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SELF-RELIANT DEVELOPMENT CHALLENGES AND PROPSPECTS

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Varna Free University „Chernorizets Hrabar“

TETIANA CHERNIAVSKA

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CONTENTS

INTRODUCTION

Contemporary challenges of globalizing development set before the governments of many countries goals of economies strategic development management efficiency increasing. This is primarily due to the numerous threats for safe development growth. In addition, local shocks suddenness and depth, chain reaction and distribution in industrial, sectorial and territorial measurements determine the need to develop effective mechanisms for interacting with aggressive factors in the global environment in the context of economic risks prevention and ways to achieve national self-reliance identifying.

What counts most to the effective integration of Ukraine into the globalized world space is the achievement of those socio-economic system self-reliance structural components that play a key role in determining the vector for secure existence and further development of the country. Regional economy depression, political instability, and both economic and social spheres imbalances exert an overall negative influence and pose multiple threats to national security.

This problem scientific imperative is intensified by the necessity of adaptive mechanisms invention to counteract dangers and threats to safe development by strengthening national socio-economic self- reliance. To

do this in parallel with the definition of the primary objective of socio-economic system self-reliant development the author has constructed a hierarchical set of goals for the final result gradual achievement.

In the present monograph attention is focused on the existing potential to ensure national self- reliance, the main challenges to its achievement and future prospects.

According to the author, transport-communication system of the country can become the dominant model for self-reliant development, due to its geostrategic location which allows it to be an advantageous bridge for goods and passengers transit transportation between the states of Europe, Asia and the Middle East. It should be noted, however, that due to the fact that our country is not a member of collective defense international systems, it must rely on its own forces, and should ensure national security and defense. In this sense, transport capacity gains significant importance, the level of which is determined by the efficiency of both physically existing resources, and domestic transport general aggregate spacio-temporal opportunities. To date, transport-communication system is hardly the only sector of national economy, which is capable to become the catalyst for socio-economic growth without significant investment, a tool to achieve self-reliance and safe level of Ukraine's development.

The history of many countries is an example of transport "putting back on its feet," a devastated economy, providing a targeted and intensive development of its basic industries. By building car plants, the United States overcame the great depression crisis. Thanks to the development of transport, based on new technologies and construction of roads, Germany and Japan restored after the World War II. Ukraine has every reason to rely on the unique geographical location and available transport capacity. Based on these circumstances, there is an urgent need to address management and economic problems of geostrategic transport possibilities of Ukraine as transportation and Communication Bridge between the European Union and East Asia realization, the country's economic and political influence in the processes of integration into the new transcontinental and regional flows and socio-economic activity network.

The purpose of this work is to study theoretical and methodological, scientific-methodical and practical foundations of transport-communication system self-reliant development, as well as challenges and prospects on the way to achieve it.

Ukraine differs from other countries so that a significant number of its cities are situated on traditional transportation and communication routes of the Eurasian continent. The State has a fairly high level of transportation attraction, but this factor, so to say, is

potential, and can be implemented only in a serious competitive struggle with other states. Along with this, the monograph assesses the transport-communication system sectors current state. So, over the past decade, transport complex was influenced by a number of negative factors such as high levels of productive assets and, primarily, vehicles obsolescence, lack of means of transport in adequate quantities to meet the needs of the economy and population in transportation, transport industry poor financial condition, lack of adequate government funding, poor competitiveness in the international transportation services market, insufficient investment in technical-technological modernization, technical re-equipment and the like. Today, in general, the Ukrainian economy transport sector meets only the basic needs of the economy and population in transportation. The level of security, passengers and goods transportation quality and efficiency, energy efficiency, environmental technological load do not meet modern requirements. That is why in the work the author pays special attention to the issues of state regulation process of transport-communication system reconstruction and modernization on all hierarchical levels, and competitiveness and produced services security provision. State support of all transport sector components can turn it into a dominant competitive advantage of the country that will effectively position

itself in the global economy and prevent the occurrence of negative externalities.

The study is based on the modern economic theory most important principles, generalization of foreign and Ukrainian practice experience for transport and communication system self-reliant and safe development based on advanced technologies and with the active mediation of the state.

In particular, based on various aspects of transport systems of regions, countries, and world as a whole functioning studies, works of domestic and foreign scientists have been used, among them are: Boiko A., Vinnikov V., Zajonchik L. V., Zakharova O., Zorina O., Kotlubaj A., Koshevoy, Kudrytska N., Lozhachevskaja A., Danilov Yu., Mihajlechenko K., Mogilevkin E., Pashchenko, Y., Pepa T., K. Pluzhnikov, D. Prejger, A. Rybchuk, Sandakova N., Sytch E., Habutdinov R., Tsvetov Y., Chernyuk l. and others.

Scientific works by modern scholars served as basis for further transport-communication system as holistic complementary formation in the space-time continuum study, among them are S. Akhmetova, K. Akhmetov, A. Gorbunov, I. Godea, S. Komilov, S. Kozhabekova, L. Pjatkina,M. Tulpacov, etc.

The following scholars dedicated scientific potential to theoretic-methodological fundamentals and practical recommendations to ensure self-reliant development level: M. Belyaev, E. Buran, F. Braudel, A. Zorina,.

Inozemtsev, R. Emerson, Y. Molodozen, K. Momjyan, S., Osadchuk T. Parsons, A. Poruchik, E. Reinert, J. Stiglitz. V. Trofimova, R. Chellen, T. Sherstjankina, etc. However, present day terms cause to re-frame a multidimensional phenomenon of self-reliance in the plane of socio-economic system safe development, and that has become the motive of this research.

Statistics and scientific research on macro-reliant system of transport and transport-economic space of Ukraine issues are widely used in the work.

CHAPTER 1
SELF-RELIANT DEVELOPMENT THEORETICAL AND METHODOLOGICAL RESEARCH FOUNDATIONS

1.1. SELF-RELIANCE AS AN EFFICIENT DEVELOPMENT THEORETICAL AND METHODOLOGICAL BACKGROUND

At the beginning of the third Millennium there has been world space configuration proliferation. The possibility of a balanced, neutralized dynamics of its development is determined by resistant structural components with flexible forms of interaction availability. One of such structural components is Ukraine as an integrated economic system with corresponding subsystems, which owns complex stable links, channels and linkages of national economy. Due to its geopolitical and geographical location, it largely determines other components of the global system mutual relations nature. This situation dictates the need to maintain national self-reliance and security, which, in turn, requires more streamlined internal processes.

National security is directly dependent on the situation in all structural elements of the country's economic system, which, on the one hand, differs in specifics of the local level, and on the other hand, is

influenced by global externalities. In this regard, each component of the system must be regarded as objectively necessary self-contained subsystem, which is directed to a secure existence and progressive development. Therefore, self-reliance along with integrity and completeness is a necessary factor for expanded social reproduction and further safe development of the country national economic system.

The problem of society economic systems, their genesis factors and formation and deployment logic is one of the most pressing in modern science. This is due to many reasons, among which, above all, the need for disclosure and full understanding of the economic systems evolution patterns with a view to designing appropriate social and economic policies, as well as searching for optimal economic models in different countries are distinguished.

Civilization vector of modern economic systems development causes significant transformational changes in all components of social system architecture. Society democratic organization acquires new dimensions, new value orientations occur and the existing are reinterpreted, and far-reaching changes are taking place in the crucial sphere of society-economic activity and society economic system as a whole functioning. All this is particularly actualizes the problem of a man as the main factor in economic systems evolution. Modern science essentially extends the subject-matter of its scientific analysis. It is on the socio-economic systems problems the attention of scientists during the last quarter of the last

century, when economists-futurologists were attempting to predict further transformation of society, have been focused. For this purpose the vector of their research has been not only directed towards the "third" world countries or post-socialist states, but also towards healthy developed national socio-economic systems which by objective processes demonstrated the need for a permanent improvement of the "economic game rules". Despite of this problem urgency, the vast majority of research in this area is still empirical in nature. Therefore, the scope of our research is focused on socio-economic systems in the context of globalization externalities development.

Modern science and public practice show the urgent need for socio-economic systems new development paradigm in overcoming the environment global turbulence and atypical global crises effects. The secure existence of Ukraine as a state, its status as a strategically important partner on the world stage fully depends on this.

The main task in the effective integration of Ukraine into the globalized world space is the achievement of those socio-economic system self-reliance structural components that play a key role in determining the vector for secure existence and further development of the country. Depressive state of regional development, political and social destabilization, imbalances of all structural components of the socio-economic system have a general negative impact and create numerous threats to national security.

The process of achieving self-reliance as a favorable environment for internal reproduction acts as a key objective for safe development, concentrating political and material efforts and other resources. The extreme complexity of this task implementation is demonstrated by the fact that over the past five and a half thousand years, humanity has been able to live in peace only for 292 years. The world has experienced about 15 thousand wars during this period. The tendency to increase the scale of conflict and release them from regional framework to the global level has proved itself in two world wars in the 20th century only. [245, p. 118].

That is therefore, research problem of self-reliance as a cross-cutting factor for ensuring national and, in particular, economic security of Ukraine in the context of globalization externalities is particularly important and meaningful.

Analysis of research papers on the self-reliance issue suggests that in modern science this factor does not have a full assessment and its reflection is confined mostly to the categorical analysis. A lot of ambiguity is caused by the lack of systematized experience, economic, political and social components of self-reliance streamlining organization that creates this phenomenon one-dimensional representation. Moreover, in a number of research papers confusion and substitution of "autarky" and "self-reliance" notions is observed.

To answer the question, what a self-reliant processes of socio-economic system development include, it is

important primarily to apply and considerably rethink "self-reliance" fundamental category, which was critical to global development in both global and local perspective.

Evolution of self-reliant development concept is emerging against the autarkical attitudes backdrop which inherently and actually serves as methodological premise, socio-economic systems self- reliant development theory foundation.

Etymologically, the term "self-reliance", is associated with the Greek word autarkeia (autarky) meaning self-satisfaction, independence. Its two central meanings are described as: 1) in ancient ethics - the term that refers to internal complacency, pleasure of the existing sufficient and independent position; 2) in economic terms, the term describes any country economic insulation policy [233].

