part 1 Article 1 of Law of Ukraine «On industrial parks» No. 5018-VI dated June 21, 2012 with amendments (hereinafter referred to as Law on industrial parks) industrial park is a territory defined by the initiator of the creation of an industrial park in accordance with urban construction documentation and equipped with the appropriate infrastructure, within which industrial park participants can conduct business activities in the field of processing industry, processing of industrial and / or household waste (except disposal of waste) as well as scientific and research activity, activity in the field of information and electronic communications under the conditions defined by this Law and the contract on the conduct of business activity within the industrial park (Law of Ukraine, 2012).

The issue of technoparks activities development in Ukraine is problematic due to the outdated regulatory and legal framework, in particular, the current Law on Technoparks is valid as amended on December 05, 2012. Also the problem of expanding economic incentives for the creation and development of technoparks in Ukraine is important. Thus, in accordance to part 3 of Article 34 of Law on industrial parks, management companies, initiators of creation – business entities and participants of industrial parks at the expense of state, local budgets and other sources not prohibited by law are: provided with funds on a non-refundable basis for the arrangement of industrial parks and / or ensuring the construction of related infrastructure facilities (roads, communication lines, heat, gas, water and electricity supply facilities, engineering communications etc.) necessary for the creation and operation of industrial parks in accordance with the procedure established by the Cabinet of Ministers of Ukraine; compensated for expenses for plugging and connection to engineering and transport networks in accordance with the procedure established by the Cabinet of Ministers of Ukraine (Law of Ukraine, 2012).

In accordance to the Technical Report by the Joint Research Centre of the European Commission on the role of science parks in smart specialisation strategies published in 2014 the role of STPs in regional development can be discussed according to two different approaches, a linear or an interactive one. The linear view sees STPs mainly as instruments of technology transfer, emphasising their role in supporting research-based commercialisation. In this understanding, the role of STPs is mainly to act as facilitators in these exchanges, as a bridge from knowledge sources to recipients (Claire Nauwelaers, Alexander Kleibrink, Katerina Stancova, 2014: 5).

Interactive approach proposes the vision of STPs as nodes in wider networks of actors supporting innovative business development. Technology transfer is only one of the ingredients of successful innovation, and the knowledge exchanges take a multi-dimensional character rather than a science-to-business line. The aim of STPs broadens to a mission of supporting innovation co-creation (Claire Nauwelaers, Alexander Kleibrink, Katerina Stancova, 2014: 5).

In our opinion, when determining the place and tasks of each participant of the technopark, it is necessary to use an interactive approach. This position is due to the fact that each participant of the technopark is equivalent and equal in the implementation of innovation and only in the general synergy between them the set goals are achieved.

In order to more effectively develop technoparks in Ukraine, we believe that on the basis of leading higher educational establishments (hereinafter referred to as HEE) it is necessary to create powerful technoparks in which the entire cycle of innovation activity should be carried out – from the emergence and development of an idea to the release of finished science-intensive products. Thus, local authorities, businesses and universities should assume their respective responsibilities and take the following expected steps:

1. Local authorities shall:

1.1. identify priority areas of the region development and create a **special interactive map** indicating: a) all universities specializing in the training of specialists in priority sectors of the region; b) relevant business entities operating in the territory of the respective region and which type of activities is determined as prioritized;

1.2. hold a tripartite forum on the creation of technoparks in the territory of the respective region between representatives of business, universities and local authorities (hereinafter referred to as the Parties) which should result in the signing of memorandums of cooperation and other relevant documents between the Parties;

1.3. comprehensively promote the activities of the technopark within the framework of their powers; take part in the development and implementation of joint initiatives, projects, events and programs for the technopark development together with representatives of universities and business.

2. Local business shall be ready to assume obligations in accordance with the signed memorandums of cooperation and other relevant documents with universities and local authorities, in particular upon:

2.1. exchange of experience and knowledge (conducting trainings, seminars, consultations etc.);

2.2. financial and material and technical support for the technopark activities.

3. The universities shall:

3.1. provide all participants of the technopark with the basic conditions necessary for its proper functioning.

3.2. adapt the curricula of institutes/faculties in accordance with which students will have the opportunity to consolidate obtained theoretical knowledge in practice while participating in the innovation activities of the technopark.

