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CHAPTER 1

CHAPTER 1

INVESTMENT AND INNOVATION SYSTEMS (IIS) – THE KEY INSTITUTIONS OF THE NATIONAL INNOVATION SYSTEM (NIS)

ABSTRACT

Research has been carried out on the processes of formation and features of the functioning of the National innovation system (NIS), its main components and the links between them. A separate direction, within the framework of this topic of this scientific work, was the study of investment and innovation systems (IIS) as key institutions of the NIS, characterized by a pronounced backbone function. At the same time, the main general scientific methods of this study were scientific abstractions, analysis and synthesis, induction and deduction, scientific modeling, and the scenario method.

The integrated use of these research methods made it possible to schematically present the structure of the National innovation system, highlighting four main institutional subsystems and subsystems of specific links that ensure the functioning of both institutional subsystems and the entire NIS. In addition, the use of the scenario method for business entities of all categories of the national economy engaged in innovative activities, in order to clearly identify investment and innovation systems among them, made it possible to determine the algorithm of their functioning, presenting it as a system of inequalities of criterial conditions.

KEYWORDS

National innovation system, NIS institutions, investment and innovation systems, regulating relations, innovation climate, innovation culture, migrating institutions, inter-innovation period.

"Ukrainians do not know what innovations are, they are constantly not ready for their implementation, while they are sure that they know and know how to deal with them, which they suffer from in their history, paying for this inadequacy with mass casualties and destruction" (Datsiuk, S. "Getting Ready for Innovations" Ukrayinska Pravda, 08.06.2018).

While agreeing with the author of these words regarding such an assessment of knowledge about innovations in our country "on average for the chamber", one cannot, however, agree with such a generalization of all Ukrainians.

We believe that the source of this inadequacy between "do not know" and "know", for which "mass casualties and destruction" are paid, is, first of all, the heads of public authorities, industries, regions, communities responsible for these areas of activity of Ukrainian society, institutions, enterprises and organizations that "…are sure that they know and are able to deal with them", but in fact, not knowing "what innovations are", they ignore and neglect their importance for the development of society, since, according to Charles Darwin "Ignorance more frequently begets confidence than does knowledge".

The national innovation system of Ukraine today exists and functions – or rather, some of its individual elements that cannot create a systemic effect, and therefore the results of their "existence-functioning" are far from desired, and, as from the beginning of the 90s, so and in the mid-2000s, as well as to the present. And this despite the fact that domestic scientists do not get tired of proving the need for an innovative direction in the development of the economy of our state, substantiating and formulating theoretical concepts and models that develop recommendations, programs, plans and strategies. However, their discoveries, inventions, utility models, samples of equipment and technologies never became innovations, did not benefit either their authors, or society, or the world.

Realizing that the process of formation of the national innovation system of our country continues to move into the future under the influence of the so-called "path effect" or "dependence on the past path" (path dependence problem), we offer our vision of organizational, structural-functional and human-oriented capabilities and ways of its real transformation into an integral system, designed to change the "bureaucracy from innovations" (which, according to Datsiuk, S. should be characterized by a total rejection of such thinking, for which "innovations are not a value") to humanocracy, with concentration "…on people – real carriers of innovations".

The presented results of the analysis and assessment of the state of management of the innovative development of socio-economic systems, the national innovation system as an object of necessary changes, supplemented by a subsystem with investment and innovation functions, can and should become the basis for radical, properly justified and managed changes in the entire system, which "…at the mental and organizational level" will change the modern "systematized pseudo-innovative activity" to new approaches to the formation in society of the necessary set of domestic "risk innovative corporations" and "personal and corporate innovators".

1.1 NEW APPROACHES TO MANAGING THE INNOVATIVE DEVELOPMENT OF SOCIAL SYSTEMS

Although the place and role of intelligence in the development of human civilization has always been undeniable and generally recognized, only in the 21st century the intellectual characteristics of a person, like many other abilities and skills acquired in the process of continuous changes in all spheres of social activity, including knowledge and experience, science and technologies, economics and behavior in it have received a new and powerful impetus for further development.

The declared paradigm of "intellectualized society – intellectualized management" [1] has become a certain result and result of the analysis of the period of the avalanche-like generation of new knowledge and experience, the development of science and technology, intellectual and digital technologies based on them, the intensification of the use of natural intelligence (NI) by its carriers with resources with simultaneous use of the latest opportunities and potential of modern achievements in the field of artificial intelligence (AI) according to the formula:

$$NI+AI, \tag{1.1}$$

as well as the creation and effective use in the future of an even more powerful tandem of natural and artificial intelligence according to the formula:

$$NI \times AI. \tag{1.2}$$

At the same time, such large-scale and dynamic changes in the human, technical and technological characteristics of modern society in all its possible components would have to correspond to adequate changes in the principles, methods and structures for managing its proper functioning and development. After all, as the founder and head of the World Economic Forum Klaus Schwab quite rightly asserts, the neo-industrial paradigm of development singles out among the criteria for the development of economies such an undoubtedly important value as management, on which the culture of changes and the conditions that should be formed for their implementation are based, and since these changes transform humanity, they must be learned to manage [2].

At the same time, according to the same author, today's "degradation of global governance" has led to the fact that "institutions and their leaders have ceased to fulfill their purpose", and the "new model" should be distinguished by a number of "fundamental aspects" [3].

Therefore, in the light of unprecedented challenges and, as follows from the above positions, poorly managed changes, the need to "...change bureaucracy to humanocracy" gradually arose and was finally realized, formulated in the recommendations of Hamel, G. and Zanini, M., authors of the well-known bestseller in the field of management, known as "Humanocracy" [4].

At the same time, however, attention should be paid to the fact that the need to eradicate the traditional bureaucracy was not the first to be noticed by these authors. A number of other researchers addressed the obvious problems of the current state of management and management in the world. After all, the traditional theoretical foundations, methodological approaches and practical recommendations have long lagged behind, did not take into account and did not keep up with the dynamic changes in the values, moods, needs and desires of society and required the search, testing and implementation of adequate changes in the practice of management and management.

This is evidenced, for example, by the newspaper article "The Death of Management" by Samuelson, R. in Newsweek [5] in 1993, and by Adam Gale's article of the same title in Management Today [6], which was published only 26 years later.

The principles, approaches, models and recommendations for theoretical substantiation, testing and practical implementation of the necessary changes in practical management and management in all areas of activity were discussed, for example, in the book "The Death of Modern Management" [7] by Owen, J. in 2009, and 10 years later in the book "Transnational Management" by Bartlett, C. and Beamish, P. [8]. At the same time, in the Boston Consulting Group article "The End of Management as We Know it" [9], its authors Beauchene, V. and Cunningham, M., based on the results of surveys of 5 thousand employees (of which 30 % are managers), stated that "Traditional management has reached a turning point", 37 % of respondents believe that the "layer" of managers will disappear and only ≈10 % "want to become a manager".

It is quite obvious that in such a situation, both theoretical scientists, and practicing managers, and business consultants in all, without exception, spheres of life of modern society, today are asking the question "Quo vadis management?" and are actively looking for answers for a variety of areas of practical management and management. Examples include articles on such specific types of management as knowledge management [10], talent management [11], change management [12], project management [13], innovation management [14, 15], investment management [16], management of innovation and investment activity [17], public management and management [18] and many others.

At the same time, many researchers generate recommendations for a certain modernization of management and management processes. However, the authors of the above-mentioned book "Transnational Management" [8] Bartlett, C. and Beamish, P. believe that, until recently, the changes taking place in the field of management theory and practice "leave some problems unchanged". At the same time, Professor Buffington, J. argues that the management we know "needs to be replaced" because it "is beyond repair" [19].

Thus, it can be argued that today the system in which management was born, developed and improved for a long time, having reached a certain system of principles, laws, rules and conditions for the relationship and interaction of many people in the process of life creation, today requires steps for radical rethinking and improvement taking into account the new conditions of relationships and interaction between people. After all, the times when most of the world was ruled by tyrants have passed and today already billions of people live in democracy, in conditions of a different capitalism, which is also dynamically changing.

In this context, it should be noted that Stiglitz, J. the Nobel Prize winner in economics, stated in his article "After neoliberalism" that "...neoliberalism should be declared dead and buried" [20], and in his book "People power and income Progressive capitalism of the era of discontent" [21] in the first place he proposed "progressive capitalism" he has already placed people, and not any other resource components of the economic life of society.

Salesforce Chairman and Co-CEO Benioff, M. is thinking along the same lines, pointing out that "It's time for a new capitalism – a more just, equitable and sustainable capitalism that truly works for everyone..." [22], and the founder and managing partner of Inclusive Capital Partners, Rothschild, L. is calling for cooperation between private and public sector leaders and creating the Coalition for Inclusive Capitalism (CIC) [23], which includes all stakeholders in its management.

All this, however, indicates that any possible future modifications and changes in the economy of any progressive, inclusive, humane, etc. capitalism will require the planning and implementation of adequate and anticipatory changes in management and management. After all, according to the professor of the European Institute of Business Management (INSEAD) Petriglieri, G. management "…should become good and humane", develop and use "…not only our strengths and skills, but also our mind" [24]. That is, new modifications of capitalism already need new management and management, which will be focused on a person as a carrier of intelligence, as a source of innovation and harmonized development and effective cooperation of such components of society as people in power, people in business and people in society.

Consequently, all the above and far from exhaustive proposals of many authors from the possibilities of improving management and management processes for the economy of modern capitalism, which continues to develop and improve, are characterized by a general trend – attempts to involve in the management of economic activity of any segment of society those people who stages of the emergence, formation and development of traditional capitalism were used exclusively as a labor force and remained exclusively objects, and not participants in the management and management processes.

It is obvious that all new solutions in the theory and practice of management and management, aimed at their humanization and intellectualization, will also be relevant for specific areas of their use, among which, obviously, there is the domestic economy, the growth potential of which, according to professor Sheremet, P., 85 % is determined by innovations and the conditions for "pulling in resources" for investing in their implementation [25]. However, when the country's economy is "the least free economy in Europe", it is quite obvious that the greatest problems of its future development in all sectors of the national economy without exception are concentrated in the field of innovation and investment management, since the level of innovative development is determined by the level of investment support and investment attractiveness.

At the same time, the determining factor in the successful innovation and investment activities of industries and enterprises is management and management, which in the country of the "oligarchic, post-socialist economy" with a "deficit of economic freedom" [25] continue to remain not even on the traditional for market countries, but on the "post-socialist" level.

And then, when the majority of domestic researchers of the problems of the investment-innovative model of development of the economy of Ukraine consider the legal, economic, organizational and other conditions for its implementation in the context or in the economy as a whole [26–28] or in the context of its individual sectors [29, 30] or individual enterprises [31], or they explore these opportunities from the standpoint of introducing modern technologies of digitalization and design management [32], etc., while leaving the problems of humanization and intellectualization of the management of these processes at the level of the national economy and its industries without attention and necessary changes, the state of the country's innovative development and its investment support will remain at the old positions. Therefore, according to the quite appropriate opinion of professor Sheremet, P. "…the economy will need to be developed and developed in the way we are fighting now. And we are fighting with smaller forces, but very innovative, very motivated" [25].