Formation of autarkical development foundations has deep roots and a lot of interesting examples in the world history. Autarky as an ancient anthropology idea comes from its presentation as a person total dependence and non-self-reliance before the development of the "completing" in the society idea and pursuit to the ideal. In scientific understanding of ancient economic and political self-reliance formation the crucial role is played by well-known scientific papers: Aristotle's "Politics", at the beginning of which it is stated that "autarky is an objective and it is the best for a polis" and "an ideal polis becomes feature of any autarky goods"; passage of Plato's "State", which reads that autarky in a polis is derived from alone non-autarky people need in each other; Pericles from

Thucydides speech, where Athens is named a perfect that is an ideal polis both for peace and for war [149]. Subsequently, in the works of Thucydides the use of the term "autarky" appears which means political and economic independence of one state from the other.

Thus, self-reliance historical account begins with the use of "autarky" notion, which was synonymous to self-satisfaction and characterized a real economic structure of Homeric Greece, Sparta military democracy, trading Athens, as well as Imperial Rome in the writings of thinkers. However, it was granted the status of a category to describe common ideal for all social strata and periods of Greek and Roman history.

Study of economic self-reliance genesis as an economic systems progress and evolution foundation and engine should primarily be based on the works of Aristotle. Actually, the term "autarky" as an expression of self-reliance was first mentioned by him in relation to political life: "The State is a communication ... of generations and villages in pursuit to achieve a perfect self-sufficient existence, which, as we say, is a happy and wonderful life" [233]. It should be noted that terms "autarky" and "autarkical" are found in the works of this philosopher more than in all the works of his predecessors. As prior knowledge systematization, autarky is further reflected by Aristotle: in biological works as medical and physiological autarky; in logical - autarky is presented as an ideal logic; in cosmological - this term describes celestial bodies and deity, who lead a blissful and the most

autarkist life; in ethical works - autarky determines a finite, perfect benefit and happiness.

In the context of our study his vision of self-reliance as a goal of a polis existence deserves special attention. Polis by Aristotle is a community of citizens who are free people possessing the right to participate in legislative and judicial branches [182]. Polis autarky is to meet not only and not so much the necessary needs, but the needs in spiritual unity, citizens "consent" and fairness. Autarky of a polis, in his analysis, should be based on public structures complex balance, which equally provides the "soul" and "body" of the state function. He considered its achievement in a polis to be "the maturity" of a human community. After the polis system collapse, theoretically justified by Aristotle, it is precisely this type of autarky that was the subject of moral and theological interpretations in further scientific works.

Subsequently autarkic views were used economically by mercantilists, and the greatest distribution they received during the period of capitalism general crisis. The autarchy phenomenon attracted particular attention and was in the purview of German thinkers and economists-theorists. One of the first founders of this research direction was Johann Gottlieb Fichte, who developed his own system of economically self-reliant, projected, closed state, reviewing the implications of Napoleon's continental blockade. His successor research Friedrich List fifty years later developed theoretical objectives against the "free trade" principles of Manchester school. As the answer to

"free trade imperialism" List's rate card system, the purpose of which was to make Germany economically independent, was proposed.

Later the meaning of autarchy was studied in depth by John Karl Rodbertus and John Ferguson, who described classical Greece as a "triumph of autarky", infinitely extending the scope of the term. So, they used autarky to characterize an ideal polis, and principle of life of the wise that are in no need of anyone or anything and it is in that are similar to God and the Church as architectural creations ideal, and even epigrams as literary works ideal.

In historical and economic discourses of the last third of the nineteenth century economic use of autarky term is becoming commonplace, and consequently, in the period between the first and second world wars, is included in the ideological security circulation simultaneously with isolationism and expansionism (evident in writings on the line of succession: Rodbertus - Bücher's teacher, Bücher - Hasebroek's teacher, Hasebroek - Laum's teacher). In Italy and Germany of that time, the use of the term "autarky" is merged with the so-called "autarchy" (self-government) and becomes the further development slogan, which traces total separation of the nation "comprehensive ideology" (in the writings of Frid) [232].

Fascism carried out an autarky policy, with a view to Germany's economic system militarization in the preparations for the Second World War. The Nazi autarky doctrine was outlined by Goering (17.12.1936, the

Prussian Landtag meeting in Berlin) and reflected in the four-year plan adopted by the Hitler Government [108].

High to low fluctuation accompanies autarky in the role of Italian and German fascism promotional slogan: from unlimited expansionist appetites in the 1930s to the appeal to German housewives cook a "complete meal from what grows in their own front yard" in spring 1945. The autarky policy was convicted at the Nuremberg trials as a preparation for war policy. "Initial flickering sense potentiated in European culture is not been clarified (not fully explored) and then pointedly echoing the statements of ancient authorities. As a result, autarky becomes a medium of intellectual self-hypnosis, which applies not only to the Nazi ideologues, but to liberal scientists "[81].

Among many scientific points of views of the past engaged in this field scientific position of Rudolf Kjellén (1864-1922) deserves the most interest in terms of the subject matter of our research. Rudolf Kjellén was a Swedish political scientist and geostrategist, one of the modern geopolitics founders. Such concepts as geopolitics (this term was introduced by him in 1899) and the living space (lebensraum) were the essence of his scientific research. Kjellén left his mark in history as a leading continental forces geopolitician, and leading naval forces of that time - the British Empire - world hegemony critic. He developed the concept of a state as economically and geopolitically protected "people's home" (folkhemmet). In the future, his geopolitical concepts were embodied in a so-called "Swedish model", in which Kjellén's geopolitical

concept, "conservative revolution" ideology and Swedish Social Democratic Party radical political will were connected.

For Kjellén the issue of self-reliance is not so much economical but a political one. He believed that the state, which is dependent on imports, can never be independent. He believed that "closed-doors" policy is essential because the Great Britain imperialist naval forces "open doors" policy was a war by means of the economy. In this context, according to him, a tariff system introduction is a mean of struggle, i.e. the counter-attack. Kjellén, convinced that the economic policy of self-reliance serves as a powerful political weapon: "Natural sphere of influence is essentially a closed economy that ensures self-reliance."

Subsequently, the development of this concept was embodied in the works of Karl Schmidt, who named it "grossraum", and General Haushofer, who named it "Pan-region". Such scholars as Gorbach, Ackerman and Neumann were influenced by Kjellén's scientific ideas. For them, the "Middle Europe" (Mitteleuropa) in geopolitical terms at the same time was a closed sphere of influence and autarkical integrated economic space. In his works Kjellén notes that in 1890 British Empire developed an "open doors" doctrine, which was essentially a conquest of markets doctrine, i.e. of structural colonization of other countries. It is obvious that in its economy management United Kingdom desperately felt dependence on free access to the territories of the countries which were an "open door" policy subjects. Therefore, control over the

seas performs a vital political imperative of the country. To maintain naval superiority, it was imperative to avoid any rival emergence. As British Admiral Fisher wrote in those days: "He, who reigns over the oceans, he dominates the world" [236]. Its dominance over the seas United Kingdom called "the principle of freedom of navigation", and that was intact in international law. Thus, the island country essence geopolitically demanded an "open door" policy adopting, that is, the permanent war by means of the economy.

Anti-thesis principles of "open doors" and "people's home" cannot coexist, as the "open door" policy, is essentially a blockade aimed at economic system destruction. "People's home" is a closed door. Here and hereafter, Kjellén developed the idea of Median Europe along the Meridian expansion, namely, by the railway line from Berlin to Baghdad. Advocating the idea of Middle Europe establishment in his point of view should be autarkic geopolitical large space. In this respect Mitteleuropa seems similar to Haushofer's Pan-region or Karl Schmidt's grossrauma. Kjellén's ideas about "Median Europe" with inclusion of some parts of Africa in order of Euro-African unification (further developed and formulated by German political scientists under the title "Levantine program"), the idea of a new balance of forces in the ocean that would occur due to the United Kingdom position weakening and the United States of Europe concept (the future of Europe was seen only as Federal

Europe by him) formed the conceptual framework basis of self-reliant economic systems development study. [108].

It should be noted that it is the transport component importance in achieving socio-economic systems of the world self-reliant development, first explored in depth by Kjellén, becomes the determining factor in delineating the contours of our future research.

To understand the autarkical systems philosophy we have studied historical examples of such autarkical countries as:

1. The DPRK since its inception in 1948 to the present time is considered to be an autarkical country.

2. Afghanistan was considered to be an autarkical country under the rule of the Taliban's from 1996 to 2001.

3. People's Socialist Republic of Albania, which became almost autarkical in 1976, as a result of "self-reliance" policy realized by the Communist Party leader Enver Hoxh. As a result, foreign trade volume increased after Hoxh's death in 1985, although it remained strictly limited even in 1991.

4. Austria-Hungary from 1867 to 1918 which was the only economic and monetary union with a population of over 50 million people. So it was not dependent on the world market, and therefore autarky reigned in it.

5. Burma adhered to the policy of autarky known as the "Burmese Way to Socialism" under the dictatorship of Ne Win, who ruled the country from 1962 to1988.

6. Cambodia was considered an autarkical country from 1975 to 1979 under the Khmer Rouge rule.

7. India, after its proclamation as an independent state from 1950 to 1991 essentially pursued a policy of autarky.

8. In Italy, Benito Mussolini claimed that the country should come to complete autarky. After the invasion in Abyssinia in 1935 the trade embargo was announced. Although, for example, trade relations with Germany and some other countries continued to be maintained both before and after 1935.

9. Japan was characterized by relative autarky during the era known as "Edo period" in the 1850th, as a part of its sakoku policy. Trade relations with China and Korea were maintained, and as to the other countries trade relations were carried out only in one port on the island of Dejima.

10. Romania headed by Nikolai Ceausescu in 1980 sought to autarky, to this end, the policy of paying all the country's external debt, increase in gross domestic production volume and dependence on imports reducing was carried out.

11. Spain during the dictator Francisco Franco reign implemented policies of autarky from 1939. External trade relations were allowed only in 1959, simultaneously with the so-called "Spanish miracle" beginning.

12. Both the United States during the time of American Revolution release, and the United Kingdom, which increased economic and military force, was close to complete autarky in 1808. At that time President Jefferson declared a voluntary embargo on international

shipping. The blockade lasted from December 1807 to March 1809, [149].

Historical and evolutionary approach to the analysis of autarky systems development leads to the conclusion that the autarky policy is an installation for the country isolation and exclusion from the world economic relations as well as this trend maintenance (resource, institutional, ideological, legal, etc.)

It is obvious that autarky as an absolute economic sovereignty of the country in the global economy of the 21st century is not a real phenomenon. World experience has shown that the idea of absolute autarky, as it turned out in practice, is utopian. Countries that tried to implement it, failed to improve the economy and get out of pauperism. Even North Korea, which is often cited as a good example of the autarky benefits. Actually, experts' macroeconomics analyses suggest questionable effectiveness of the absolute autarky policy. In addition, in 1994 the DPRK President Kim Il Sung decided to move away from the Juche's ideology (self-reliance strategy on its "own strength ") and shaped the course to the country's participation in international trade. Strictly speaking, the DPRK vector of development was changed from complete autarky to the direction of relative autarky.