3.3. carry out: scientific substantiation, analysis and assessment of problems and prospects of regional development in the context of the technopark activities; organizational and methodological support for research; scientific support for the implementation of the concept, initiatives, projects, events and programs of the technopark development.

3.4. publish the results of scientific research and issue the materials on the main activities of the technopark.

The model of *«network park»* is also interesting (hereinafter referred to as network technopark) which assumes that the organization of a science and technology park is formed as a relatively free network system and the management of the park serves as an orchestrator managing and coordinating the activities of independent scientific and business entities cooperating directly or through a network orchestrator. The primary objectives of this kind of a scientific and technology park are to organize cooperation in research and development and the creation of companies implementing innovation projects through the creation of an Internet platform for exchanging information and projects, conducting discussions, conferences in the frame-work of park members (Łobejko Stanislaw, Sosnowska Alicja, 2015: 87-88).

Communication between the participants of network technopark is carried out primarily by Internet, it might be online contacts, teleconferencing and other means available by the electronic media. Extensive use of the network allows access to the park not only geographically close, but also remote entities and individuals. In constructing the management model of network, a scientific and technological park needs to specify the basic objectives of the whole organization, functions of the entities participating in the park, the principles of cooperation between the entities, tasks for an orchestrator and its role in relation to the other members of the network (Łobejko Stanislaw, Sosnowska Alicja, 2015: 87).

We believe that the network technopark model will gain more and more relevance every year, given the modern challenges and the growing trend of remote cooperation. In addition, flexibility and the ability to quickly adapt to external conditions despite the significant number of the network technopark participants and complexity of the connections between them can attract foreign partners, donors and investors since there are guarantees that in the event of a political and/or economic crisis within the country or in case of military aggression of another country the network technopark will continue its activities without interrupting the production process and foreign donors and investors will not lose their funds and trust.

The synergy of enterprises, universities and other research institutions additionally with the assistance of local governments will contribute to the growth of science-intensive industries (including creative ones) within a certain territory (region). In this regard, it is necessary to separately highlight the proximity factor meaning geographical (territorial) proximity which allows the participants of the technopark to quickly solve certain tasks related to the activities of technopark and effectively exchange knowledge and experience.

However, a natural question arises: How to deal with network technoparks where geographic (territorial) proximity is not required? In this regard, it is proposed to introduce ***network clustering*** *which implies the growth of science-intensive industries, both within one country and in several countries at the same time, through the implementation of research and production activities by the participants of the network technopark within the framework of a specially created Internet platform.*

Thus, through the use of capabilities of modern information technologies it is quite possible to start in Ukraine the practice of development and implementation of *parallel development programs* together with foreign partners where the efforts of representatives of the authorities, scientists and entrepreneurs, both from the side of Ukraine and from the side of a foreign state-participant of network technopark, are aimed at solving common problems for each side.

Network clustering has a much wider range of influences and possibilities. In general, in the future, under the conditions of a globalized world, there will be a complete transition of the Ukrainian economy to an innovative development model.

In this regard, we believe that *technoparks* should become launching pads for the formation of **regional innovation clusters**. One of the successful examples of the implementation of such a task is the experience of South Korea in creating Innopolis Daedeok which during its existence has gone through three stages of development: a science park, a technopolis, an innovation cluster.

In 1973, on a site covering 27.8km2 , the South Korean government began the construction of Daedeok Science Town (from 2005 – Innopolis Daedeok), which was established as national R&D center to enhance the national competitiveness of high technology and economic prosperity through the agglomeration of research institutes and universities in a planned science city (Deog-Seong Oh, Insup Yeom, 2012: 141) .

Daedeok Innopolis has served a critical role in raising Korea's scientific competitiveness to global top-4 status (Deog-Seong Oh, Insup Yeom, 2012: 145). Innopolis Daedeok has been developing in the following stages:

Initial stage – Science Park: 1.1. constructing infrastructure: designing, developing and managing the Science Park. 1.2. managing and operating the Science Park: harmonizing R&D facilities, amenities, and welfare facilities with each other; 1.3. constructing institutional infrastructure: regulation of environmental pollution, activation of business and R&D activities and enhancing of the convenience of residents (Deog-Seong Oh, Insup Yeom, 2012: 146).