Therefore, it can be stated that the formation of modern systems for managing the development of society in the era of the information economy should be based on the model of innovative development of its national economy, the key element of which is the National Innovation System (NIS). Moreover, it is the level of "formation" (or "unformedness") of its own National Innovation System in a particular country today that is one of the determining factors of what position it occupies in world rankings, and how much this country influences or can influence – really – those processes that are taking place very dynamically in today's globalized world.

1.2 NATIONAL INNOVATION SYSTEM AS THE BASIS OF THE MODERN MODEL OF INNOVATIVE DEVELOPMENT OF THE COUNTRY'S ECONOMY

A characteristic feature of the beginning of the 21st century is the constant growth of the dynamics of changes taking place in all areas of public life. At the same time, such changes, which have already been noted above, are a direct consequence of the "intellectualization" of modern society, which is manifested through the rapid development of science and technology, the accelerated generation of new knowledge, the creation of the latest "intelligent-intensive" technologies, and an increase in the share of processes using artificial intelligence.

It is obvious that the most active part in shaping the processes of global intellectualization of modern society is taken by the states that today are rightly considered the leading countries of the world economy. After all, it is they who, constantly generating the latest knowledge, introducing "intelligent-intensive" technologies, spreading the "standards" of the sixth technological order, act as a kind of "locomotive of change" in the modern world.

It is important to note that the further growth of the influence of such countries on all processes taking place in the world may also carry a certain threat – an increase in the level of their dominance in the world economy may contribute to increased differentiation between the levels of development of these and other countries of the world, which directly affects the further "stratification" of the world community and thus creates the prerequisites for the emergence of new conflicts between states. At the same time, and this is very important, globalization and its consequences can act as an effective and efficient tool to curb the possible further rapid polarization of the world (according to socio-economic criteria) in this situation. Since globalization processes contribute to the integration of "all" countries of the world (including those countries that are not world leaders today) and at the same time are directly related to the processes of "intellectualization" of modern society (and, consequently, to all components of the processes of development of science, the generation of new knowledge, the creation of new technologies), then in this situation globalization acquires the function of not only a kind of "compensator" for the possible further polarization of the world, but also creates prerequisites for reducing the differentiation that currently exists between these countries.

An analysis of the main characteristics of the countries that are today the world leaders also indicates the existence of differences (in some places considerable) between such countries.

So, they may differ from each other in the state structure, the size of the territory, the population, the political system, the form of government, the type of economic system, the model of its financial system, the country's belonging to different superstate formations, etc.

However, despite all the possible differences between the main classification features of the leading countries, they all have one common (the same for all) characteristic – the socio-economic development of each of these countries is based on the model of its innovative development. At the same time, the very model of innovative development can rightly be considered a defining feature of the current stage of civilizational development.

In other words, today the basis of various models of the national economy of each (without exception) successful country in the modern world is certainly the model of its innovative development, covering all spheres of public life. At the same time, all the differences that exist between the national economies of such leading countries (as mentioned above) are expressed only in the form of the country's innovative development model itself, and the specificity of this form of the model ensures its maximum efficiency for its national economy.

Thus, it can be argued that the national economy of each modern economically developed country is based on its own model of innovative development, which differs from the development models of other countries of the world leaders, first of all, in the features of its national economy. (Obviously, this statement is also true for countries that today are not world leaders, but in their development are guided exclusively by the principles of a market economy and are guided by a model of sustainable development). At the same time, the basis of such a model of innovative development of each country of the modern world is its National Innovation System (NIS), which is designed not only to create and provide the most favorable conditions for the implementation of innovative activities by all its business entities, but also to directly participate (in various forms) in the processes generation, production, implementation and dissemination of innovations in all spheres of life of modern society. Moreover, the level of development (development) of the NIS of the country determines the level of efficiency of the model of its innovative development.

The term "National innovation system" was first formulated by Freeman, C. [33], in his study of the technological policy of Japan (1987), and a few years later (in particular in 1992) Christopher Freeman's thesis about the objective need for the formation (and functioning such a system in the national economy of each country was supported and developed in the scientific work "National Innovation System" edited by Lundvall, B. [34].

It should be noted that in the above works, to define such a system, the term "National Innovation System" was used ("direct" translation of the English term National System of Innovation (NSI)), in contrast to the modern term "National Innovation System". Moreover, in scientific publications in this area at the end of the 20th and beginning of the 21st centuries, this formulation of this term is predominantly found, that is, the "national system of innovation" (NSI), and not the "national innovation system" (NIS). Moreover, this was typical for most publications of that time, regardless of whether the authors were foreign or domestic scientists.

However, later the term "national innovation system" began to be used more and more often. Such changes in the wording of the name can be explained by the fact that such a terminological construction – "innovation system" (rather than "innovation system") – corresponds to the construction of other currently generally accepted terms, in particular, such as "economic system", "financial system", "social system", "mechanical system", etc.

Thus, during this period, in the area related to innovation and innovative activity, there was a gradual "displacement" of the term "NSI" by the term "NIS". The adoption (in 2009) by the Cabinet of Ministers of Ukraine of the "Concept for the Development of the National Innovation System" can be considered a kind of "final stage of institutionalization" in our country of the term "National Innovation System" [35].

It should be noted that at present this document has lost its force, as a result of the adoption of a new action plan for 2021–2023 for the implementation of the Strategy for the development of the sphere of innovation for the period up to 2030 [36]. At the same time, the main definitions of the National Innovation System, formulated in the NIS Development Concept (2009), remain relevant today, despite the fact that the document itself has become invalid.

Conducting a further comparative analysis of the use of the terms "NSI" and "NIS" – both in their form and in their content – based on studies of English-language publications in the field of innovation and innovation activity, made it possible to identify characteristic trends, respectively, in two areas:

– in the English-language scientific literature today, two terminological forms of the definition of the National Innovation System are quite common:

1) National System of Innovation (NSI);

2) National Innovation System (NIS).

At the same time, there was no significant difference in the number of publications in which the first or second terminological form was used;

– the essence, main features and description of the categories NSI (National System of Innovation) and NIS (National Innovation System) in English-language publications are not characterized by systemic fundamental differences. This means that categories such as NSI and NIS can be considered identical categories.

Thus, on the basis of the study, an intermediate conclusion can be drawn. The categories "National system of innovation" and "National innovation system" are identical in their content. At the same time, in further research, it seems appropriate to survive the term "National innovation system" because:

1) in the documents of a regulatory nature (these are the above-mentioned relevant orders of the Cabinet of Ministers of Ukraine), such a wording was defined;

2) in scientific publications of domestic authors, this terminological form is used much more often. Obviously, this can be explained by the presence in the domestic regulatory and legal field of the above-mentioned orders of the Cabinet of Ministers. In addition, it is this terminological construction that is more unified for the Ukrainian language.

Despite the fact that foreign and domestic researchers have been actively engaged in the problems of NIS for the last 30 years, today it has not been possible to formulate a single approach (or at least a few "generalized" approaches of an applied nature) regarding the essence of the National Innovation System and the features of its formation and functioning. In modern scientific literature, one can find dozens of different interpretations of NIS, which were offered (or were offered earlier) by Ukrainian and foreign scientists.

In order to systematize the conduct of further research on the category "National innovation system", it seems appropriate to present in tabular form the most common definitions of it, while grouping them according to the structural-functional criterion (**Table 1.1**) and the criterion of the institutional-system approach (**Table 1.2**).

● **Table 1.1** The most common definitions of the category "National innovation system" in the scientific literature (according to the structural and functional criterion)

Author (authors)	Definition, source
1	**2**
Cabinet of Ministers of Ukraine	NIS is a set of legislative, structural and functional components (institutions) that are involved in the process of creating and applying scientific knowledge and technologies and determine the legal, economic, organizational and social conditions for ensuring the innovation process within national borders and ensure the growth of the competitiveness of domestic organizations and enterprises by increasing their innovative activity. At the same time, the main components of the Ukrainian national innovation system are five subsystems, in particular: 1) state regulation; 2) education; 3) knowledge generation; 4) innovation infrastructure; 5) production [35]
Varblane, U., Dyker, D.	NIS is all parts and aspects of the economic structure and institutional structure that affect both learning and search and research – the production system, the marketing system and the financing system are subsystems in which learning takes place [37]
Yaremko, L.	NIS is a set of interconnected organizations (structures) engaged in the production and commercialization of scientific knowledge and technologies within national borders. It consists of two elements: 1) research and production, represented by various enterprises, universities, state laboratories, technology parks and incubators; 2) infrastructure-providing, including institutions of a legal, financial and social nature, which in turn provide innovative processes [38]
Pobirchenko, V.	NIS is a system, the main structural blocks of which are: 1) a creative block or a block of knowledge generation (universities, research institutes, individual specialists, complex social networks that provide informal interaction between researchers from different institutes and universities); 2) technology transfer block; 3) funding block; 4) production block; 5) training block [39]

Continuation of Table 1.1

1	2
Yanenkova, I., Samarska, V., Alfiorova, A.	NIS is a complex system, which is simultaneously a process of interaction between various subjects of innovative activity and the result of this interaction. The main subsystems of the NIS are: 1) public policy; 2) science; 3) education; 4) business; 5) organizational and financial institutions of development [40]
Marchenko, E.	The main components of the NIS are four elements: 1) knowledge generation – a set of organizations that carry out fundamental research and development, as well as applied research; 2) education and training; 3) the production of products and the provision of services covering the production of science-intensive products produced by corporations, representatives of small and medium-sized businesses, whose labor vector is directed to science; 4) innovation infrastructure containing business innovation, telecommunications and trade networks, technology parks, business incubators, innovation and technology centers, consulting firms, financial structures [41]
Fedulova, L.	The structure of the NIS includes subsystems: 1) a subsystem which activities are focused on providing the innovation process with intangible resources; 2) a subsystem, the elements of which are directly involved in the innovation process; 3) a subsystem which function is to provide innovative activity with material resources [42]
Demchishak, N.	NIS is a set of relations about the creation, dissemination and use of innovations within a certain country, determined by national socio-cultural specifics, geopolitical features and economic development strategy. At the same time, its key elements (components) are: 1) knowledge generation is a set of organizations engaged in fundamental research and development, including research institutions, leading universities, etc.; 2) production of innovative products are the production of science-intensive, high-tech products, as well as the provision of services, the commercialization of new organizational and marketing solutions, and other activities carried out directly by innovators; 3) innovation infrastructure is technology parks, business incubators, innovation centers, science parks, etc.
Bagrova, I., Cherevko, O.	NIS includes two subsystems: a subsystem for generating and disseminating knowledge and a subsystem for innovation infrastructure [44]
Karpun, I.	The main structural elements of the NIS are: 1) knowledge generation, education and training, production of products and services; 2) innovative infrastructure, including financial and information support [45]
Griga, V.	The main subsystems of the NIS are: the system of knowledge generation and the system of its application (business, industry), which are the main participants in technological development; state and innovation infrastructure. At the same time, the knowledge generation system is responsible for the emergence of new knowledge and, to a certain extent, for its application in the country's economy. The system of application of knowledge directly consumes new knowledge obtained in the process of interaction with the system of its generation [46]