Historical experience proves that complete or absolute autarky is impossible even for large and resource-rich countries; therefore in scientific discourses the term "autarky development trends" or "partial autarky" is increasingly adopted. Such trends, as history proves,

cause irreparable damages to the economies of such countries, swinging them back in scientific and technological progress, social production economic efficiency and population standard of living.

Panoramic view on economic, political and social changes in different countries and at different times has shown that autarky as a development pathway proved to be ineffective. Directing all efforts at autarky countries self-reliance cannot simultaneously focus resources in necessary volumes for a balanced, optimal level of all sectors of the national economy development. Autarky development is contrary to the laws of world economy development and in some cases even leads to such countries socio-economic backwardness. The choice of autarky policy vector generally reflects the economy unhealthy state, based on a painfully accentuated sense of patriotism, the idea of preventing national economy transformation into a global economic system appendage.

Thus, having reviewed the issue of political and economic activities as a factor in the evolution of socio-economic systems in classical West European, socio-philosophical and economic thought, we have come to the conclusion that autarky is mainly manifested in economic and political spheres and has the following characteristics:

– isolation from the outside world;

– economic, political and cultural relations with the outside world gap;

– economic system insulation and isolation;

– political and military confrontation to the countries of external environment;

– political and economic independence pursuit;

– focus on domestic production and consumption of own production;

– economy resource-oriented focus on directive planned basis;

– sectors of national economy on the global level underrun.

Based on theoretical synthesis and new understanding of scientific problems of ascertaining the content of economic systems autarky we offer our own interpretation of this category.

Autarky is interpreted as the ability of an economic system to ensure social reproduction process on the basis of domestic resource mobilization and development mechanisms in the context of autonomy in the globalized world.

It is appropriate to emphasize that the autarky as self-reliant economic system archaic plane content, specifies its existence and development based exceptionally on internal sources and resources. We believe that the content of "autarky" and "self-reliance" concepts identification, that is fairly common in modern scientific literature, is erroneous. In fact autarky inherently denies market economy conditions, and therefore may not reflect polyphonic socio-economic system versatility in the self-reliant development process globalization context.

Therefore, an objective condition for a certain economic system to be recognized as a self-reliant is the availability of both external and internal competitive environment, within which the numbers of similar structural elements of such a system operate.

This implies that *self-reliance in its gnosiological essence is basically a derivative of autarky*. It is fully confirmed by the following facts: originally autarky countries with planned economies based on command-and-control management are gradually transformed into countries with a market focus development and competitive management mechanism, which in turn causes the need for an open economy functioning.

The above mentioned proves that self-reliance *should be investigated from the two perspectives: in statics and dynamics. In statics self-reliance serves as a tool for economic growth, and in dynamics it is an indicator that shows the status of the system, which displays the point of a specific socio-economic system or its specific segment between the two poles (that are open economies and autarky) from the development trends perspective.*

Multidimensionality of self-reliance phenomenon awareness indicates its content theoretical generalization process issues. Many of the existing self-reliance definitions in modern science bear specific connotation, but do not possess a fixed conceptual meaning. It is deemed that self-reliance is more complex and multidimensional phenomenon than it is interpreted in

the work of those researchers who only focus on selected aspects of contemporary socio-economic systems.

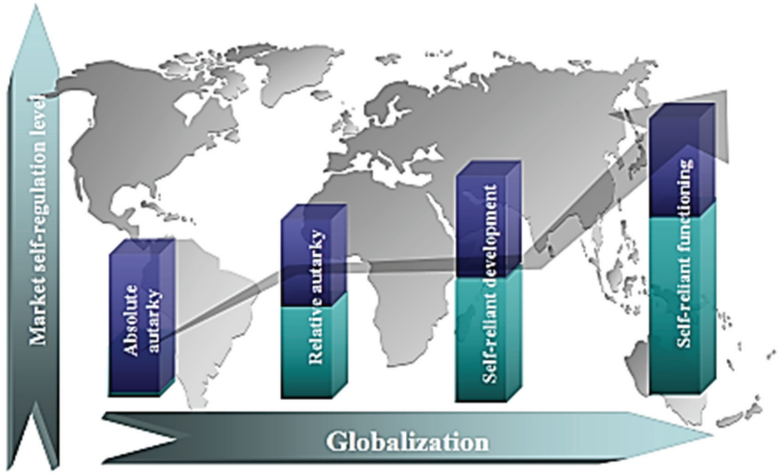


Figure. 1.1. Autarky and self-reliance in the process of socio-economic systems evolutionary development ratio

** Source: compiled by the author*

For example, according to sociological dictionary self-reliance is: 1) natural appearance and further existence without outside influence; 2) property of stable and long-term (at a historically significant period of time), or unstable and short-term active system existence at an outer space constant state [134]. In this same dictionary we find an explanation of these definitions from the system approach perspective, where a self-contained system is defined as "... capable at constant environmental conditions to be maintained and destroyed by internal causes". Analysis of the above interpretations reveals

their application in the context of modern socio-economic systems impossibility. In fact, the first version of the interpretation actually applies to closed systems. With regard to the second definition, it already clearly characterizes this condition as active systems property, but, in our opinion, is fairly simplistic.

The idea of a famous American sociologist and theoretician Talcott Parsons, who deals with social systems self-reliance problems, seems convenient: "Society is such a type of social system which reaches the highest level of self-reliance towards the environment". He defines self-reliance as a function of control mechanisms over the society balanced combination with the environment relations, as well as the extent of its own internal integration. According to T. Parsons self-reliance appears as "... interchange relations stability and the ability to control this interchange in own functioning interests" [163, p. 20].

Russian scientist K.H. Momjyan believes that when politicians argue about self-reliance they generally reduce it to economic-administrative or some other autonomy in the global community. However, from a philosophical point of view the case is a quite relative independence that it is quite socially measurable. It is clear that any globally independent society cannot exist outside and independent of nature, since it needs all necessary material and energy resources for its functioning. That is, self-reliance, in a sense, in any case is not the ability of a system to exist "by itself", "in and for itself ", but entering into relationship

with the environment and carrying out some kind of interaction with it. In the case of social systems, self-reliance does not mean the lack of external environment but a special mechanism of interaction with this particular environment, a generation tool to support and develop essential properties of the system that creates its inherent quality. In this approach, K.H. Momjyan considers functional self-reliance to be the main feature of the society [245].

Y.B. Molodozen draws attention to the fact that self-reliance describes the system in every aspect of its existence, that is, extends to its structure and functioning, and its development: "In all these cases we are dealing with the immanence of life, existing according to its own laws, the effect of which is limited by the system itself and does not apply to the external reality"[140, c. 22].

The self-reliance phenomenon which has been studied in depth by Professor A.M. Poruchik in his monograph "National Interest of Ukraine: Economic Self-reliance in Global Dimension " acquires particular importance. The author explains it as "the ability of a country to ensure social reproduction process on the basis of domestic resources maximum mobilization and resources in conjunction with the effective involvement and using the potential of foreign economic relations" [179, p. 29]. He applied dialectic approach to determining the national self-reliance ratio and global integration that allows studying this economic category on a new scientific level.

E.V. Buran offers the following definition of self-reliance: "Self-reliance is the system's ability to reproduce itself in the necessary external conditions presence". In contrast to such a narrow understanding F. Braudel feels that self-reliant economy has a certain organic unity, which is ensured by internal relations and exchanges actions [29, p. 12]. We are convinced that a certain self-reliant economy unity will be achieved through a balance of both external and internal conditions. And, in contrast to E.V.Buran's opinion, own resource potential plays, above all, a key role in the system reproduction capacity. In our view, financial-resource component must be the basis of this reproduction.

Special actualization of territorial systems financial, budgetary and fiscal self-reliance problems has acquired attention during economic recovery after the global financial crisis period. A number of scientific works have been devoted to rationale for financial self-reliance as a prerequisite for economic stability ensuring. So A.V. Shevchenko interprets territories financial self-reliance as an opportunity to enforce the authority and provide public services which are not below a certain level. In our view, the provided definition is general in nature and is not specific [251].

More thorough approach to the study of ensuring the financial sustainability problem is given by S.V. Osadchuk, who believes that financial self-reliance notion includes the sum of all financial resources and fiscal self-reliance is their principal component. "...

Definition of financial self-reliance is associated with the tax base formation, with non-tax revenue, with the opportunity to borrow from the financial markets for budgetary purposes". It (self-reliance – author's note) "... provides an opportunity to address society financial problems through the effective use of resources: local budgets formation and use, communal property enterprises functioning and additional financial resources attracting. However, the author fails to generalize the definition of the investigated phenomenon.

Self-reliance as the ability to provide financing for the economy at the expense of its own sources conception [224, p. 243] needs to be expanded, because at the present stage of development in that interpretation none of the socio-economic systems of the countries of the world can be considered self-reliant.

The foregoing, to the fullest extent suggests that *financial self-reliance is a basic component of a socio-economic system self-reliance.* And it is the one to determine current state and trends of economic stability in a country and progressiveness of social development. In our view, self-reliance main objective is compliance with national economic interests, which constitutes the state's basis of financial independence and financial flexibility, do not vitiate it in making own financial decisions, reflect national economy resilience, its full reproduction and potentially progressive development.

The problem of self-reliance in the context of national economic development models in the era of globalization is

explored in depth by V.V. Trofimova. She defines "national economic self-reliance" concept as the ability of a country to ensure the permanence of the selected development path based on internal and external resources and development mechanisms optimal attracting. The author defines self-reliance types on various classification criteria. Besides V.V. Trofimova develops approaches to defining the country's economic self-reliance criteria in terms of implementing the models of different levels.

Assessing the absolute significance of V.V. Trofimova scientific heritage, the absence of a proposed unified self-reliant structured system should be noted, which makes essential comprehension of the multidimensionality of self-reliant socio-economic systems development process impossible.

Methodological key to socio-economic systems self-reliance detailed understanding and its inner nature definition is presented in our developed structure, shown in Fig. 1.2.

Given a self-reliance object, energy, food, transportation, as well as military, environmental, etc. self-reliance are highlighted in the structure.

Depending on the ensuring sphere self-reliance may be distinguished as financial, budgetary, innovative, investment, informational, organizational, resource, professional, technical, technological, legislative and transportation. It is clear that for a socio-economic system with a view to achieving self-reliant integrated

development accumulation of security scope components is required.