Middle Stage – Technopolis model:

2.1. HEIs and research institutes actively support business incubation activities: containing legal support, constructing infrastructure (business incubation center, and etc.); 2.2. R&D capacity of the Science Park is enhanced; 2.3. industrial areas are expanded next to Science Park; 2.4. venture firms are created and the roles of HEIs become more important; 2.5. all HEIs, including research centered HEIs and local engineering HEIs, conduct technology commercialization and collaborative research with firms, research institutes, and HEIs (Deog-Seong Oh, Insup Yeom, 2012: 147-148).

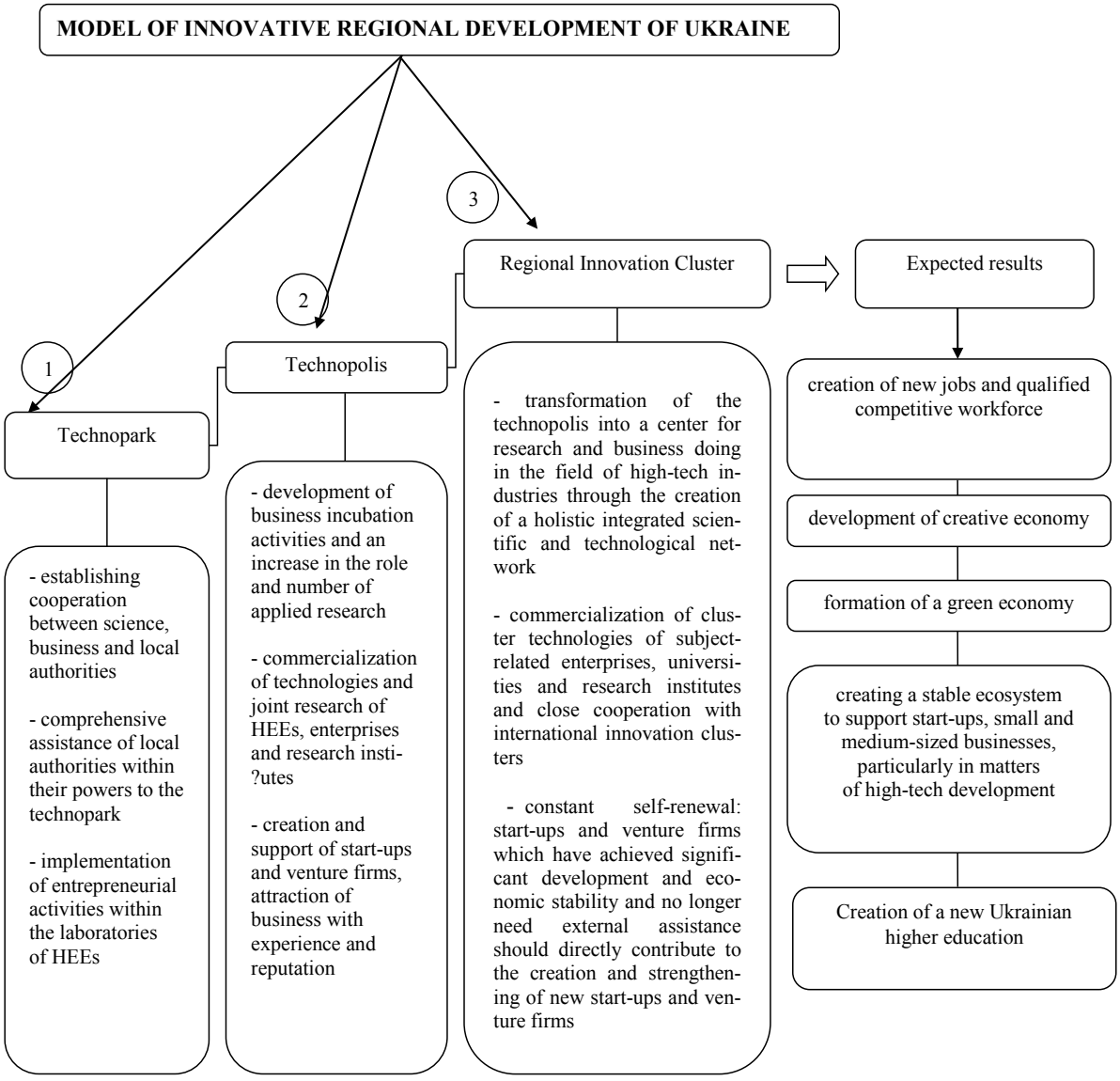
Mature stage – Innovation Cluster Model:

3.1. technopolis turns into a center of business excellence on high-tech industry in the global science; 3.2. a specialized science and technology network is established to maximize innovation of science and technology; 3.3. a cooperation system among firms, HEIs, and research institutes is enhanced in strategic industrial fields such as IT, BT, and NT; 3.4. cooperation with international innovative clusters; 3.5. creation of clusters of related institutes to promote the growth of strategic industries; 3.6. systematic and integrated structure of R&D facilities, business facilities, and management facilities are required in order to promote the development of high-tech strategic industries; 3.7. a multi-purpose site is established to attract strategic industries, foreign advanced research institutes, and foreign research centered firms; 3.8. technology commercialization (Deog-Seong Oh, Insup Yeom, 2012: 149).

Appendix 1 presents data from the Korea Innovation Foundation (Korea Innovation Foundation) on the performance of Innopolis Daedeok in accordance with four criteria: sales status, research achievements, manpower status and tenant institutes status of Innopolis Daedeok.

It should be noted that in the initial stages the role of the South Korean government in the development of the Daedeok Science Town (hereinafter also referred to as DST) was dominant as DST was established by a central government initiative (Deog-Seong Oh, Insup Yeom, 2012: 144). Local governments also adhered to the central government's policy of supporting venture firms and their growths; the functions of business incubation centers established by local governments were enhanced to also provide financial aid; the cooperation with local governments was taken for the sustainable development of technopolis (Middle stage – Technopolis Model). Clusters of strategic industries are created by the cooperation between science park and local governments (Mature stage – Innovation Cluster Model) (Deog-Seong Oh, Insup Yeom, 2012: 150).

The key place in the development of regional innovation clusters in Ukraine should be taken by local authorities. This position is due to the need to strengthen decentralization processes in Ukraine



Pic. 1

and expand the institutional capabilities of Ukrainian regions by ensuring their scientific, business and industrial freedom and independence. Therefore, it is necessary to legislate the powers of local governments in the field of promoting the innovation activities of technoparks which is the subject of additional research.

Based on the above, the following model of regional development of Ukraine is proposed (pic. 1).

Conclusions. Thus, in the context of this work the achievement of the following results is predicted:

1. The creation of new jobs and a qualified competitive workforce will be achieved through the rapid development of entrepreneurship and the emergence of creative industries which will contribute to the emergence of specialties and professions of the future, in particular those related to the field of information technologies, as well as the development of a dual education system in HEEs, where starting from the student bench, students will have the opportunity to directly join the production process.

2. The development of a creative economy involves the capitalization of ideas and human talent in order to develop a scientific, cultural and innovative product with added value, develop technical and technological inventions and create works of art.

3. The formation of a green economy in the context of this work means the formation of such an economic model that: 1) is able to ensure a balanced development of the country without causing harm to the environment and the depletion of natural resources; 2) provides for the direction of public and private investments in those types of economic activity that are aimed at preserving the natural environment, rational use and restoration of natural resources.

4. The creation of a stable ecosystem to support start-ups, small and medium-sized businesses, particularly in matters of high-tech development, provides for two key areas:

1) for start-ups: financial support; providing access to the necessary infrastructure and technical equipment; scientific support of start-up activities; provision of a whole range of legal services, consulting services, marketing, etc.

2) for small and medium-sized businesses: assistance in bringing finished science-intensive products to the domestic and world markets.

5. The creation of a new Ukrainian higher education implies the rapid development of a dual educational system which involves the training of specialists on the basis of coordinated interaction between the educational and industrial spheres, that is, a combination of theoretical training within HEE and practical one at the enterprise. It is also important to define the principle of competition between domestic and foreign HEEs, since the external competition is the engine which will facilitate to bring Ukraine to the forefront of innovation development in the world.