● **Continuation of Table 1.1**

1	2
Tsybulev, P.	NIS is a system consisting of three interconnected subsystems: 1) the subsystem of the innovation process, which embodies the model "from an idea to the implementation of innovative products on the market" and consists of four stages: research; development; production; implementation; 2) the subsystem of state assistance to innovation activity (the impact of the state can significantly change the final result, despite the "self-sufficiency" of the subsystem of the innovation process as such); 3) a subsystem of international relations in the field of innovation, which influences institutions and represents the indicated four ways [47]

● **Table 1.2** The most common definitions in the scientific literature of the category "National innovation system" (according to the criterion of the institutional-system approach)

Author (authors)	Definition, source
1	2
Freeman, C.	NIS is a network of institutions in the public and private sectors whose activities and interactions are aimed at initiating, importing, modifying and disseminating new technologies [33]
Lundvall, B.	NIS is a set of elements and their interrelations that ensure the creation, dissemination and use of new and economically useful knowledge localized within the boundaries of the nation state [34]
Nelson, R.	NIS is a set of institutions whose interaction determines the innovative productivity (efficiency) of national firms [48]
OECD Experts, Oslo Management	NIS is a set of institutions of the private and public sectors, individually and in the process of interaction determining the development and dissemination of the latest technologies, creating prerequisites for the development and implementation of state innovation policy [49]
Metcalfe, S.	NIS is a set of different institutions that jointly and individually contribute to the development and dissemination of new technologies and form a framework within which governments form and implement policies to influence the innovation process [50]
Galli, R., Teubal, M.	NIS is a historically established subsystem of the national economy, in which different organizations and institutions interact and influence each other in the process of implementing innovative activities [37]
Nelson, R., Rosenberg, D.	NIS is a number of institutions whose interaction describes the innovative activities of Russian companies [37]
Patel, P., Pavitt, K.	NIS is national institutions, their incentive structures and their competencies that determine the speed and direction of technical training (or the volume and composition of the change in activities) in the country [37]
Edquist, C.	NIS is all important economic, social, political, organizational, institutional and other factors affecting the development, dissemination and use of innovations [37]
Yim, D.	NIS is government, research institutes and other research organizations, universities, research and development enterprises, financial institutions [51]

● **Continuation of Table 1.2**

1	2
Fedulova, L., Pashuto, M.	NIS of the state is a set of interconnected organizations (structures) engaged in the production and commercialization of scientific knowledge and technologies within the national boundaries of small and large enterprises, universities, laboratories, technology parks and incubators as a complex of legal, financial and social institutions that ensure innovation processes and have national roots, traditions, political and cultural features [52]
Shapovalova, L.	NIS is an integral set of institutions interconnected within one country, whose activities are aimed both at implementing innovative transformations in the national economy as a whole and at creating favorable conditions for organizing innovative activities [53]
Bilozubenko, V.	NIS is a complex of interrelated institutions of organizational and legal nature, connected by a special structure, ensuring the flow of the national innovation process, its individual stages, as well as the participation and regulatory role of the state in the field of innovative development [54]
Sharko, M.	NIS is an economic mechanism based on the development and exploitation of new knowledge, an entrepreneurial approach, integration into foreign markets and the accelerated development of the competitiveness of the country and its regions [55]
Kuzmenko, O.	NIS is a historically, culturally, economically, scientifically, technically and informationally conditioned set of relations between the subjects of innovative activity regarding the creation, dissemination and use of innovations, which takes place within a certain country [56]
Kavtysh, O., Grechko, A.	NIS is a dynamic, open, structured subsystem of the international innovation system, consisting of interconnected actively collaborating institutions and supporting institutions involved in the process of creating, accumulating and implementing scientific knowledge, techniques and technologies, taking into account the legal, economic, organizational, socio-cultural conditions of the innovation process within the national economy and based on the strategy of scientific and technological development, the main goal of which is to increase the competitiveness of the economy and the standard of living of the population [57]
Shabelnikova, E.	NIS is a complex of legislative, structural and functional elements that are directly involved in the process of formation and implementation of scientific knowledge and technologies, thereby providing economic, organizational, social and legal conditions that ensure dynamic innovative development [58]
Ponomarenko, V.	NIS is characterized by three main features: 1) is identified with the innovation infrastructure; 2) are special integrated structures that have the characteristic of innovation and whose functions are innovation; 3) is based on the mechanism of the relationship between the elements of the system [59]

A detailed analysis of the interpretations of the definition of "National Innovation System", given in **Tables 1.1**, **1.2**, allows to draw the following conclusions:

1. The definitions given in the two tables are only a part of the totality of the most common interpretations of this definition, which are offered by domestic and foreign researchers of the NIS problem. At the same time, the formation of just such a selection of definitions of this category took place directly in the process of "filling" the indicated tables, while observing the basic principles of ensuring the maximum representativeness of this selection. In other words, the definitions

presented in the tables fully reflect the entire range of the most common interpretations of the definition "National innovation system".

2. Despite the existing "visible" differences between the definitions of the NIS category based on the structural-functional approach (**Table 1.1**), they all single out, one way or another, four main subsystems, which can be generally characterized as:

– knowledge generation subsystem;

– production subsystem;

– financial support subsystem;

– subsystem of innovation infrastructure.

In other words, the vast majority of scientists in the field of innovation consider these four subsystems as integral (or "mandatory") components of an integral and effective National Innovation System. At the same time, "significant" differences in the number of NIS components (and, consequently, in the functional purpose of each of them), cited by the authors in their formulation of the essence of this definition, can be considered as a consequence of a certain "extreme" in approaches (or "overly generalized", or "overly detailed") to the classification of the main structural elements of the National Innovation System.

3. Most scientists in their research focus on identifying the key components of the NIS and their functional classification. At the same time, the question of the "system of links" between these components basically remained outside the main attention of researchers. Only a small number of scientists in their works tried to outline and characterize such links, while noting their functional nature [38–40, 42, 43, 47]. Obviously, inadequate attention to the study of the system of links between the main components of the National Innovation System is a significant problem, since such an approach does not reveal the essence of their interaction with each other, which ultimately makes it impossible to understand "how exactly does the NIS function?" (in other words, only a set of NIS components, without a system of interconnections between them, is not a "functioning active system").

4. Almost all are given in **Table 1.2** definitions of the National Innovation System based on the institutional system approach, outline it quite fully, complete and at the same time are characterized by a certain scientific significance in the theoretical aspect. However, almost all of them define the NIS too generally, without revealing its essence as an "active system", and do not characterize the features of its formation and functioning. In other words, from the applied, practical side, such an approach cannot be considered sufficiently informative.

Thus, the intermediate conclusions formulated above make it possible to determine the direction of further research to determine the key components of the NIS and the system of relationships between them. At the same time, the next stage of the study will be based on the structural-functional approach, which is quite natural, taking into account the results of the analysis already mentioned above. (Observing the principle of objectivity of research, it should be noted that only in domestic specialized publications there are more than ten different scientific approaches to the definition of the category "National innovation system". Thus, in her dissertation work, the Ukrainian researcher Nosovets, A. identifies and classifies such scientific approaches to the definition of NIS:

macroeconomic and mesoeconomic approach, American and European (and additionally within each of them – broad and narrow) approach, as well as systemic, institutional, object-subject, historical-empirical, knowledge and relationship approaches [60]. It is quite obvious that such a systematic and detailed classification of the currently known definitions of the category "National innovation system" is important, first of all, for studies that have a theoretical orientation or study the features of the semantics of such interpretations. At the same time, such a detailed classification of scientific approaches is usually not used in applied research, since they do not reveal the "physics of the processes of a certain phenomenon" or "the mechanism of functioning of a certain process").

The next stage of this study, as noted above, is to identify the key elements of the National Innovation System, as well as the relationships between them. The analysis of the main NIS components, according to which scientists in this field reveal its essence in their works and single them out as key elements of an integral system, made it possible to identify the following four subsystems of the National Innovation System according to the structural and functional criterion:

1) knowledge generation subsystem;

2) production subsystem;

3) financial support subsystem;

4) subsystem of innovation infrastructure.

Obviously, the proposed structure of the NIS based on four subsystems (this does not yet take into account the subsystem of interconnections between them) requires additional explanation regarding the essence (or content) of each of these subsystems. At the same time, it seems quite logical that such content of filling the main components of the National Innovation System can be revealed based on the characteristic functions that each of these subsystems should provide for the formation and functioning of the entire NIS.

Thus, the knowledge generation subsystem – as a set of various institutions that produce, use, transfer and disseminate the knowledge necessary for the process of innovation – includes: universities, educational and research centers, academic and industry research institutes, scientific laboratories, training and retraining organizations personnel in the field of information technology management, institutions for patenting, licensing and consulting (on issues of protection, protection, evaluation and use of intellectual property, as well as evaluation of the commercialization of scientific results), information system objects (analytical and statistical centers), innovative business incubators, business accelerators, start-ups and various public associations of innovators and inventors.

The composition of the production subsystem – as a set of business entities that produce innovative products, provide services and (or) are consumers of technological innovations [35] – includes: all enterprises engaged in innovative activities (regardless of their size or organizational and legal form), scientifically – production enterprises, production and technological structures (technoparks, technology hubs, innovation and technology centers, pilot production), as well as all enterprises in the IT sector.

The subsystem of financial support – as a set of various financial institutions directly involved in the process of innovation by financing operations related to the creation (production), implementation and dissemination of innovations – includes: banks and various credit institutions, services

provided in the field of innovation, investment, venture and insurance funds, other funds for supporting innovation (usually industry or specialized), credit guarantee organizations of the non-banking sector, financial and industrial groups that systematically finance innovation, as well as various crowdfunding platforms financing startups.

As for the innovation infrastructure subsystem, its content is identical to the definition of "innovation infrastructure", which is defined by the Law of Ukraine "On Innovation", according to which it is "a set of enterprises, institutions and organizations, their associations that provide services to ensure innovation (in particular, financial, consulting, marketing, information and communication, legal, educational)" [61].

The above definitions of the key subsystems of the National Innovation System, as well as the presented list of the main institutions that make up each of them, are designed to clearly outline the structure of the NIS and characterize the specific functions of each of its components.

At the same time, further analysis of the entire set of these institutions as "primary" (or "basic") elements of the National Innovation System revealed the lack of validity of this approach to identify just such structural and functional subsystems of the NIS. Yes, almost all the elements related to the subsystem of the innovation infrastructure of the NIS are part of its other three subsystems. Moreover, these institutions cannot be considered "characteristic" elements of the fourth subsystem, since each of them is already a "characteristic" element for "its own", respectively one of the other three subsystems of the National Innovation System.

In other words, enterprises, institutions and organizations that provide services to ensure innovation activity are characteristic institutions, first of all, of the production subsystem of the NIS (and therefore they are not part of the innovation infrastructure); accordingly, educational and scientific institutions, as well as consulting, marketing and information and communication structures in the field of innovation are characteristic elements of the knowledge generation subsystem, and financial institutions, which activities are related to the processes of generating, producing and implementing innovations, are characteristic elements of the financial subsystem.