It is quite logical that this raises the question of self-reliance emphasizing in reference to the current state and development trends, as well as self-reliance potential utilization (taking into account unused capacity), available or real independence and self-reliance, which has already been used. It is advisable to allocate as well an intermediate-reliance that characterizes the intermediate state from one stage of a system development to another. In relation to the environment self-reliance acquires an exogenous nature. Regarding the internal state of the socio-economic system constituent structure (region, industry or economic overheads, etc.) self-reliance is considered as endogenous.

Modern socio-economic systems development imperative in the context of global externalities is self-reliance achievement, i.e. a balanced harmonious social reproduction in all structural components of the system at the expense of 2/3 of their own resources with the desire for the complete self-reliance.

Therefore, with respect to self-reliance potential it is advisable to highlight absolute and relative self-reliance. By volume self-reliance is structured as basic (set of system development indicators fluctuate around 2/3) and potential (from 2/3 to 1).

Evolutionary historical experience has shown that achieving self-reliance in individual countries development is the result of a socio-economic system

gradual development process. In the opposite case, for example, in autarkic countries that took place through dramatic transformations due to reforms, regime change or military events, change for self-reliance development vector. Therefore, typical and atypical self-reliance separation regarding evolutionary origin is quite logical. In the sequel, it is appropriate to structure self-reliance regarding the stages of development to one that is just being formed, self-reliance of functioning (basic level of development parameters achieving) and permanent self-reliance (stable growth dynamics of development parameters achieving).

Each socio-economic system overcomes its own path towards self-reliance, which is accompanied by numerous obstacles. Therefore, regarding the purpose of a socio-economic system development we offer to distinguish development stabilization, recovery development, growth and sustainable self-reliance development. Given the risks of external and internal environment development self-reliance acquires characteristics of resistant and non-resistant. To achieve safe development, self-reliance can take a stimulating or destructive and even threatening nature. This suggests that a self-reliant system is not always safe for further development.

Economic behavior of self-reliance in statics or dynamics will be manifested differently. Upon reaching a stochastic (random) self-reliance nature in any component of the system, economic behavior would already have other features and options than during static or dynamic self-

reliance. As to adaptive self-reliance it expresses system maximum mobility to environmental conditions.

The global nature of development makes an impact on self-reliance achieving process in monopolies and oligopolies (for example, integration or cooperative associations). It should be noted that mechanisms and tools of its achievement in both cases can vary dramatically. It is therefore advisable to highlight the level of competition as both monopolies and oligopolies self-reliance.

Managing process of self-reliant development achievement can be bureaucratic or liberal based on self-management principles at each hierarchical level of the system. Therefore, it is logical to classify self-reliance in reference to the management mechanism as bureaucratic and liberal. In the context of the regulation nature self-reliance takes on unregulated, regulated or self-regulated characteristics.

For self-reliance development effective mechanism achieving, first and foremost, it is necessary to determine action planning temporal horizon. For this purpose, it is appropriate to highlight operational self-reliance (within a current year), tactical self-reliance (mid-term) and strategic self-reliance (long term perspective). In any case effective indicators will vary within the "self-reliance corridor" framework, but mechanisms of achieving specified parameters will differ depending on the deadlines. Therefore, regarding the forecast expected and

anticipated which is predictable or unpredictable self-reliance can be obtained.

Regarding self-reliance effectiveness it is appropriate to consider both efficient and inefficient self-reliance. Whereby, in the first case a long-term effect in all spheres of socio-economic system should be observed. If we evaluate, for example, a one-time (short-term) positive effect on the parameters of self-reliance achievement, in general it is possible to speak about inefficient self-reliance in the period under review. In the case of self-reliance capacity optimal mobilization and disposal, it could be argued that self-reliance acquires rationality characteristics. In other cases, when the proportion of resources utilized is unreasonably high to achieve self-reliant development parameters and if the "self-reliance price" is too high, irrational self-reliance is observed.

Self-reliance structuring once again proves that the development of globalization processes in all spheres of social and economic life generates a qualitatively new challenges for countries that need to adapt their economies to the global transformation processes through self-reliant development models capable of responding to global challenges and threats formation and implementation, as well as mechanisms for effective integration into the world economic system development.

In this context, V.V. Trofimova's scientific views seem to be debatable. Note some perfectionism vision of globalization prospects that permeate all publications of the author. Thus, in her view, "... It's time to highlight not

only "global integration - national self-reliance" but also "globalization - global economy" economic categories dialecticism. The author proposes to consider global economy as a harmonious economic system of the future, but globalization is "... the thorny path to the global economy, which not everyone will be able to overcome immediately." "The trend towards allocating economic borders and trajectory displacement, regardless of territorial boundaries, has led to the new concepts such as economic concept of national identity markers that allow interpreting the self-reliance of national economies without rigid binding to the country's borders emergence." Such trends, according to V. V. Trofimova, constitute the integration processes driving force, as a result of these objective laws, countries will be forced to enhance coordination and, as a consequence, global coordination mechanisms.

Idealizing global economy, the author does not take into account numerous internal globalization antinomies and ultimately determines a change in approaches to ensure the national security of Ukraine. It is impossible not to take into account simultaneously existing opposing trends - integration and disintegration, each of which has its deep foundations. In this regard, globalization can be considered as a complex form of integrity that specifies a binary coexistence on complementary principles.

Another feature of globalization that is the simultaneous existence of both positive and negative effects is also confirmed. On the one hand, it has great

potential to stimulate economic growth, technological progress, information systems development, is a source of significant social changes, etc. on the other hand, it dramatically deepens inequality between people and countries, radically changing axiological potential and historical development experience. So, V.V. Trofimova's opinions on the feasibility of a global government establishing seem subjective enough.

According to our opinion, impact of the first acyclic global crisis, 2008 assessment hardly for the first time in human history demonstrated globalization processes economic challenges and threats, and the experience to overcome them allows the issue of determining global integration process nature and effectiveness comprehensively addressing.

In their work "Globalistics is a New Synthetic Science "[16] well-known scholars A. Belous and V. Vlasov emphasize globalism negative consequences: "Globalism as a new malignant world order and world system causes world community systemic crisis cycle, destroying valuable forms of world order resistance, undermining international relations state-centric structure". In their opinion, the virtual financial speculative technologies of global geo-economy deform not only the traditional industrial but also the postindustrial economy. It destroys world economic defense mechanisms, applies global information monitoring, and weakens economies total transparency. "The world economy which is becoming globalized, according to foreign and domestic researchers,

becomes increasingly unstable, prone to cyclic and acyclic crises".

One cannot but agree with the authors that "... getting involved in global economic imperialism, national comprador regimes betray national interests ". The effects of globalization A. Belous and V. Vlasov attribute as the loss of developmental security at the national level.

Having regard to the above, in the plane of the problem under consideration scientific work of T.V. Sherstyankina acquires special importance. The author's thesis research [253] is dedicated to the regions self-reliance as a factor of national security in globalization context exploration. We fully share the author's opinion that one of the ways of countries adaptation to the globalization conditions is regionalization, which increases the regions importance in ensuring modern states national security. It is clear that Ukraine's flexible response to global changes is supported by self-reliant regional socio-economic systems by which the state acquires the ability to resist globalization negative effects, deriving strategic benefit from the global situation context. However, weakened by the events of the past few years, the country does not have enough capacity for regional development: independence, self-reliance, self-development, self-financing, self-management, determining self-reliant regional development. In this regard, numerous challenges in ensuring national security of Ukraine, adaptation of the country to turbulent environment conditions have emerged.

In the context of the conducted research self-reliance becomes a kind of mosaic and can be represented as a multidimensional, natural-historical process of holistic socio-economic structures and relationships formation and development. By virtue of the modern world economic centricity it is the economy that can be considered an engine for self-reliant socio-economic system, and growing needs of all hierarchical levels of national systems satisfaction is considered to be its prime objective.

This fully proves that national economic self-reliance is a state-level category. In macroeconomic terms, it means the ability of a state to ensure social reproduction at the expense of traditional sustainable sources of resources necessary to perform its functions, meet the needs of population and existing commitments to other states implementation.

Therefore, ensuring national economic self-reliance in our interpretation is an activity of the state and society on the measures aimed at optimal state of the socio-economic system and national security achievement introduction. Continuation of this national economic self-reliance can be considered as a preventing element in minimizing risks and elimination of threats to national security system in performance the duties to the community.

The above allows explicating *socio-economic system self-reliance as the relationship between different levels of socio-economic system with a view to balanced level of development achieving: when economic growth, material production and consumption, as well as other activities of*

the society contribute to national security. This interpretation adoption suggests that self-reliance is a system category, which is characterized by such system features as: integrity; balance; sustainability; dynamism; manageability; entropy; adaptability to the environment; all organizations of the system subordination to a specific purpose.

Environment in this case should be understood as everything that is outside the system and interacts with it. For example, for ergatic socio-economic system interaction with social and political spheres is considered, where the latter represent the environment. In addition, this also includes economic systems of higher hierarchical levels. Analysis of atypical world crises effects proves turbulent nature of the environment. Turbulence is defined as an unpredictable and rapid change or variability of the environment. "It is not the financial crisis that has caused turbulence in business", Donald Sull, a Professor of Strategy at London Business School says. "If the financial crisis ends sooner or later, the turbulence will accompany business for a long time." In his new book, "The Upside of Turbulence: Seizing Opportunity in an Uncertain World ", the author focuses on the need to monitor the constant variability not only to ... "survive, but also to use it in favor, [245].

Note, turbulence occurs rapidly, resulting in imbalance of all unprepared and vulnerable to chaos socio-economic system actors that it affects. And although the turbulence cannot be avoided in the process of functioning,

system management entities, probably, can choose how they will perceive it. On the one hand, management system must overcome turbulence and curb its negative effects. On the other hand, it is chaos, panic, period of uncertainty caused by the turbulence that may be the chance, the potential for positive change, which should be used to the advantage.

So, socio-economic system development in general understanding is interpreted as the process of its transition from one state to another, with the system quantitative and qualitative characteristics flux caused, among other things, by external environment turbulence. Note that this development does not necessarily mean growth, since the system can develop and if there is no growth (in particular, as a result of the transition to a new, but in comparison worse condition). Thus, the socio-economic system self-reliance is characterized by its ability to neutralize the consequences from influence on it, while maintaining its own security, integrity and structural balance.

Therefore, based on the foregoing, it can be argued that self-reliance is not only a management activities result, but at the same time, it opens up new prospects, ensures a socio-economic system development, and hence it is its result and prerequisite.