Appendix 1

Table 1

Sales Status

As of December 2020 (Unit: USD 1 million)

Classification	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Corporatoions Sales	2,563,893	6,706,454	9,928,319	11,237,907	12,291,634	14,470,552	16,414,924	16,414,924
Classification	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Corporatoions Sales	16,698,007	16,414,944	16,713,695	16,415,404	16,034,849	18,071,603	18,064,166	19,276,874

Source: Korea Innovation Foundation

Table 2

Research Achievement

As of December 2020 (Unit: USD 1 million)

Classification	Domestic patents (Cumulative)		Overseas patents (Cumulative)		Number of technology transfers	Technology transfer fees
	Patents pending	Registered patents	Patents pending	Registered patents		
2020	147,814	71,617	75,431	26,755	1,601	134,086
2019	147,038	70,398	73,265	27,315	1,440	88,071
2018	139,124	69,270	70,643	25,829	1,603	64,232
2017	131,509	65,530	61,144	24,287	1,667	61,249
2016	118,757	61,082	59,346	23,420	1,974	72,740
2015	116,998	56,635	57,273	19,380	1,577	64,631
2014	102,775	52,247	47,045	17,368	1,530	64,139
2013	93,866	49,156	45,893	16,256	1,054	68,937
2012	92,118	46,661	43,067	10,246	906	81,562
2011	86,596	41,146	34,218	9,552	821	84,849
2010	80,432	39,052	32,779	9,005	796	96,905
2009	66,764	32,664	28,822	7,684	910	109,394
2008	55,154	30,737	20,492	6,544	974	95,723
2007	46,355	29,193	17,893	5,978	815	77,798

Source: Korea Innovation Foundation

Table 3

Manpower Status

As of December 2020 (Unit: Persons)

Classification	Researches & engineers (A)				Production workers, administrative workers (B)	Number of employees (A)+(B)
	Doctors	Masters	Bachelors and below	Total		
2020	17,504	12,715	8,776	38,995	43,180	82,175
2019	16,726	12,427	8,013	37,166	40,940	78,106
2018	15,519	12,756	7,623	35,898	39,802	75,700
2017	15,264	12,199	7,456	34,919	37,752	72,671
2016	15,269	11,109	6,760	33,138	36,475	69,613
2015	14,675	10,926	5,733	31,334	36,362	67,696
2014	13,526	10,613	5,499	29,638	37,752	67,390
2013	12,195	11,083	5,599	28,877	38,177	67,054
2012	10,333	10,856	6,234	27,423	36,898	64,321
2011	10,244	9,951	6,298	26,493	36,196	62,689
2010	9,055	9,736	5,643	24,434	31,180	55,614
2009	7,661	8,191	4,670	20,522	25,004	45,526
2008	6,783	7,253	4,173	18,209	23,429	41,638
2007	6,800	7,669	4,327	18,796	21,542	40,338

Source: Korea Innovation Foundation

Table 4

Classification	Tenant Institutes Status As of December 2020 (Unit: No)												
	Research field							Non-research field				Corporations	Total
	Public Research Insititutes					Other Research Institutes	Sum	Government and Public Institutes		Other Non-profit Institutes	Sum		
	Government Research Institutes		Universities	Specialized Production Technology Institutes	National and Public Research Institutes			Government Institutes	Public Institutes				
	NST Research Institutes	Specific Research Institutes											
2020	17	9	7	0	3	10	46	10	18	30	58	2,243	2,347
2019	17	9	7	0	3	9	45	10	18	30	58	1,971	2,074
2018	17	9	7	0	3	9	45	10	17	26	53	1,948	2,046
2017	26		7	0	3	9	45	10	14	23	47	1,784	1,876
2016	26		7	0	3	9	45	10	14	22	46	1,669	1,760
2015	26		7	0	3	9	45	10	14	23	47	1,613	1,705
2014	28		7	0	3	9	47	10	14	23	47	1,516	1,610
2013	28		7	0	3	9	47	9	14	23	46	1,484	1,577
2012	28		7	0	3	8	46	9	13	23	45	1,312	1,403

Source: Korea Innovation Foundation

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