So, based on the identification of all the "basic" elements of the NIS according to the criterion "characteristic"/"not characteristic" for each of the four previously identified subsystems, it is possible to conclude that only three of them are "unique" – the knowledge generation subsystem, the production subsystem and the financial support subsystem. At the same time, the fourth functional component of the NIS, the innovation infrastructure subsystem, is actually not unique, since all organizations and institutions that, according to many domestic scientists, constitute its content, are actually part of the other three subsystems of the NIS.

At the same time, it should be noted that the scientific approach, according to which the innovation infrastructure is singled out as a separate subsystem of the entire National Economy, is sufficiently justified. Its obviousness is as follows:

1) all institutions that are part of the domestic economic system can be conditionally divided, according to the criterion of their level of innovative activity, into two sets – "innovatively active" and "ordinary" (or "innovatively inactive");

2) in the process of implementing the model of innovative development of the national economy of the country, the entire set of "innovatively active" (regardless of the scope of their main activity – educational and scientific institutions, manufacturing enterprises, financial and credit institutions, etc.) can be considered as an innovative infrastructure of the entire economic country systems. At the same time, it is advisable to group the set of "ordinary" institutions according to the sphere of the main activity of the institutions included in this set.

The correctness of this approach is obvious. However, it cannot be used to classify the components of an effectively functioning National Innovation System, since all of them, without exception, must be innovatively active (otherwise, it is impossible to form a real functioning NIS). Moreover, the very concept of "innovative infrastructure of the NIS" (i.e., "innovative infrastructure of the innovation system") seems to be not entirely correct: after all, if it is interpreted literally, then all three other functional components of the National Innovation System that were described above can be considered also as separate components of the innovation infrastructure of the NIS (since their "basic" elements are characterized by innovatively active institutions), which loses the meaning of such an approach.

Thus, based on the analysis carried out, it can be concluded that it is unreasonable to single out the innovation infrastructure as one of the key functional components of the National Innovation System. At the same time, this does not mean that the other three subsystems described above, the validity of identifying which as the main functional components of the NIS was confirmed by the results of the study, form the "completed" structure of the National Innovation System.

The main argument in favor of the assertion that the structure of the National Innovation System can be formed by more than three of its functional subsystems listed above is the fact that the input data for the analysis of the main components of the NIS were only well-known results of previously conducted research by scientists in the field of innovation. That is, the most common approaches to determining the structure of the NIS by institutional or functional criteria were taken into account (as noted above). At the same time, the results of some recent scientific publications regarding the presence in the structure of the National Innovation System of special institutions that are "characteristic" exclusively for the NIS have not yet been taken into account at this stage of the study.

One of such modern approaches to the formation and functioning of the National Innovation System is the approach that justifies the presence in its structure of such elements as "investment and innovation systems" (IIS) [62], which are integral components of the NIS. Moreover, according to some researchers, IIS are characteristic components exclusively for the National Innovation System, and therefore, one of its key elements [63]. At the same time, the obvious confirmation that investment and innovation systems are a characteristic component of the NIS is precisely the definition of this definition: "an investment and innovation system is such a socio-economic system that, as a result of the implementation of innovation activity, forms "new" investment resources with the aim of use for the production of "new" innovations" [63].

In other words, "an investment and innovation system is a system that provides the possibility of permanent and cyclical transformation of investments into innovations and vice versa with

a constant increase in their value" [64]. The above definition of the IIS category is fully consistent with the main goals of the creation and functioning of the NIS – ensuring consistency in the processes of generating, producing, implementing and distributing innovations in the national economy of any developed country in order to achieve maximum efficiency in the field of innovation.

So, based on the above results of the analysis, as well as the materials of previous studies, it can be concluded that the functional structure of the National Innovation System consists of four subsystems: the knowledge generation subsystem, the production subsystem, the financial support subsystem, and the investment and innovation systems subsystem. In this case, the "characteristic" elements of the fourth subsystem are exclusively IIS, i.e. regardless of their economic activity and industry affiliation. (It should be noted that the main issues affecting the essence of the IIS, as well as the features of their formation and functioning, will be considered in the following subsections of this study. At the same time, at this stage of the analysis of the structure of the NIS, the use of previously published results of the study of investment and innovation systems to argue that they are a characteristic component of the National Innovation System seems quite reasonable and sufficient).

The identification of the four main functional subsystems of the NIS cannot be considered the final stage of this stage of the study, since the question of how exactly the interaction between them occurs remains unanswered. In other words, in order to reveal the essence of an effectively NIS functioning, it is not enough just to identify its key components, but it is also necessary to identify all the links that exist between them and characterize them. (It should be noted that in systems theory there is a scientific approach, according to which in complex systems all links between their main functional subsystems are singled out into one subsystem of links and, at the same time, it is considered as another functional subsystem [65]).

The results of the study of the main publications on the issues of NIS revealed an insufficient level of attention to the study of the system of links between the main components of the National Innovation System (this was already noted above). Therefore, to identify the existing links between the specified functional subsystems of the NIS, it is advisable to apply a different scientific approach based on the results of earlier studies of the "system of links between the main participants in innovative activity" [66]. (It should be noted that this approach is described in detail in the guidelines for the study of regulatory factors in the formation of the innovative climate of enterprises [67], the author's monograph [66], as well as some other scientific publications).

Thus, earlier studies based on the above approach made it possible to single out (at the micro level) three categories of participants in the innovation process – an idea generator, an enterprise and an investor in an innovation project, as well as three categories of links that exist (or may exist) between them – information, regulatory and financial relations [66, 67].

Obviously, these three components of the process of innovation activity (at the micro level) do not require any additional explanation. Moreover, they can be considered as a kind of "responders" to the main subsystems of the macro level, that is, the functional subsystems of the NIS. That is, the "idea generator" component (at the micro level) conditionally "corresponds" (at the macro level) to the knowledge generation subsystem, the "enterprise" component conditionally "corresponds" to

the production subsystem, and the "innovation project investor" component to the financial support subsystem.

At the same time, the above three categories of links between the main components of the innovation process require a detailed explanation.

To define all three categories of relationships (at the micro level), it is advisable to use their definitions formulated in the results of previous studies.

So, information links are links that "provide: the search for "ideas", "generators of ideas", as well as potential investors of an innovative project; conducting their rating and comprehensive assessment; choosing the best option.

Regulatory links provide: participation (legal and economic) of each of the parties in the process of implementing an innovative project; development of technical and economic documentation of an innovative project; formation, regulation and observance of the rights and obligations of each of the parties; amending existing agreements; resolution of disputes between the parties.

Financial ties provide a financial opportunity to implement an innovative project" [66]. (It should be noted that the wording of the above definitions of the categories of links, as well as their qualitative assessment, carried out on the basis of such criteria of links as the "importance" and "value" of information, are based on the results of studies previously conducted by the Ukrainian scientist Vovkanych, S., in science-intensive economy of an innovative society [68]).

Thus, taking into account the conditional similarity of micro- and macro-level systems (according to the criterion of the main activity of these systems – the generation, production, implementation and dissemination of innovations), as well as the fundamental similarity of the functions of their main subsystems (with the exception of the IIS subsystem, which does not have its own "respondent" on micro level), it can be stated that the above definitions of the three categories of links between the main components of the innovation activity process (at the micro level) can serve as a kind of basis for formulating definitions of the categories of links between the functional subsystems of the National Innovation System (at the macro level).

Therefore, on the basis of the studies carried out, it is possible to formulate the definition of three categories of links (at the macro level) that exist between the characteristic subsystems of the NIS and thereby ensure its functionality and viability.

Information links are links that create and/or provide the possibility of joint participation of all functional subsystems of the NIS in the processes of generation, production, exchange, distribution, accumulation and preservation of new knowledge necessary for the implementation of innovative activities. The main object of this category of links is "information", which is characterized by "the third level of importance (this is information of a creative nature)" [66] and a high value of its "value", i.e. it is "considered as an investment in the innovative development of the future and is described by the inequality: "the value of information $\gg 1$" [68].

Regulatory links are links that create and/or provide the possibility of legal regulation of the joint participation of all functional subsystems of the NIS in the processes of innovation. The main object of this category of links is "information" of a legal and/or economic orientation, which is

characterized by "the second level of importance (this is specialized typical information that allows solving complex typical production issues)" and the average value of its "value", i.e., information is valuable for solving specific urgent problems and is described by the inequality: "the value of information ≥1" [66].

Financial links are links that create and/or provide the possibility of direct participation of all functional subsystems of the NIS in the processes of innovation. The main object of this category of links is cash flows in any of their forms (targeted receipts, investments, loans, grants, equity participation, etc.).

Thus, having outlined all the functional subsystems of the National Innovation System, as well as the characteristic links between them, it is possible to visualize the block diagram of the current NIS (**Fig. 1.1**).

The block diagram of the national innovation system shown in this figure makes it possible to explain the algorithm and the basic principles of its functioning. Thus, the interaction between the main subsystems of the NIS begins primarily through the formation of direct information links between the individual elements of these subsystems. It is obvious that such links are conditionally "primary" (i.e., they can be formed between different economic entities without the presence of links of other categories between them – regulatory or financial). Moreover, the "primacy" of information links is also manifested in the fact that their effective functioning between specific elements of various NIS subsystems is a necessary condition for the formation of regulatory links and a partial prerequisite for the formation of financial links between these subjects of management.

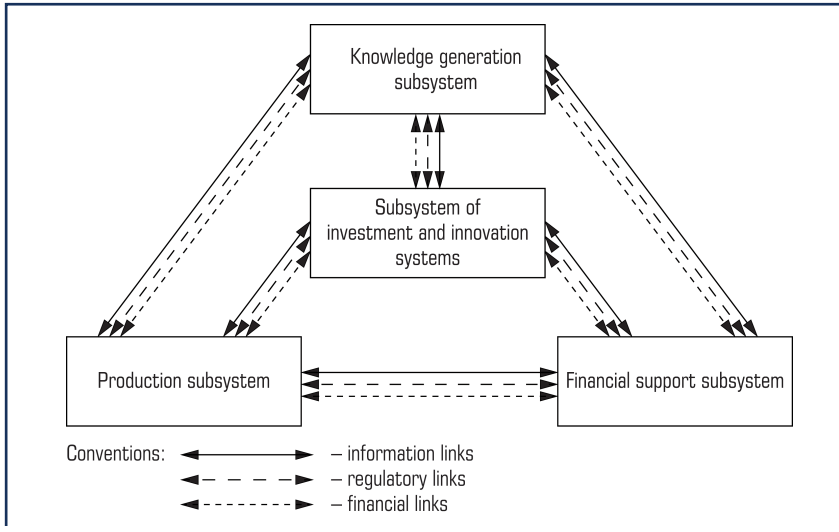

Fig. 1.1 Structure of the National Innovation System (NIS)
Source: author's development

Further analysis of the presented scheme allows to formulate another important statement: the totality of information links between the individual elements of the key components of the National Innovation System form stable information links between the most functional subsystems. At the same time, the quantity and "quality" of such links – that is, the volume and "quality" of information, the transfer of which they provide at the stage of existence of only this category of links – characterize the level of the innovation climate of the entire socio-economic system [66], i.e. in this case, the level of innovation climate of NIS.