Conducted comprehensive study of self-reliance phenomenon proves that the "self-reliance" category is of general historical and general social concept, which covers the whole history and future of humanity, is essential to

the existence of both individual and social communities, as well as systems of any level.

In determining self-reliance parameters approach of the Russian scientist M. I. Belyaev, the author of scientific publications of the series "Milogiya is the basic science of the III Millennium" [12] seems to be the most thorough for us. Theoretical comprehension of hierarchical systems self-organization principles and their disposal methodological principles deserve not only academics but also practitioners of modern time attention. In particular, in national science "self-reliance" category research and further development of M.I. Belyaev views in the context of self-reliant transport system effective functioning is reflected in the writings of A.I. Zorin [71, p. 86], which is the motive for deepening the scientists views in this field in present study. Milogiya is a new science that contains fundamental laws and the laws of nature description and refers to the system integrity and self-reliance principle as follows: in any system there is the main link, which is a "guide" by pulling which the whole "system tangle" can be unraveled. This link carries the meaning of the system monad. It reflects the clear and explicit semantic content of the system integrity. System monad poles are characterized by complementarity.

It is the principle of self-reliance, according to M.I. Belyaev, acts as the cornerstone of modern economic science: "...self-reliance is almost synonymous with the system integrity concept and determines the integral system minimum lower boundary. Self-reliant systems

possess properties of its internal functions from external influences performance independence, with the exception of one or several veils “elected” by the system for these purposes that are responsible for such interaction".

The "absolute integrity" category in all holistic systems is taken as "1" (one). This category is used in reference to the systems that are directly included in the given. Thus, integrity and self-reliance link can be represented as follows:

$$\frac{Integrity}{1} = -\frac{1}{Self-reliance} \qquad (1.1)$$

Integrity and self-reliance define the upper and lower boundaries of any system. While the system exists within the specified limits, it is the system as such. According to the views of M.I. Belyaev, if integrity limit is less than necessary for self-reliance, the system will not be holistic and will be a part of some self-reliant subsystem (system). Self-reliance can have its quantitative characteristics as well. Herewith the ratio of 1/3:2/3 is most frequently used, which means that any system will be self-reliant if the 2/3 of the target system features multitude the system implements completely independently. Any integral Monad with external duality is holistic, i.e. 1/3 + 2/3 = 1.

As a result, exploring a "self-reliance-integrity" monad, which characterizes its two poles, we come to the fact that "integrity" reflects "upper bound" of the monad (one), and "self-reliance" reflects the "golden ratio" property (2/3). The rest (1/3 of the one) are the monad target at each stage of its evolution. Moreover, "self-

reliance" is a measure of a monad existence. With a smaller proportion (less than 2/3) the Monad loses its properties: it becomes a "puppet", integrated in other monad and does not have the same "self-reliant" rights.

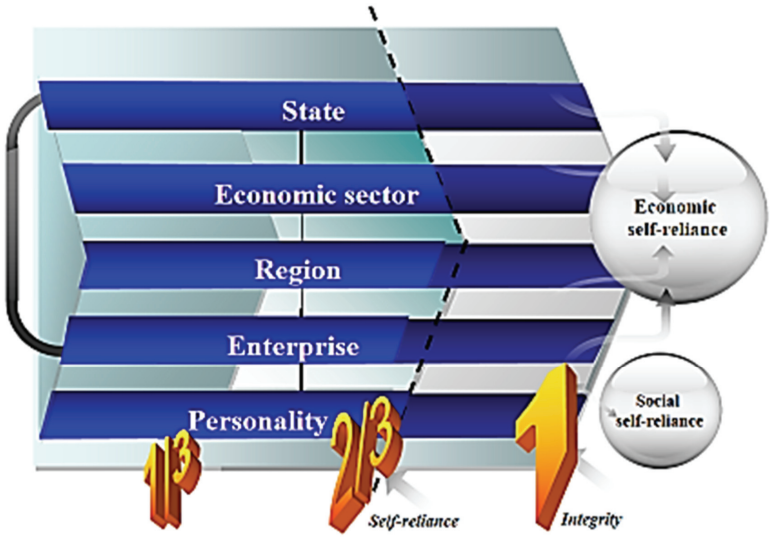


Figure. 1.2. Self-reliance levels and socio-economic system agents

** Source: compiled by the author*

In the context of our research it should be noted that in almost any economic structure it is possible to highlight a particular self-reliant part (segment) that can be represented dually: that is when it is able, on the one hand, to fulfill its functions independently (mostly at the expense of domestic resources) and if it is integrated (self-reliant) and, on the other hand, if it is able to enter into the market with self-reliant partners, that is quite viable. For such self-reliant systems it is required that 2/3 of the

resource needs was implemented at the expense of its own (domestic) resources or self-reliant internal potential.

It should be emphasized that system permanent self-reliance status preservation does not provide quantitative immutability of its parameters values. They may vary within the self-reliance scope. That is, the status of a socio-economic system is to some extent self-reliant while the value of its parameters varies from 2/3 to 1 within the self-reliance scope. The lower limit determines the socio-economic system self-regeneration limiting capabilities. With the achieved self-reliance minimum level, it is advisable to predict self-reliance potential that will determine the need for appropriate resource requirements and actual resources they provide.

This allows, in turn, justifying our own interpretation of "socio-economic system potential self-reliance" concept. In our interpretation, *socio-economic system self-reliance potential is a separate quantitative-qualitative characteristic of available resources as well as mechanisms for their distribution and disposal, with a view to achieving self-reliant development in turbulent environmental conditions.*

Socio-economic system self-reliance potential characteristics can be based on two approaches. The first involves an assessment of the resources available to the system, and the second is to determine a possible socio-economic result from the disposal of all involved in the economic turnover natural, human, financial and other resources at a particular time. The problem is that the

resources are used for both benefits and risks and threats reproduction. Consequently, the main problem is not only and not so much in resources availability but in utilization efficiency and socio-economic results.

In the socio-economic system self-reliance potential structure natural, industrial, scientific and technical, innovation, etc. types can be distinguished. Each of them has the essential features of development and functioning, trends and formation patterns. Thus, socio-economic system self-reliance formation is characterized by system of economic relations that contribute to self-reliance potential with a view to the further effective disposal. This requires a system of socio-economic and organizational-economic relations to transform this potential into reality, into a necessary and adequate self-reliance level.

Socio-economic system self-reliance potential can be viewed from the three perspectives: 1) in terms of physical-property structure; 2) in terms of its present status and development and utilization prospects; 3) in terms of this potential organizational forms of management and its implementation management.

In the first case, we are talking about the composition and structure of the resources that are included in the socio-economic system self-reliance potential and determine its size and dynamics. In the second it refers to the current status and the results of objective and subjective changes in quantitative and qualitative characteristics of self-reliance potential. The third position stipulates self-reliance potential forms, methods

and management tools, as well as its implementation process regulation. It should be noted that latter can be carried out both in the socio-economic system self-organization process, and in the process of conscious influence from the state.

Assessing the self-reliance potential, it is necessary to take into account factors influencing change in its quantitative-qualitative characteristics, dynamics of its composition and size. In our view, these could include the amount and accessibility of existing economic resources, the level of scientific and technical progress development, which determines the quality and performance of the national economy technical base as well as accumulated by the country scientific potential and the quality of the staff.

Since self-reliance is a relative concept, the following socio-economic system status changes directions identification arise from its parameters values with their base (or a certain optimum, potential, etc.) level comparison. Quantitative comparison of the system status (from among those that belong to self-reliance domain) at different times is carried out by determining these conditions self-reliance level by using the appropriate self-reliance indicators.

From the statics point of view, economic system is seen in a particular stationary equilibrium of its elements, that is, in the absence of their development. The dynamic approach involves the study of the system in the process of its system elements and their ratios changing [24]. On

this basis, in dynamics socio-economic system self-reliance, in fact, acts as an indicator that shows its internal environment status.

Socio-economic systems self-development process can be seen as a succession of the system self-reliance states, each of which at least is not worse than the previous one. It should be noted that the following states non-worsening condition, first of all, concerns the system economic component, which in turn leads to changes in social system. For systems, launching characteristics of which are comparatively lower, economic growth should be one of their self-development indexes. It, as noted previously, must be accompanied not only by quantitative changes but also by the system level qualitative increase.

Thus, economic self-reliance or economic systems self-reliant development is the ability to maintain a self-reliant balanced growth. Herewith, this balanced growth relates to the socio-economic system and it should manifest itself in its super-systems interaction (for example, meso-and mega-levels), as well as with the rest of the systems that are in contact with it. This definition actually combines self-reliance interpretation (as an economic system status) and actual self-reliant development.

Obviously, socio-economic system is a complex object of research. The solution of any problems encountered in such objects operation requires the use of systems analysis tools. In its initial stage the problem to be solved is formulated. Further the ultimate goal that must be

achieved in the process of solving the stated problem, as well as associated with these ultimate goal sub-goals, possible ways of their implementation and the resources of all kinds are defined. At the same time, selection of the most suitable areas and means of achieving the global goal is performed.

It should be noted that in modern conditions socio-economic systems structural elements are characterized by dynamism, variability, inconsistent development. This determines the need for constituent parts of the society economic system structural differentiation, without which it is impossible to know the objective laws and principles of its functioning. Any system is characterized by a hierarchical structure and seeks to acquire integrity and harmony status. System hierarchy is determined by its elements in the social structure location and their subordination mechanism. As it is known, the type of a system elements relationship can be "vertical" or "horizontal". Vertical dependence is manifested in relations of coercion, power and subordination, control and subordination, but horizontal links are affiliating, voluntary, competitive.

Not only necessary but also sufficient elements availability for the system self-development and self-reproduction multifunctional activity characterizes its integrity and self-reliance. System harmony attribute indicates an internal "socio-genetic" unity, purity, not its elements foreignness. The more transient mixed phenomena, forms and processes in economic system, the

lower its harmony and purity degree. This development trend should not be seen as categorically negative. If in modern conditions interdependence, intersection, economic systems development convergence enrich and improve each other it is a progressive process.

It is quite clear that development, interaction and complementarity at all system levels is the key to its sustainability, dynamism and efficient performance. And the ability to comprehensively, adequately and promptly respond to the turbulent environment changes indicates the socio-economic system adaptability. This, in turn, is not only a guarantee of both macroeconomic and micro-economic balance, but also of the system as a whole security.