Regulatory links between individual elements of different components of the National Innovation System can be formed only after information links have already been formed between them, but there are no financial ones yet. Therefore, regulatory links can be considered conditionally "secondary", since, firstly, they are formed on the basis of an already functioning set of information links between individual elements of the key components of the NIS, and secondly, they are a prerequisite for the emergence of financial links between these elements. At the same time, the number and the "quality" of the totality of information and regulatory links – that is, the volume and "quality" of information, the transfer of which is ensured by the interconnected functioning of the set of stable links of these two categories between the key subsystems of the NIS – characterize the level of innovation potential of the National Innovation System (in the general case, the totality of information and regulatory relationships characterize the level of innovation potential of any socio-economic system [66]).

Such changes, the "transformation" of the innovative climate of the NIS into its innovative potential, are primarily due to the fact that the formation of regulatory links changes the "level of functioning" of already existing information links: they develop, their characteristics (both quantitative and qualitative) improve significantly, and the "quality" of information (primarily of a creative nature) is growing dramatically.

It is obvious that financial links between the functional subsystems of the National Innovation System can be formed only after an interconnected set of stable information and regulatory links has already been formed between them. As a result, an integral subsystem of the necessary links is formed, which, providing the interaction between the other four key subsystems, turns a simple set of main components into a capable and efficiently functioning NIS.

Thus, summarizing the results of the study, it can be stated that the outlined and designated main four components of the NIS are its functional subsystems, and the effective interaction between them, which occurs through the use of a set of information, regulatory and financial links, ensures the consistency and systematic nature of the generation processes, production, implementation and dissemination of innovations in society, which in fact is the main goal of the formation and functioning of the National Innovation System.

At the same time, it should be noted that among all the above functional subsystems of the NIS, investment and innovation systems occupy a special place in it. They are the defining elements of the NIS and characteristic institutions of exclusively economically developed countries of the world.

The note indicates the need for further research on the features of the formation and functioning of IIS.

1.3 INVESTMENT AND INNOVATION SYSTEMS: THEIR ESSENCE AND FEATURES OF FUNCTIONING

As already noted, investment and innovation systems are institutions that are characteristic only for those countries whose economy corresponds to an innovative development model. Otherwise, if the national economy today is based on the principles of the traditional development model, the emergence of IIS in the economic space of such states seems unlikely or premature (i.e., in a non-innovative economy there are no prerequisites either for the creation of such institutions or for their effective functioning).

This means that the absence of this type of institutions among all types of business entities in a non-innovative economy makes it impossible for such a country to form its own NIS. Therefore, it should be considered fair to say that investment and innovation systems are the defining elements of the National Innovation System (and, accordingly, their combination forms the defining subsystem of the NIS) and characteristic institutions exclusively for the economically developed countries of the modern world.

It should also be noted that the other three functional subsystems of the NIS – the knowledge generation subsystem, the production subsystem and the financial support subsystem – are integral components of the National Innovation System, necessary for its formation, effective functioning and development (as mentioned earlier). However, they cannot be considered "characteristic exclusively for NIS", since all elements of these subsystems exist and function for a fairly long period of human development (long before the formation of an innovative economy), therefore, they are "typical", in fact, for any economic system, regardless of its model, management system, level of organization of production and other defining features of a particular social formation.

At the same time, the assertion that such elements are "typical" for any economic system does not mean that their activity in the conditions of an innovative economy, and even more so within the framework of the functioning of the NIS, is "the same" as in a non-innovative economy. In other words, the activity of such institutions as "generators of ideas" ("generators of new knowledge"), production systems and financial institutions, as participants in the innovation process within the framework of the functioning of the NIS, differs significantly from the functioning of similar institutions in a non-innovative economy, and primarily in terms of their level of organization and management.

The formulated statement is based on the following logically obvious dependencies and regularities.

1. The data of international statistical reference books [69] and ratings [70] show that the quantity and quality of innovations generated, produced, implemented and distributed in an innovative economy is much higher than in a non-innovative economy, which is undoubtedly obvious. At the same time, this means that the level of intensity (as well as the effectiveness) of the activity of typical institutions in different models of economic systems differs significantly from each other. That is, the dynamics and effectiveness of all processes – processes occurring both "inside" each such institution, and between the institutions themselves belonging to the same or different functional subsystems of the NIS – are much higher in an innovative economy than in a non-innovative economy, which characterizes significantly a higher level of quality of the functioning of these "typical" institutions, and hence the level of quality of their management.

2. One of the prerequisites for the effective operation of the National Innovation System is the achievement of "synchronism" in the work of all four of its functional subsystems, and hence the totality of the elements included in each of them (according to the theory of systems, only under this condition can a "system effect" arise [71] or synergy effect [72]). This means that the level of efficiency of the functioning of typical institutions (primarily the level of their organization and management) must correspond to the level of efficiency of the functioning of the newest institutions, and in this case, investment and innovation systems.

3. The modern sphere of innovation is characterized by a reduction in the duration of the life cycle of innovations [73] and the expansion of areas of innovation activity [74]. This occurs as a result of increasing the dynamics of processes in all NIS subsystems (additionally confirming the previously formulated regularities) and expanding the activity of the elements of these subsystems themselves. For example, the leading universities of the world, which are characteristic elements of the knowledge generation subsystem, today quite often take a direct part in the "production processes" of creating the final innovative product, actively engaged in its production and distribution (i.e., without involving the institutions of the production subsystem). Moreover, at the same time, they can also act as the main investors in the implementation of a specific innovative project (i.e., without the involvement of institutions and subsystems of financial support [75]).

It is obvious that a similar situation with a "temporary change in the status" of a "characteristic" institution of one or another functional subsystem of the NIS, in the process of implementing its innovation activities, can now be observed in almost all components of the National Innovation System. This means that "typical" institutions that are "characteristic" of their functional subsystem of the NIS acquire the features of "migratory" institutions that, at different stages of the innovation process, can perform the functions inherent in the institutions of other functional subsystems of the National Innovation System.

Thus, the presence in the national economy of effectively functioning "characteristic" institutions with signs of "migratory" significantly reduces the duration of the life cycle of innovations. This is primarily due to the shortening of the period between the stage of "generation of new knowledge" and the stage of "creation of innovative products". Such a reduction in the duration of the specified period becomes possible by reducing the so-called "non-technological time losses" in the process of implementing innovative activities (non-technological time losses are the time required to form a system of links (information, regulatory and financial) between the main participants in the innovation process ("generators of ideas", production systems and investors of the innovation project) in order to carry out innovation activities).

In this case, a modern enterprise, which, for example, "specializes" in the production of innovative products and has a unit in its structure that purposefully and systematically "generates ideas", and at the same time its financial management actively uses the latest tools to finance innovative activities (fundraising), crowdfunding [76]), the other two participants in the innovation process, which are usually necessary for a "traditional" enterprise to implement a specific innovation project, may become "unnecessary". At the same time, such a modern enterprise (and in the general

case, a "production system") acquires the features of a "migrating" institution, since it "takes over" the functions of "typical" institutions of the other two NIS subsystems. Obviously, a similar situation can arise among organizations that are typical institutions of the other two functional subsystems of the National Innovation System – knowledge generation and financial support. As a result, they can also "take over" the functions of institutions that are characteristic of other subsystems of the NIS, and therefore acquire the features of a "migrating" institution.

Thus, the above justifications of the previously formulated assertion that in the conditions of the functioning of an innovative economy (and, consequently, in the conditions of the functioning of the NIS), the innovative activity of typical institutions differs significantly from the activities of similar institutions in a non-innovative economy, allows to draw the following conclusions:

1. One of the prerequisites for the formation and effective functioning of the National Innovation System is an equally high level of development of all subsystems (and, consequently, the elements of these subsystems), which makes it possible to "synchronize" their activities within the NIS. This means that the level of organization and management of typical institutions as a whole should correspond to the level of organization and management of the "latest" institutions that are characteristic exclusively for the National Innovation System, that is, investment and innovation systems.

2. One of the features of the functioning of "typical" institutions in the innovation economy in general and in the NIS in particular is that they can "temporarily change" their status as a participant in the innovation process (idea generator – production system – investor of an innovation project) at different stages of the innovation process. This means that according to the criterion of the ability of one organization to independently (i.e. without the participation of other participants) perform various functions in the process of innovation, "typical" institutions partially acquire (or can acquire) some features of IIS, in particular, independently, self-sufficiently and with relatively equal efficiency to perform three main functions within the framework of a single innovation process – investment, production and innovation. (It should be noted that this ability is characteristic of investment and innovation systems and is determined by the specifics of their operating activities, which combines three sub-types of activity – investment and innovation (investing in the process of generating new ideas and new knowledge), production (production of innovations, production innovative products) and innovation-investment (turning the results of innovation into new investments necessary for further innovation)).

3. The presence of similar features between typical institutions and investment and innovation systems regarding their ability to independently and self-sufficiently perform various basic functions of innovation activity allows to state that the features of organizing the IIS activities and managing them are (or may be) relevant for the management and organization of activities "model" institutions operating within the framework of the National Innovation System.

Thus formulated conclusions indicate the need for an in-depth study of the features of the functioning of investment and innovation systems, as well as the processes of organizing and managing them.

A kind of confirmation of the need for such research can also be the fact that today in the scientific space there are quite a few publications (both domestic and foreign authors) directly

related to the problems of the functioning of investment and innovation systems, or problems related to their activities.

At the same time, only a relatively small number of research results published by scientists in the field of investment and innovation systems [77] (including studies of categories semantically similar to IIS, in particular, innovation and investment clusters [78], innovation and investment dominants [79], investment and innovation systems [80], investment and innovation models [81], innovation and investment complexes [82], innovation and investment mechanisms [83], innovation and investment instruments [84], innovation and investment levers [85], innovation and investment components [86], etc.) makes it impossible to conduct a comprehensive analysis of the processes of organizing IIS and the features of their management.

Moreover, this situation indicates the need for a priority study of the general problems of the functioning of the IIS, which will fully reveal the essence of such institutions, determine the mechanism of their activity and its main tools. And only after that it will be possible to conduct further research on the organization of investment and innovation systems and the features of their management.

However, the aforementioned problem is further complicated by the fact that, firstly, in the vast majority of scientific publications of this direction – exploring the various "innovation-investment" or "investment-innovation" objects mentioned above – their authors do not give their own formulation of such definitions, no generally accepted interpretation. Secondly, the names of the categories described above, which are semantically similar to "investment-innovation" systems, are often formulated by their authors "mirror", that is, either "innovation-investment mechanisms" [87] or "investment-innovation mechanisms" [88]. At the same time, there is no explanation in the publications themselves as to why exactly this wording, and not vice versa, should be used to define this category. Moreover, in such scientific articles there is no analysis of whether institutions differ from each other, which in the scientific literature mean "mirror" – "investment-innovation" and "innovation-investment" objects (and if they differ, then what is the essence of such a difference), whether these categories are identical.

Therefore, for further research, given the above problems, it is necessary to formulate two remarks:

1) the names of objects (categories) that contain "mirror" phrases "investment-innovative" or "innovative-investment" in this study should be considered identical, since their authors in their publications do not define such definitions, and do not emphasize because it is this sequence of categorical adjectives that should be in these phrases;

2) to define the category "investment-innovation system" it is necessary to use just such a sequence of categorical adjectives in the phrase "investment-innovation" (rather than "innovation-investment"), since it is this formulation that reflects the logic of the process of implementing innovation activity, where investments act as a "resource" necessary for the implementation of such activities, and innovations – its end result, the product of such activities.

As noted above, IIS are the key and defining elements of the National Innovation System (their totality forms one of its four functional subsystems) and characteristic institutions for both economically developed countries and NIS. At the same time, one of the features of the functioning

of the National Innovation System itself is the so-called "interactive activity of the NIS institutions" [66], which can be effectively carried out only if the national economy (and society as a whole) has an integral system of links between them – informational, regulatory and financial.

Thus, it is logical to assume that the most effective approach (from the point of view of the possibility of obtaining results of an applied nature) to reveal the essence of investment and innovation systems is an approach based on the definition of the "physics of processes" [89] of the mechanism of their functioning.

One of the features of this approach is that when conducting a study of the physics of the processes of the mechanism of functioning of IIS within the framework of the NIS, it is necessary to take into account their "subject-object" nature (which, of course, leads to the "complication" of such studies):

– at the level of a separate investment and innovation system, it is an independent subject, that is, a subject that generates "its own" processes and ensures their flow at "its own" level (at the level of functioning of the IIS itself);

– at the level of the National Innovation System (and in the general case at the level of the national economy of the country) – this is an object of the "general process", that is, a component (element) in the total set of processes and elements of the NIS, the coordinated and interconnected activity of which ensures the generation, production, implementation and dissemination of innovations, as well as the use of the results of each of these stages [66].

Therefore, taking into account such a feature, which is objective within the framework of this study, and also taking into account the significant diversity of IIS institutions (this is manifested in the presence of a large number of their fundamentally different organizational structures and forms, various organizational management systems, areas and directions of their activities, various branch affiliation, as well as other features characteristic of the newest organizations in the innovation economy), it is most optimal, from the point of view of revealing their essence, to consider the category "investment and innovation system" in dynamics, that is, by examining those changes in the general innovation process as well as post-innovation activities, which, in fact, are due to the presence of IIS and their functioning as characteristic institutions of the NIS. At the same time, it is important to note that such changes must be "formalized" (i.e., they must be expressed in the form of one or another "typical" scenario of the development of the situation), which, as a result, will allow them to be classified and thereby reveal the real essence of investment and innovation systems through their influence on the course of processes in the field of innovation.

Surely the last remark that needs to be made before starting this stage of the study is that, according to the definition of the definition of "investment and innovation system", one of the basic functions of its main activity is "turning investments into innovations" [66] (in fact, this is one from the stages of its production process). And as noted earlier, the process of innovation activity of any socio-economic system (including IIS) is based on the algorithm for the targeted conversion of investments into innovations, which indicates a significant similarity between the institutions of "IIS" and "non-IIS in the course of their innovation activities.

This means that at the beginning of this stage of the study, all institutions of the National Innovation System (i.e., both "IIS" and "non-IIS") should be considered as "ordinary" socio-economic systems that carry out innovative activities. At the same time, significant differences between them begin to appear precisely at the stage of their post-innovation activity, that is, after they create a specific innovative product, reaching the level of classification differentiation between these institutions.

As a result, on the basis of an assessment of the defining differences, it will be possible not only to identify the "investment-innovation system" among all socio-economic systems that carry out innovative activities (i.e., to clearly differentiate the categories "IIS" and "non-IIS"), but also to reveal their essence.

Thus, based on this approach to the subject of research (taking into account the definitions described above, the reservations and restrictions that it provides), the definition of "investment and innovation system" and the main goal of its functioning, as well as using the scenario analysis method, it is possible to conclude, the most likely are three development scenarios in the field of innovation, which are implemented by institutions (socio-economic systems) in an innovative economy.

The first possible development scenario is obviously the simplest. It assumes that the socio-economic system (SES), which has created an innovative product (as a result of its own successful innovative activity based on the "transformation" of investments into innovations) and selling it to consumers (in any of its forms: product, service, work, license, intellectual property, etc.), receives significant additional cash (financial) receipts, which leads to a significant increase in its own financial resources. At the same time, all additional income received from the sale of this innovative product, this institution completely (100 %) directs to its own consumption (to its own consumer needs).

It is obvious that such a scenario (it is schematically presented in **Fig. 1.2** as a series of successive stages of investment-innovation and post-innovation activities of the socio-economic system) identifies such an institution as "non-IIS" and is extremely unlikely for any functioning business entities (and even more so for such entities in the innovation economy in general or the National Innovation System in particular), which means that it can be considered only as a "theoretically possible" option.

The second possible development scenario (it is schematically presented in **Fig. 1.3**) can be interpreted as the "economic growth" of the socio-economic system. According to this scenario, the socio-economic system at the stage of post-innovation activity sells its own innovative product (which it created as a result of its own successful innovative activity), and all the money received from such a sale is directed not to consumption (i.e. not to its own "consumer needs" not only in the first scenario), but solely to expand its operating activities. At the same time, its operating activities are characteristic exclusively for a business entity that is not an investment and innovation system (for IIS, operating activities include three sub-types of activities – investment and innovation, production and innovation-investment, as noted above).

It is quite obvious that the last stage of the second scenario, the stage of post-innovation activities of the socio-economic system, is characterized only by the growth of the main financial

and economic indicators of its operational activities. Thus, this scenario reflects the process of possible economic growth of this institution as a result of the successful implementation of a certain innovative project by it as part of its innovative activity.

It should be noted that the economic categories "growth" and "development" are not identical. At the same time, in modern economic literature, the category "economic growth" is often identified with the category "quantitative economic development" [90]. Moreover, sometimes instead of the word "quantitative" (development) use the words "unidirectional" or "linear" (development) [91].

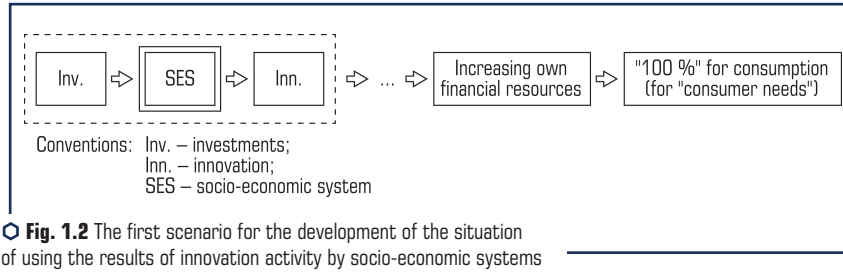

Fig. 1.2 The first scenario for the development of the situation of using the results of innovation activity by socio-economic systems
Source: Author's development

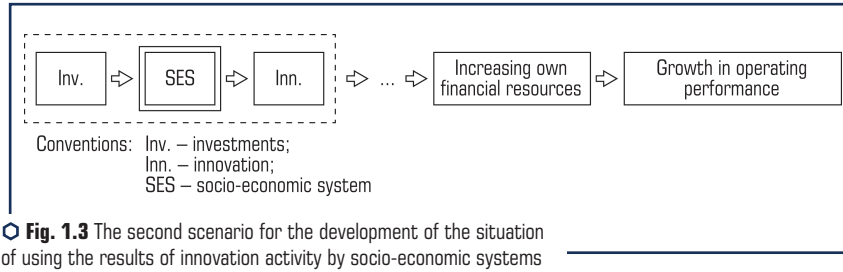

Fig. 1.3 The second scenario for the development of the situation of using the results of innovation activity by socio-economic systems
Source: Author's development

Obviously, the second scenario is quite realistic, given that such cases are not an exception or a rarity (even today) in the activities of a significant number of business entities in a non-innovative economy. At the same time, in the conditions of an innovative economy, the probability of this scenario for the development of the situation for a particular institution is extremely low, because, due to its non-orientation towards its further innovative activity, it cannot be characterized by high dynamics of the flow of all its processes and a high level of their quality (which certainly affects its information links and the quality of the information itself).

As a result, the pace of development of such a socio-economic system begins to slow down, which makes it impossible for its further "not too active" innovation activity (in the form of separate "one-time" innovation projects), and as a result, it will lead to a drop in its competitiveness in an innovative economy.

Carrying out a comparative analysis of the first and second scenarios allows to formulate some intermediate generalizations:

1. The second scenario of the development of the situation regarding the use of the results of innovative activities by business entities in the National Economy is more realistic than the first, since it provides (provides) the possibility of their economic growth (quantitative economic development), which may be a sufficient condition for the further functioning of institutions that are not investment and innovation systems, in a non-innovative economy. The first scenario does not imply such a possibility.

2. Both the first and second scenarios are a reflection of the situation in which the innovative activity of economic entities is non-systematic, that is, it is carried out, in most cases, in the form of separate "one-off" innovative projects. Moreover, the implementation of such projects is "separated" in time, that is, they are all carried out "sequentially" one after the other with a certain time lag. At the same time, the duration of such a time lag (post-innovation or inter-innovation period) is commensurate with the total duration of the life cycle of an innovative project, which indicates a low rate of dynamics of all processes in such socio-economic systems associated with their development and innovative activity.

3. Both the first and second scenarios are fully consistent with the so-called innovation model proposed by the Ukrainian scientist Vozniuk, M. in the work "Organizational and institutional conditions for investment and innovation activity in the region" [92], which confirms the correctness of the above conclusions.

Thus, the intermediate conclusions described above are quite informative for understanding the essence of such business entities whose innovative activity corresponds to the first or second development scenario. At the same time, such enterprises themselves are clearly identified as "non-IIS", which is important for the classification of institutions of the national economy and its NIS.

In addition, the second conclusion is of one more importance for further research, since it states that the sign of "non-systematic" innovation activity of socio-economic systems indicates not only the failure of their functioning in an innovative economy, but also the lack of consistency in their innovative activities (in other words, the characteristic features of the innovative activity of such business entities are both "non-systematic" and "non-systematicity"). And, in turn, the lack of consistency in innovation activity indicates that such institutions do not meet the criteria for investment and innovation systems, since they lack the defining feature of their operational activity – the ability to systematically produce innovations.

The course of the third possible scenario for the development of the situation is schematically shown in **Fig. 1.4**. It is obvious that it already meets the criteria of the model of innovative development of socio-economic systems to a greater extent, since it involves the use of the results of successful own innovation activities not for simply improving their financial and economic condition (second scenario) or eating them away (first scenario), but for the formation of "new investments" (in the diagram they are presented as "Investments ↑" or "Inv. ↑"), necessary for the further development of such institutions. Moreover, in this scenario, all three subtypes of

operating activities that are characteristic exclusively for IIS are clearly visible – investment and innovation, production, and innovation and investment.