If the balance between the relevant objective functions of individual socio-economic systems and subsystems is ensured at every level of society hierarchy, it can be argued that there is self-consistent field in the society objective functions. The complex of such objective functions will constitute an integrated self-consistent field of the society. In favor of self-reliance, it is necessary that from 2/3 to the maximum possible one (or 100%) of these functions were implemented in the socio-economic system structure. Therefore, *the limit of self-reliant development or "self-reliance corridor" is from 2/3 to 1.*

In parallel with the primary objective of socio-economic system self-reliant development identification a hierarchical set of sub-goals for the final result gradual achievement should be structured. In this aspect it is

important to ensure the right choice of priority for these sub-goals practical implementation. At the beginning a so-called national socio-economic system self-reliance core should be formed, which will act as its development stabilizer. It is appropriate to introduce such components, which are steadily in demand and, above all, domestically into the composition forming the spheres and individual activities core. It is more logical to select them from food, energy and transportation coverage. In these sectors it is necessary to identify a limited number of priority growth options and support them at the state level. By ensuring these sectors self-reliant development, i.e. forming national socio-economic system self-reliant capstone, which is not subject to significant fluctuations in the turbulent environment, the state will be able to rely on sufficient level of political, economic and social stability, which in turn creates the prerequisites for self-reliance and safe development achieving.

1.2. SELF-RELIANCE AS A MANAGEMENT TOOL FOR SOCIO-ECONOMIC SYSTEM SAFE DEVELOPMENT IN GLOBAL EXTERNALITIES CONTEXT

Scientific controversy, which is carried on finding the ways to overcome instability, the need to ensure the domestic socio-economic system further safety development is caused on the one hand by the need to adjust external aggressive challenges, and on the other hand by the need to reduce entropy within the system itself. It becomes obvious that its further development

strategic planning in the old model context is no longer possible. This will only lead to an entropy increase (randomness, energy disorder) in the system. It is logical that processes that increase economic entropy simultaneously facilitate outflow and reduce economic energy for future development processes.

We will try to explore and express our own scientific attitude in assessing the impact of modern structural changes of social formation on the socio-economic system functioning and further development. This particular will allow substantiating self-reliance as a management tool decisive role whereby a safe level of our country development can be achieved.

In our opinion, self-reliance instrumental quality is determined precisely through a comprehensive analysis of the socio-economic system business environment palette in the global externalities context. To this end, it is advisable to begin global structural changes historical analysis with a study of economic structure information technology paradigm implementation period, resulting in information technologies powerful leap development in the 1990s. This process was launched mainly in countries which are referred to as G-7 countries; however it has changed production activities worldwide. Production has not only acquired new forms of the division of labor, but has also completely changed its shape, giving the information technology paradigm just as the industrial revolution fundamental changes status, with the only difference that the backbone of the industrial revolution

was energy production and distribution and as for informational it was data transmission technologies [17]. The period that began after the World War II, is characterized by a number of tangible and significant scientific and technological discoveries, resulting in the 1980s in production mechanisms, based on microelectronics and computer science, mass implementation. It acted as a catalyst for the computer technology over the next decade development, which had already been widely distributed and used not only in production but also in everyday life. In this regard, it is important to understand how data transmission, processing and storage electronic information and communication technologies gradually began to occupy a prominent place in the socio-economic processes and designated the global "communication revolution".

The communicative network rapid development and expansion, which carrying capacity has grown due to fiber optics introduction, was a significant impetus in this direction. Padded in 1956 the first transatlantic telephone cable supported 50 compressed voice channels, modern fiber-optic systems support more than 50 thousand [33]. In the future, a variety of types and forms of communication has increased significantly due to the expansion of the frequency range - microwave and laser communication, as well as digital cellular telephony introduction. All these achievements have led to a drastic scale in global socio-economic system displacement: from the use of information and communications tools as stand-

alone devices for storing and processing information to their capacities interactive combination in the network. Caused leapfrog development of electronic information and communication systems also caused exponential growth in communicative acts. As a result, owing to communicative processes participants' technology driven clutches, in particular, such system as the Internet has been formed. Today it is the multimedia unified field, combining different epistemic structures in the global socio-economic system framework.

Electronic information and communication technologies proliferation, new high-tech industries creation, the global nature of changes, and the ongoing economic space virtualization necessitate self-reliance as an attractor of safe development new research perspective. Today, information production and consumption are an economic system and social structure of a society basis.

The above-mentioned allows to summarize that electronic information and communication landscape expansion, information multiple increase and the number of this information users lead, on the one hand, to the progressive attractors of socio-economic system development emergence and, on the other hand, contains numerous threats to this system functioning. Attractor (from the English attract - to engage, to involve) is a dynamic system, the area in which all possible deviations of the trajectory of the system at a stable phase of its movement are involved. Figuratively speaking, the

attractor can be represented as a rapid river with abrupt banks. Boat can move along any path on the river, but will not be able to leave it. The flow will always pull it so any complex open system can only leave the attractor at the bifurcation point. If you continue comparison with the river it is a tumultuous place, where the river is divided into several new threads. And no one knows where the boat will fall into which of the new channels. At this point, under even quite minor actions influence, a complex open system switches to one of several new attractors.

The role of government in the national economy in the global economic environment of the 21st century development should be manifested in the three-dimensional simply connected economic spaces (business systems) creation, which are homeomorphic with the respect to the three-dimensional global economic environment (similar to the Poincaré conjecture, proved by G. Perelman). One-connectivity refers to such links in the systems, which do not allow gaps when the energy economy circulates and is supported through information and communication resources involvement and sharing to strengthen the loosely linked economic chains and possibilities of their interaction between all economic actors.

In turn, homeomorphism is one-to-one and continuous mapping of economic interactions processes, the reverse processes in which are also continuous, that is, the processes are preceded with the permanent function of arbitration or moderation implementation.

Thus, states' strategic objective in a global competitive environment and national economic security threats growth, is new system structures formation (which are based on the data transmission latest information technologies), and thereby contribution to self-reliant development achievement by involving new members that will finally absorb disparate resources in that composition and volume, which will contribute to the system homeostasis achievement.

In the system of global externalities of today the state, which at domestic and international levels is able to form the most flexible and labile system of socio-economic relations on the basis of effective electronic information and communication system, wins. This will expand the country working population job security and information technologies for data processing and transmission use for competitive products (goods, works, services) production and sale, including export opportunities expansion and as a result - economic self-reliance and therefore national security achievement.

Based on the above, we can safely insist that the dynamic turbulent informational environment forms and directly affects the national system social and economic area architectonic, permeates all parts of social reproduction and simultaneously contains prospects, potential, as well as the threats to its development. This influence and importance underestimation would inevitably lead to an increase in entropy and even collapse in the socio-economic system. Thus, the dynamic turbulent

informational environment is the foundation and plays a role of:

– self-reliant leverage determinant, and thus national socio-economic systems safe development;

– formation factor of socio-economic system actors new forms of communicative behaviour with no hierarchical, spatial and temporal boundaries;

– demarcation in management factor;

– socio-economic system hierarchical levels harmonization factor;

– entropy and/or geentropy in the system resonator;

– socio-economic system actors new types and forms of organizational structures producer;

– socio-economic system adaptive management-organizational constructs modulator;

– socio-economic system management actors actions implementing acceptor;

– socio-economic system managing moderator.

In our work we focus on socio-economic systems safe development actual problems study. We believe that economic self-reliance is a national security function. Socio-economic system will be able to achieve a safe level of development if it is economically self-reliant.

Secure sustainable development of a society in conditions of permanent changes, determined by the social and economic processes increasing speed (rate of new data entry, response speed, and rate of appearance and use of new highly technical achievements of mankind) issue is one of the main reasons for the problem significance

accentuation in the modern science. As a result of modern development processes in the context of global externalities detailed study philosophers, political scientists, economists, and social scientists seek to find answers to the questions: What are the relationship of such phenomena as socio-economic system stability, permanence, self-reliance and national security cause and effect? All this is fully applied to Ukraine, which defines search methods and tools vector in further development strategy. Transport-communication system as a domestic socio-economic system structural element may become the "lifeline" that without significant financial investments at the expense of the existing potential can lead to the stability and self-reliance path.

To analyze the proposed hypotheses we offer to engross into sustainable development process understanding. So, at the moment there are more than fifty different definitions of reliance development. The term holds and hides a very general guideline and does not allow to determine its criteria precise limits, specific goals and methods of achieving.

Scientific literature on this subject panoramic overview indicates these concepts for the socio-economic system further development inconsistency, which results in different interpretations, as well as some one-sided understanding of their nature and relationships. Therefore, we see it necessary to clarify "stability", "consistency", "reliance" and "security" concepts from the system approach standpoint.

Summarizing presented in scientific literature various scholars' views we offer our own explication:

1) resistance is the ability of a system by means of its own capacity and internal properties (mechanisms) return to the preset trajectory of development;

2) constancy is the features of the system trajectories characteristics. It can be positive, that provides socio-economic development, and can be constant (stable) that provides internal and external balance state of the system and it can also be destructive and negative, at which the system degradation will occur;

3) socio-economic system development is believed self-reliant if that satisfies the majority (at least 2/3) of the internal operation needs at the expense of its own (domestic) sources and equivalent exchange of goods (works, services) export-import.

We perceive a definite correlation between these concepts. The relevance of this scientific discourse is defined by continuous mainstreaming in the context of a socio-economic system self-reliance instability status, and as a consequence, economic sciences increased interest for its nature and properties comprehensive study. A special perspective is self-reliance scientific representation that delineates the range of outstanding issues:

Firstly, there is a need for a socio-economic system self-reliance framework comprehensive analysis with respect to the trichotomy "form-content-function", which will build the self-reliance modal organization frame.

Secondly, this parameter estimation and national socio-economic system self-reliance potential specification will enable to define ways and means of national security achievement.

Thirdly, this self-reliant development management mechanism thorough study will make it possible to find new horizons in understanding terms, ways, causes and effects.

The solution to these issues is in the interdisciplinary research plane that "absorbs" various sciences achievements in the context of these processes examination. As it is known, scientists began to investigate the issues of sustainable socio-economic development thoroughly at the end of the last century. In this context, it should be noted the reports of the Club of Rome members and its founder A. Peccei [174] synergetic theory representatives works G. Haken, I. Prigozhin, I. Stengers, A. Poincare; E. Laslo, N. Luman [229, 290, 188, 182, 183, 116, 125.126]. Among Ukrainian and Russian scientists whose work is focused on solving the society stability and sustainability in the context of modern externalities issues, it may be noted A. Knyazev, P. Kurdyumov, V. Voronkov, V. Volovik, V. Beha, L. Bevzenko, S. Grabchuk, M. and others. [102-105, 39].