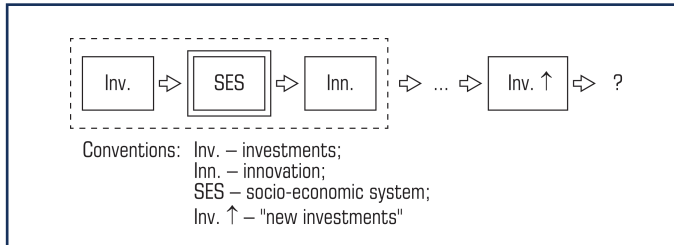

Fig. 1.4 The third scenario for the development of the situation of using the results of innovation activity by socio-economic systems
Source: Author's development

However, as can be seen from **Fig. 1.4**, this scenario is incomplete, since its last stage is still "unknown" due to the uncertainty of the "investment ↑" category. Therefore, further research requires, first of all, clarification of the category of investment ↑, which will make it possible to determine the last stage of this scenario, and hence the scenario of the development of the situation itself or its possible options.

In view of the fact that the category "investment ↑" is a kind of "derivative" of the category "investment", which is obvious according to the logic of the third scenario (as well as according to the specifics of the IIS operating activities), further research needs, first of all:

1) a clear identification of the very concept of "investment" – this is necessary for an unambiguous interpretation of this definition within the framework of this study;

2) the use of a modern extended classification of investments according to their main characteristic features – this is necessary to be able to conduct a comprehensive comparative analysis between the categories "investments" and "investments ↑" in order to identify the main differences between them, which, as a result, will allow to determine the category "investments ↑".

It is obvious that in order to define the category of "investment" in this work, given the direction of its research, it is advisable to use their most general interpretation: "Investment is an investment of capital with the aim of increasing it and making a profit" [93]. It should be noted that such a definition of this definition today is not only the most general, but also the most common in the scientific literature in the field of investment activity.

To conduct a comprehensive comparative analysis between the categories "investment" and "investment ↑", one should use their most complete general classification, presented in the works of the domestic scientist Bezpiat, I. "Basic approaches to the classification of investments", in which she, summarizing the results of scientific research of domestic and foreign authors, identifies 16 main classification features of investments [94], as well as Ukrainian scientists Belenky, P.,

Shevchenko-Marcel, V. and Drugov, A. "Investment-innovative ensuring the competitiveness of the region", in which they classify investments only in the form of their innovativeness [95].

The analysis of these signs according to the criterion of the direct and immediate impact of "investments" on "innovations" – that is, the impact of investments on the possibility of carrying out effective innovative activity – made it possible to identify only three signs that are decisive for the development of one or another variant of the final phase of the third scenario.

The first such defining feature is the feature "according to the object of investment in intangible assets", which includes two categories of investments – "innovative and intellectual investments" [94]. At the same time, the author uses the results of studies by two other Ukrainian scientists – Peresada, A. and Fedorenko, V., which mean these two categories of investments, in particular: "Innovative investments are investments in innovations, and intellectual investments are investments in intellectual property arising from copyright, inventive law, the right to industrial designs and utility models" [96].

The second defining feature is the feature "behind extensive and intensive influence on social production", which also includes two categories of investments – investments of "intensive and extensive type" [94]. At the same time, as the author of this approach himself notes, "investments, the results of which contribute to the intensification of social production, should be considered investments of an intensive type, and, accordingly, investments, the results of which contribute to the extensification of social production, are investments of an extensive type" [97].

The third defining feature is the feature "according to the criterion of the direction of actions", according to which, according to the Ukrainian researcher Leus, M., three categories of investments can be distinguished: "net investments – initial investments that are directed to the foundation of the project; extensive investments, directed direction is to increase the production potential, reinvestment – profits aimed at expanding production" [98].

Thus, the three classification features described above are decisive for revealing the essence of the "investment ↑" category in terms of the possibility of their direct impact on the innovative activity of the enterprise, which, in turn, allows to outline two possible options for completing the third scenario.

Obviously, the first such plausible option, which does not imply differences between the categories "investments" and "investments ↑" on the basis of "object of investment in intangible assets" (i.e., according to the criterion "innovative and intellectual investments", the value of "investments ↑" does not exceed the amount of "investments"), from the point of view of the possibility of their direct influence on the further innovative activity of a certain institution, cannot be considered a variant of its innovatively directed development. In this case, in the absence of prerequisites for the further innovative development of the socio-economic system, the categories "investments ↑" and "investments" may differ in terms of their values and on the basis of "extensive impact on social production", which identifies them as "extensive type investments", and on the basis of "direction of action", which classifies them as extensive investment or reinvestment. It should be noted that in this case, a fairly high level of correlation is observed between the second and third signs, which confirms the correctness of the conclusion made.

The results of the study are important because, firstly, they identify the main difference between the concepts of "investment" and "investment ↑" in terms of their values (or volumes) according to a certain criterion (in terms of the possibility of their direct impact on further innovative activity), which in practice can be expressed in positive dynamics between these categories either in terms of quantitative indicators, or in terms of qualitative non-innovative indicators (i.e., qualitative indicators that are not characterized by an innovative component), or in terms of quantitative and qualitative non-innovative indicators [63].

Secondly, such a probable version of the third scenario is, in fact, a reflection of the process in which the socio-economic system purposefully uses the results obtained by it from the implementation of a certain innovative project to form new investments that, in terms of their quantitative and/or qualitative non-innovative parameters exceed the previous investments that were used by it for the implementation of this innovative project. As a result, this scenario is a pronounced development scenario, the varieties of which can be:

1) development of the activities of the institution;

2) development of the institution itself;

3) development of the institute and its activities.

At the same time, none of the above variants of this scenario has an innovative orientation, since "investment ↑" does not exceed "investment" by the criterion of "innovation and/or intelligence", and therefore, they, having no "in themselves" innovative component, are investments of extensive type.

Thus, the first version of the third scenario, despite the three possible variants of its completion, can be schematically described by one "universal" model – "investments ↑" are directed by the enterprise not into the sphere of innovation, but exclusively for its expanded economic growth, which is characterized by positive dynamics the main indicators of its economic activity according to quantitative and/or qualitative non-innovation criteria. At the same time, such a "universal" model, by its features, cannot be considered some kind of "separate" or "independent" development scenario – in view of the variability of only the last "final" stage. Therefore, it should be interpreted as "one of the options for the third development scenario" (for example, "scenario 3a"), which is schematically presented in **Fig. 1.5**.

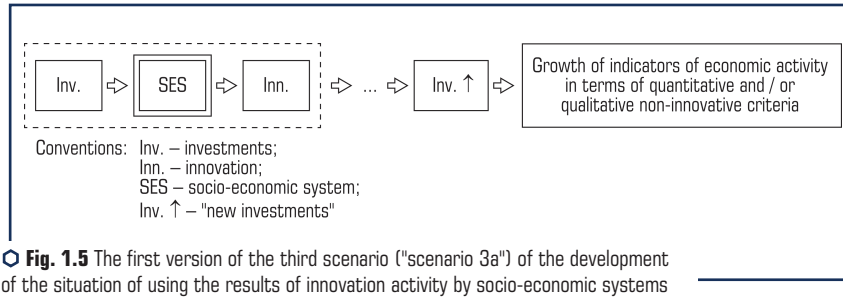

Fig. 1.5 The first version of the third scenario ("scenario 3a") of the development of the situation of using the results of innovation activity by socio-economic systems
Source: Author's development

The second probable variant of the third scenario, which provides that on the basis of "object of investment in intangible assets" the value of "investments ↑" is greater than the value of "investments" (i.e., according to the criterion "innovative and intellectual investments", the volumes of "investments "investments"), from the point of view of the possibility of their direct influence on the further innovative activity of the socio-economic system, is undoubtedly a variant of its innovatively directed development. It is obvious that in this case, since there are real prerequisites for the further innovative development of this institution, the categories of investment and investment differ from each other in magnitude and on the basis of an intensive influence on social production, which identifies them as investments of an intensive type, and in the "direction of actions", which classifies them as a net investment. It should be noted that in this case, a high level of correlation is observed between all three classification features of investments, which also indicates a high level of consistency in the investment activity of an enterprise, which is typical for investment and innovation systems.

In such a situation, it is quite logical to assume that an enterprise that, as a result of the successful implementation of a "preliminary" innovative project, has formed "new investments" that are characterized as "innovative and intellectual investments" and at the same time correspond to the level of "intensive investment", will send them as a "net investment" for further own innovation activity in order to create "new innovations". Such a development of the second variant of the third scenario seems absolutely natural and unambiguous, because the situation in which investments characterized by an innovative component will be used by a business entity not for his further innovative activities, and, for example, for the simple expansion of his usual economic activities, would be indicative of "irrational behavior of the manufacturer", which seems extremely unlikely.

Thus, the second version of the third scenario (**Fig. 1.6**, "scenario 3b"), which reflects the innovatively directed development of the socio-economic system, can be schematically described by such a model – "investments ↑" are directed by the enterprise exclusively into the sphere of its innovative activity, which, in as a result, it provides it with the opportunity to create "new innovations", that is, "innovations ↑", which is a direct evidence of the permanence of its innovative activity.

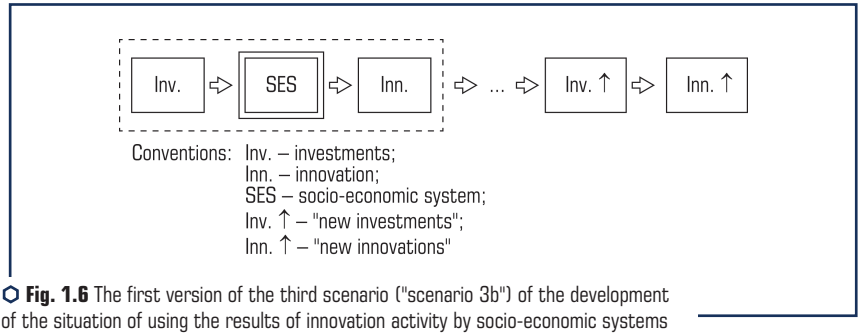

Fig. 1.6 The first version of the third scenario ("scenario 3b") of the development of the situation of using the results of innovation activity by socio-economic systems
Source: Author's development

Obviously, this version of the third scenario not only fully reflects all the features of the operating activities of investment and innovation systems, but also conditionally includes two incomplete cycles of such activities: investment and innovation, production, and innovation and investment activities of the first cycle (Inv. → Inn. → Inv. ↑), and investment and innovation activity of the next cycle (Inv. ↑ → Inn. ↑), which is a direct evidence of the permanence of innovation activity.

To complete this stage of the study, it is necessary to clarify the category of "innovation". To this end, it would be appropriate to use the approach that has already been used to define the category "investment ↑".

To define the category of "innovation" in this work, given that they become objects of intellectual property [99], the following interpretation should be used: "Innovation is such targeted changes in the system (the entire system) that determine the development (replacement) of its paradigm" [66], since it is this definition of this definition that is most complete corresponds to the direction of this study and the main approaches to revealing the essence of investment and innovation systems.

To conduct a comprehensive comparative analysis between the categories of "innovation" and "innovation ↑", one should use their most complete classification, presented in the work of the Ukrainian researcher Kariuk, V. "Improvement of the system of specific classification of innovations", in which she, summarizing the results of scientific research by domestic and foreign authors, identifies 14 main classification features of innovations [100].

An analysis of these features according to criteria that can characterize the further development of the socio-economic system as innovatively directed, revealed only one such feature – "in terms of the effectiveness of innovations", according to which they are divided into high-performance and low-performance [100].

Such a "limitation" in the number of features on the basis of which this comparative analysis can be carried out is explained by the fact that innovations are primarily a "commodity" (as opposed to "investments", which in this situation act, to a certain extent, as a "universal resource"), and therefore are characterized by "their" consumer properties, which are "absolute", and therefore "incomparable". Therefore, in this case, the other six qualification features (out of all fourteen) directly or indirectly characterize the innovative direction of the development of the institution – in terms of the scale of the influence of the innovation process, the depth of changes, the degree of influence on changes, the degree of novelty, the significance and direction of actions – actually "tied" to the consumer properties of "specific" innovations, which makes it impossible to use them for such a comparative analysis [100].

In other words, a comparative analysis of the categories "innovation" and "innovation ↑" can be carried out only according to such classification features that are "universal" in terms of their consumer characteristics as a "product" (corresponding to the category "innovation") and "product ↑" (corresponds to the category "innovation ↑").

Therefore, it can be stated that the classification feature "according to the effectiveness of innovations" is decisive for revealing the essence of the category "innovations ↑", which is

necessary to identify the type of development of the socio-economic system based on its innovative activity. In particular, if the value of the category "innovation ↑" on the basis of "the effectiveness of innovation" is greater than the value of the category "innovation", then "scenario 3b" (**Fig. 1.6**) is a pronounced scenario of the innovation-oriented development of this institution, and the "innovations ↑" themselves can be classified as "high performance" [100].

Obviously, otherwise, when the difference between the values of the categories "innovation ↑" and "innovation" on the basis of their effectiveness is "zero" or negative (i.e., on the basis of "productivity of innovations" Inn. $\downarrow \leq$ Inn.), "scenario 3b" (**Fig. 1.6**) does not correspond to the model of innovation-oriented development of the socio-economic system, and the "innovations" themselves should be classified as "low-performing".

Thus, according to the results of the study, based on the analysis of the expected scenarios for the development of the situation, the following conclusions can be drawn.

1. "Scenario 3b" schematically reflects the process of functioning of a "typical" investment and innovation system, which in the general case can be described in the form of an algorithm:

$$\text{Inv.} \rightarrow \text{Inn.} \rightarrow \text{Inv.} \uparrow \rightarrow \text{Inn.} \uparrow, \tag{1.3}$$

where Inv. – investments; Inn. – innovations; Inv. ↑ – "new investments" or "investments ↑" (see above); Inn. ↑ – "new innovations" or "innovations ↑" (see above).

Obviously, the proposed algorithm is a "universal" algorithm, since it reflects the process of purposeful implementation of innovative activities by any enterprise over a certain period of time. In other words, the presentation of the situation development scenario in this form does not allow identifying an institution that carries out innovative activities as an "investment-innovation system" or "non-investment-innovation system".

2. In order to be able to clearly classify the institutes "IIS" and "non-IIS", this algorithm must be supplemented with a system of conditions, compliance (or non-compliance) with which will make it possible to clearly determine which category a particular enterprise carrying out innovative activities belongs to. Such an algorithm with a system of conditions (in the form of inequalities) that meets the main criteria for the functioning of an "ideal" IIS is represented by formula (1.4):

$$\begin{cases} \text{Inv.} \rightarrow \text{Inn.} \rightarrow \text{Inv.} \uparrow \rightarrow \text{Inn.} \uparrow; \\ \text{Inv.} \uparrow - \text{Inv.} = \Delta\text{Inv.} > 0; \\ \text{Inn.} \uparrow - \text{Inn.} = \Delta\text{Inn.} > 0; \\ T_{IA} \Rightarrow T_{MA}, \end{cases} \tag{1.4}$$

where T_{IA} – the period of time during which the enterprise carries out innovative activities; T_{MA} – the period of time during which the enterprise carries out its main activities.

It is obvious that this algorithm describes the functioning of an "ideal" investment and innovation system, in which the duration of the period of its innovation activity approaches the period

of time of its main activity ($T_{IA} => T_{MA}$), and at the same time, the effectiveness of its investment and innovation activity is continuously increasing ($\Delta Inv. > 0$; $\Delta Inv. > 0$) with each implemented innovation project. As a result, such a process acquires all the signs of an innovation-oriented development of the socio-economic system, which, at the same time, has all the signs of an investment and innovation system.

3. In the event that one (any) of the three criteria does not meet the conditions defined by formula (1.4) (i.e., the total duration of time during which the enterprise was engaged in innovative activities is significantly less than its main activity ($T_{IA} \ll T_{MA}$), or the effectiveness of its investment or innovation activity is not positive ($\Delta Inv. \leq 0$; $\Delta Inn. \leq 0$)), then this institution, although it does not meet the criteria of an "ideal" IIS, however, retains the main features of "investment-innovation system". Such a statement can be explained as follows: the algorithm for the implementation of innovative activity by a certain enterprise corresponds to formula (1.3), however, its efficiency is not maximum either by the criterion of the duration of such activity, or by the criterion of quantitative and/or qualitative characteristics of "new" investments and/or new innovations. Obviously, if two (any) of the three criteria do not match, such an institution will have even fewer signs of IIS.

4. In the case when all three criteria do not meet the conditions defined by formula (1.4), it can be argued that such an institution does not have the characteristics of an IIS, and therefore is identified as a "non-investment and innovation system". Moreover, in this case, the very fact that the enterprise complies with this algorithm for its implementation of innovative activities (formula (1.3)) seems unlikely, since the permanent continuation of "unprofitable" innovative activity is evidence of the irrational behavior of the manufacturer, which confirms the correctness of this conclusion.

So, the main results of the study can be considered the definition of the algorithm for the process of functioning of investment and innovation systems, which actually reveals the essence of such institutions and the features of their activities. In addition, the application of this algorithm in combination with a system of certain criteria conditions (in the form of inequalities) that characterize the effectiveness of investment and innovation activities in absolute and temporal dimensions make it possible to identify and classify enterprises engaged in innovative activities into three categories.

Thus, the main result of the study should be considered the definition of the algorithm for the process of functioning of investment and innovation systems, which actually reveals and details the purpose, role, place and essence of such institutions and the features of their activities.

The application of the proposed algorithm in combination with a system of criteria conditions defined in the form of inequalities (1.4), characterizing the effectiveness of investment and innovation activities in absolute and temporal dimensions, makes it possible to identify enterprises engaged in innovative activities and differentiate them according to the following three criteria:

1) "ideal" IIS is an enterprise whose activities fully comply with the basic algorithm of the process of functioning of investment and innovation systems and all criteria conditions that characterize the effectiveness of investment and innovation activities in absolute and temporal terms. Obviously, such business entities, meeting all the signs of an "ideal" IIS, are characterized by a pronounced innovation-oriented development;

2) an enterprise with IIS features is an enterprise which activity as a whole corresponds to the basic algorithm of the process of functioning of investment and innovation systems and partially meets the criteria conditions that characterize the effectiveness of investment and innovation activities in absolute and temporal terms. At the same time, the range of the level of compliance of the enterprise with the features of the investment and innovation system can be quite wide, depending on what (what) signs (features) is the discrepancy, and what is its (their) value. In addition, such an assessment simultaneously characterizes the development model of this enterprise for its compliance with the conditions for the innovatively directed development of socio-economic systems;

3) an enterprise that is not an investment and innovation system is an enterprise whose innovative activity does not meet any of the criteria that characterize the effectiveness of investment and innovation activity in absolute and temporal terms. As a result, this makes it impossible for them to introduce a model of innovation activity based on the algorithm of the process of functioning of investment and innovation systems, which, in turn, does not contribute to the formation of prerequisites for its innovation-oriented development.

CONCLUSIONS

Thus, as a result of stating the facts of intellectualization, dynamic development and changes in the mentality of modern society, globalization and informatization of the world economy and its economy, the necessity of modernizing such undoubtedly important and necessary attributes as proper and high-quality management and management of all spheres of its vital activity.

At the same time, it is demonstrated that the leading scientists and experts of the world schools of management and management have already identified the main needs for changes and the conditions for managing new people of the 21st century, who should learn to lead in a new way, and also set the necessary directions for changes, which consist in the humanization and intellectualization of systems management national and world economies and all their subsystems on the basis of priority innovation of methods and technologies of management and administration.

After all, the further use of traditional approaches in modern administration requires not just their improvement, but radical, large-scale and simultaneous changes in all, without exception, spheres of the physical activity of mankind, which must always be preceded by the results of its intellectual activity. Since innovations and innovative development of society are, first of all, the products of the intellectual activity of people, the necessary changes in the management of the sphere of intellectual activity and the subsequent transformation of intellectual products into real results with positive consequences for society are its most important component.

Therefore, the transition from bureaucracy to humanocracy should also take place in the management of the structures and processes of any National Innovation System as a new foundation for the modern model of innovative development of the country's economy.

The structuring of the NIS according to the functional criterion into four subsystems (knowledge generation, production, financial support and innovation infrastructure), the allocation of information, regulatory and financial links between the latter and the determination of the conditions for their effective interaction, proposed in the study, provide a new organizational structure for the implementation of generation, production, implementation and dissemination of innovations processes in society.

Justification of the need to introduce investment and innovation systems into this structure as a functionally necessary subsystem determines the organizational and structural novelty of the NIS, which today is characteristic only of similar institutions in economically developed countries of the world.

A comprehensive theoretical analysis of the scenarios and options for the functioning of the NIS in combination with an added element – the functional subsystem of the IIS led to the conclusion that it is the absence until recently of this type of institutions in non-innovative economies that makes it impossible to form their own National Innovation System in such countries.

An in-depth study of the features of the functioning of investment and innovation systems as key subsystems of the NIS through the analysis of structures, scenarios, options and processes for organizing and managing them made it possible to reveal the purpose, role, place and essence of such institutions and the features of their functioning, as well as to determine the algorithm of their functioning, presenting it by means of a system of inequalities of criterion conditions. The application of this algorithm in practice makes it possible to evaluate the effectiveness of investment and innovation activities in absolute and temporal terms, and also allows to identify and differentiate the subjects of innovation activity according to three criteria:

1) subjects that meet the conditions of the "ideal" IIS and are characterized by a pronounced innovation-oriented development;

2) subjects with IIS features, which generally meet the conditions of innovation-oriented development;

3) subjects that are not investment and innovation systems and do not form the prerequisites for their innovation-oriented development.

Therefore, a completely justified direction for further research should be considered the approbation of the formulated structural-functional and algorithmically criteria-based recommendations in the practice of managing the functioning of real subjects of the national economy of different categories in order to verify their impact on the state and results of innovation-oriented development.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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