It should be noted that state's economy as a synergetic socio-economic system stable equilibrium relies upon structural evolutions continuity as the only possible way of its existence and development. In turn, each economy subsystem has its own periods of stability and reshaping.

However, in this case, a complex open system must have the ability to survive in almost continuous structural changes. Stability periods, i.e. the periods of its major backbone links preservation, are accompanied by moments of local bifurcations in the structural components, i.e. in the socio-economic system subsystems. Thus, the economy stable equilibrium state must necessarily possess dynamic equilibrium or dynamic stability properties.

Each "successful" local bifurcation, namely, which culminated in a more complex structure formation leads to external subsystem stability, and thus the entire system stability is retained until its subsystems at the cost of their restructuring do not allow fluctuations cross the system as a whole stability threshold [40]. The next stage of socio-economic systems development is their steady growth. Sustained growth is the basis for reliant development. However, for synergetic systems stability and equilibrium acquire a somewhat different conception, like the equilibrium state in biological systems understanding, where mutually opposite processes of assimilation and dissimilation occur continuously resulting in homeostasis.

The term "homeostasis" (homeostatic balance) was first introduced in 1932 by an American physiologist Walter Bradford Cannon. "Homeostasis" comes from the Greek language and is a combination of the two words "similar, the same" and "fortune, property". According to the Great Soviet Encyclopedia [26] it means internal

environment composition and properties relative dynamic stability, a living organism basic physiological functions stability; the ability of a population to maintain genetic composition dynamic equilibrium, which ensures maximum vitality. This term is most often used in biology. The homeostasis basis function is living organisms' ability to resist changes in the external environment using autonomous defense mechanisms.

Although the use of "homeostasis" concept in economics is quite rare, it is not unique. So, in the works of B.A. Rayzberg [189, p. 179] it is interpreted as the desire and ability of the economic system to maintain the equilibrium, which characterizes its sustainability, stability and conservatism. In other words, dynamic equilibrium type, which is characteristic of complex self-regulating systems and consists of essential parameters to maintain the system within the available limits; the ability of the economic system or structure to preserve economic developmental stability, while maintaining the existing public management system is recognized as homeostasis. We share the scientist's opinion, since it resonates with our views on the need to achieve and maintain socio-economic system self-reliance, which is defined within the specified parameters (self-reliance limits) and as a result provides safety development.

It should be noted that "homeostasis" concept is of particular importance in the cybernetic approach to the complex open systems study application which always include the feedback principle. It allows revealing self-

organization mechanisms, which provide stability. The tendency of the system to maintain homeostasis results in feedbacks creation, which can be parameterized with the behavior functions. Homeostasis phenomenon investigation made complex systems simulation possible.

Tektology of A. Bogdanova [22] is based on the system instability as a source of further internal development concept. Herewith, the author indicates the direct dependence of sustainability from the combination of elements method that is of organizational structure. The scholar distinguishes two types of organizational structure that is "centralist" and "skeletal". Centralist structures have a strong center to which gravitate and which are closely linked to other structural components of the system - they are subject to the center. In turn, the skeletal structure consists of skeletal framework and flexible parts. The first is the basis of the system, establishes the critical parameters and gives strength to the system. The second provides system flexibility and enables it to adapt and change according to external influences and internal needs in its attributes and parameters modification.

We believe that this classification is appropriate to be applied to organizational and socio-economic structures. For example, centralist organizational structures are typical of national administration structures: There is a dominating centre and management hierarchy principle. Along with this it should be noted that the centre authoritarianism is not always able to instantly respond

to external environment fluctuations and optimally modify the system itself i.e. respond to fluctuations instantly. The second type of organizational structure- "skeleton" dominates in the current socio-economic system which develops dynamically and is characterized by the variety of business entities forms. In the context of turbulent external environment impact uncertainty flexibility and adaptability is an indispensable prerequisite not only for the system viability, but also for its development. Particularly noteworthy are the findings of A. Bogdanov on the interaction of the two parts that is of the skeletal system and flexible one. The author argues that the flexible part of a socio-economic system is able to anticipate the centre in its development, which is less subject to change [22]. On the other hand, flexibility increases complexity and configuration form of the system. The system accumulates possible changes experience, which in turn stimulates the development of flexibility due to an increase in possible combinations to solving problems related to the system viability preservation and its further development.

In this context, a scientific position of A.N. Grabchuk [39, 40] is of particular interest, she believes that the economic system homeostasis is the system's ability to maintain the structural organization constancy in dissipative and entropy processes dynamic equilibrium. The author emphasizes the difference between synergy systems from complex structural systems. As in a synergistic system heterarchy property is the result of the

hierarchy development, and homeostasis is the dynamic equilibrium status manifestation. However, if it is usually argued that the mere equilibrium existence contradicts the entropy process nature, the homeostasis phenomenon is based on the simultaneous entropy and dissipative processes dynamic equilibrium. Like any homeostasis, a socio-economic system homeostasis is characterized by the system instability (the system is never in equilibrium, but always tries to achieve it) the structural organization of the system relationship (homeostasis is largely supported through internal structure flexibility or plasticity). It is by virtue of outlined phenomenon, according to A.N. Grabchuk, a so-called system previous state "memory" emerges, which is reflected, in particular, in economic processes fractal dynamics studies; and regulatory influences unpredictable results (as regulating effect is generated by the system itself and is an endogenous, the implementation of this effect leads to a change in the internal space, along with force and self-regulatory effect changes).

The homeostatic phenomenon is also a system autopoiesis result. It is the entropy and dissipative processes dynamic equilibrium account for the economic system growth for a certain long period of time without losing its structural organization sustainability. Homeostasis on the contrary is realized by the aggregate feedback that may be either positive or negative. While positive feedback the amplitude of deviations from the current structural organization of the system increases,

while it is negative the amplitude decreases. According to the author, the economic system homeostasis is not the result of deliberate control, and is implemented as a result of economic processes regularities. However, it is possible to return to homeostasis through control actions if the economic processes regularities have led to homeostasis disruption within certain limits.

Feedback processes investigation (or worsening conditions) gives scientists information that is important to explore various economic, political, social and ecological processes and phenomena, characterized by speed, unpredictability, leading to devastating consequences. Such characteristics are, for example, the disasters and crises phenomenon. The feedback processes in society and catastrophe theory lead scientists to the conclusion that the search of spectrum of metastable attractors, which could reduce system losses to a minimum during its entry into the aggravation scope, is indispensable. In our opinion it is the self-reliance that can be metastable attractor for a socio-economic system safe development.

One of the greatest aspirations that are the desire to preserve the system stability is distinctive for the whole of the living world. Destruction as a result of the system stability loss indicates the death of the system. But if we consider the statics as synonymous to stability, then it will lead to a loss of the system for which the dynamic parameters are the key development parameters. Sustainability, reduced to a certain limit, makes further development impossible. For too stable forms of

organization any evolutionary changes are impossible. The foregoing suggests that for such a dynamic complex living system, which is a socio-economic system as well, the two types of mechanisms are equally necessary and significant, that are negative and positive feedback mechanisms. Socio-economic system must not only maintain its homeostatic parameters (self-preservation parameters), but also continue its development (trying to achieve self-reliance), retain the ability to change itself in relation to the dynamic changes in the environment (ensure its functioning safety).

Note about the diversity phenomenon for the socio-economic development importance. System diversity curtailing will lead to its demise. It is through numerous changes, i.e. mutations, a socio-economic system acquires new features, becoming more complex and flexible, capable of sensitively and rapidly respond to turbulent external environment changes. The ideal state of a living system is the continuous state of the most comfortable conditions for it exploration. Comfortable conditions for a living system are the conditions under which the system is able to develop: acquire new qualities and eliminate old, unnecessary at this stage of development ones.

The impetus for the system diversity development is due to the two interrelated characteristics that are reactivity and resistance.

Reactivity (from the Latin reactia - opposition) is the property of a system to respond to the various environmental factors impact with functioning changes.

In the course of evolution, along with the complexity of management systems increasing, reactivity forms and mechanisms become more complex. The more complex socio-economic system is the more complicated its reactivity form. Thus, the reactivity mechanisms study is of particular importance for the preventive mechanism organization understanding, which is a mechanism for safe development ensuring. Reactivity changes can lead to homeostasis or vice versa, can cause entropy increase in the system. If reactivity changes in either direction (i.e. upwards or downwards) contribute to the system protective and adaptive responses inclusion, such reactivity changes improve resistance; accelerate the homeostasis restoring process, thus contributing to the self-reliant development threshold achievement. Conversely, if reactivity changes limit the protective and compensatory functions and lead to anergy (complete or partial loss of a specific "immune" reactivity), as a result, this leads to the socio-economic system reduced resistance. Thus, reactivity is a mechanism of a socio-economic system resistance regarding safe development threats.

In the context of a socio-economic system development, the mutation concept is not accepted to be applied, although it is completely equivalent to the phenomenon when the system assumes new qualities. It is to maintain its sustainability, a socio-economic system, like any other living system, dispenses from old and obtains new qualities. New qualities are appraised by the system for optimal application, if they meet the system's

requirements they become constant until the turbulent external environment requires new qualities to adapt to the newly changed conditions. The complexity of mutations, both in biological and socio-economic systems, is that they are unpredictable and the result of their actions cannot be reliably determined. So, the socio-economic system that seeks to survive produces "mutations" (for example, organizational structures invariants) as a response to the changed conditions. If the mutation leads to the system vital functions optimization, i.e. to its "immunity" or vitality strengthen, it is fixed and becomes a part of the system homeostasis.

Cumulative scientific potential of domestic and foreign scientists' research in the context of our study provides an opportunity to explicate the following: internal economic self-reliance serves as a socio-economic system homeostasis indicator and external economic security or self-reliance is the system's ability to interact with external environment without the homeostasis of the last disturbance. To the full extent we can assert that homeostatic property enables socio-economic system to maintain its composition parameters and functions relative dynamic stability in a turbulent environment.

Hence it follows *the self-reliance principle, which is decisive and necessary in socio-economic system functioning security protection. This principle is based on the system homeostatic boundaries exponential growth increment with self-reliance parameters in the context of all its structural levels dynamic harmonization.*

Basic conditions for achieving self-reliance and thereby ensuring economic security generalization have allowed us to identify its tool status, namely:

- self-reliance as a tool to achieve a socio-economic system geentropy;
- self-reliance as a tool to balance the relationship between the socio-economic system subjects;
- self-reliance as a tool of a socio-economic system structure harmonization;
- self-reliance as a tool of innovation development;
- self-reliance as a tool for competitive advantages achieving;
- self-reliance as export-import activities regulatory tool;
- self-reliance as a tool to financial equilibrium support;
- self-reliance as a tool of regional harmonious development.

Apparently, self-reliant development is much more extensive, and therefore requires a deeper and broader scientific notation of its cognitive-semantic organization and its potential identification.

1.3. CONCEPTUAL APPROACHES TO TRANSPORT-COMMUNICATION SYSTEM AS A TOOL FOR ACHIEVING ECONOMIC SELF-RELIANT DEVELOPMENT STUDY

As indicated earlier, globalization processes in the world economy lead to linkages, interdependencies and interpenetration regarding different economic entities

multidimensional increase, socio-economic system structure significant complication and, as a result, management problems of self-reliant and thus secure development become more acute. These objects successful management should take into account turbulent external environment effect and be based on an optimally chosen vector and sound strategy. This is fully applied to transport-communication system self-reliant development strategy as well.

It should be noted that globalization processes, simultaneously affecting all spheres of public life, "set the tone" and strengthen the focus on the national socio-economic system further development priorities. Therefore, the question of effective models, forms and technologies of self-reliant development in new environment identification is interdisciplinary, and in this basis must be treated from theoretical and methodological level.

With a view to establishing a coherent conceptual model we use an integrative approach. It is an integrative approach is defined as a core principle, which is based on the idea of basic theoretical approaches cumulative and synergistic interaction. So, to build the model we have used 33 approaches combinations for our purpose designated as transport-communication system self-reliant development, its operational environment and its interactions with each element position indication (of integrative dominant), intended to ensure the cumulative

effect of development by virtue of accentuation and intensification:

- Ukrainian TCS potential due to its uniqueness, originality, strategic value and its conceptuality implementation; the TCS environmental subjects disposition integrated characteristics in terms of self-reliant and secure development ensuring;

- reliability and intension to the economic self-reliance balanced development in contempt of destabilizing threats and actions;

- in their interaction and causal lines of the highest manifestations intermingling, dual response and impact mechanisms; formation and self-manifestation, maintaining and self-complication, self-actualization as a function of integral individuality system, self-reliance and security development fields in the context of global externalities resonance.

Conceptual model of transport and communication system self-reliant development in the context of globalization can be introduced through the three-dimensional transformations:

-У-axis – conceptual ideas chronological analysis regarding transport system development and its strategic importance;

- X axis – conceptual views on global development genesis;

- Z axis – self-reliance, its role in the national socio-economic system development conceptual ideas analysis.

The three-dimensional conceptual model of transport-communication system of Ukraine self-reliant development is presented in Figure 1.1.

From the standpoint of general, special and individual the processes are considered in the nonlinear system and presented in a simplified analysis scheme, in which the three-dimensional intervals are detailed:

– total in the X-axis coordinates;

– special in the Y-axis coordinates;

– individual in the Z-axis coordinates – self-reliant development in the context of transport-communication system integrated identity. Integrated identity in the context of our research is a TCS innovation development factor and national self-reliance, security and development ensuring, as well as its globalization influences product.

The represented boundaries zones are non-rigidly delineated as conceptual views evolution stages on each of the axles are subjects to individual differences. Individual facets "intersection" points require scientific comprehension, especially for radical transformations short-term critical phases, when the self-reliance role is paramount.

The study of transport in countries internal politics role, transport-communication systems impact on economic, political, cultural, geographical, etc. development have been discussed in the writings of many eminent foreign and domestic economic geographers, political economists, specialists in the fields of public policy and management, territorial development and transport studies.

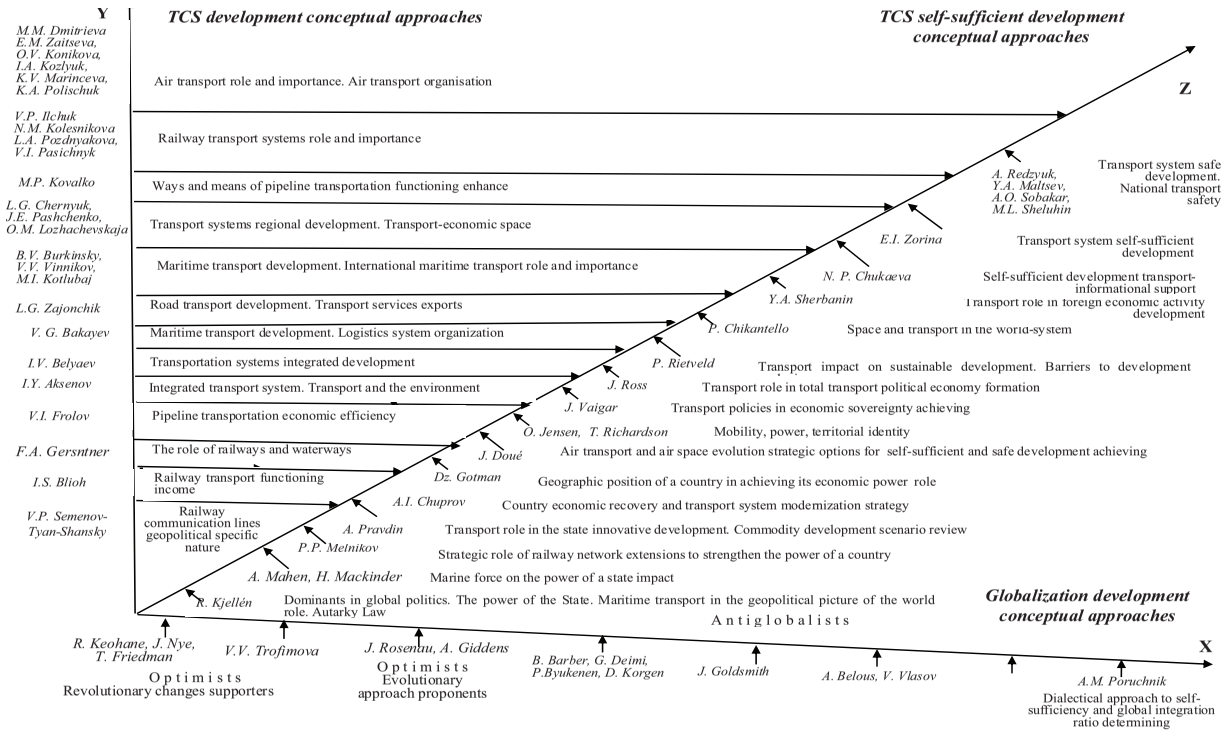


Figure. 1.4. The three-dimensional conceptual model of TCS self-sufficient development

In our view, it is appropriate to include some of the most important scientific works into theoretical approaches chronological analysis: the work of the Russian scientist V. P. Semenov-Tyan-Shansky "A Region and a Country", I.S. Blioh. F.A. Gerstner, V.I. Frolov [18, 35, 234]; Soviet researchers considerations such as I.Y. Aksenov "Transport: history, present, prospects and problems", I.V. Belov "Transport economic theory in the USSR", V.G. Bakayev, V.S. "Navy Operation", B.C. Virginsky "The railroads in Russia prior to the 40-s of the XIX century emergence", S.A. Vyshnepolsky "World paths and navigation" [3, 8, 37].

Transport communications crucial geopolitical importance was described by a famous Russian geographer V.P. Semenov-Tyan-Shansky in his work "A region and a country ", published in 1928. In his view, in the course of historical evolution the humanity has developed three types of states territorial systems: circumferential, parceled and "from sea to sea" (or cross-continental). The latter type, to which Russia belongs, necessarily involves the state attending to the inland water and terrestrial communications organization and development, as well as internal colonization. In doing so, Semenov-Tyan-Shansky makes very important in the context of the present dissertation conclusion of rail transportation geopolitical specifics and the need for its inclusion in the system of international transport links: "cross continental railways are very expensive and acquire

its real meaning only in conjunction with ocean flights fleets. Thus, we apply to the great world routes"[37].

Theoretical contribution to the development of transport, in particular railway, was made by a financial expert and publicist I. S. Blioh, who was the main shareholder, leader and a number of railroad tracks (St. Petersburg-Warsaw line, Ivangorod-Dombrowski, Lodz, libavo-Romenskaya, Tiraspol, Kyiv-Brest, etc.) and banking institutions (commercial Bank of Warsaw, the Warsaw society of insurance against fire, Credit companies, etc.) initiator, should be noted.

Participating from the mid-1860s in "Russian Railways Main Company" enterprises, Blioh dedicated a number of scientific publications to the rail issue: in 1864 Blioh worked out a note about this new branch of state economy in the Russian Empire accurate formulation. In 1875 a large study of Blioh "Russian railways regarding the operation revenues and expenditures, smuggling and movement of goods costs" with Russian and French texts published; that first experience in commodity railway statistics developing awarded a medal on geographic exhibition in Paris.

Theoretical substantiation of extensive transportation network linking rail and waterways importance belongs to F.A. Gerstner, a Professor at the Vienna Polytechnic Institute [35]. In 1834, Russian Mining Office invited F. Gerstner to Petersburg and proposed to inspect factories and mines. By the time he had already proved himself a highly educated professional, had an experience

in horse railways construction. After reviewing the situation in Russian industry and commerce, he concluded that Russia needs an extensive railways network which would link industries, commercial centers and ports. In particular, Moscow, St. Petersburg, Nizhny Novgorod, Kazan, Odessa and Taganrog.

Of particular importance in the history of pipeline transport economy are the scientific works of V. I. Frolov. In the author's monograph, published in 1928, which has not lost its importance in our days, he gave extensive factual material on the oil economics major issues, trying to draw attention to a number of mistakes in the industry management [234].

Among the Soviet scientific heritage in the field of transport development issues I.Y. Aksenov's [3] works should first be noted. The author systematized historical material and accomplished analytical work as to an integrated transport system creation, as well as presented the vision of its development prospects. In addition, the author explored the issues of transport on the environment impact.

A comprehensive study of the domestic transport economic theory formation and main development stages, as well as the analysis of key issues and transport system main development directions were presented in the works of Ivan Vasilyevich Belov [11], the Rector of Moscow State University of Railway Engineering in 1980-1985, honorary academician of Russian Transport Academy.

Theoretical approaches of V.G. Bakayev were distinguished by progressive views. In a number of scientific papers dedicated to maritime transport development, the author formulated the basic logistics credo well ahead of the western experts. He deceived the essence of this credo not only to allocation of freight between transport modes rationalization, shipping arrangements and processing in load transfer points, but also to ensure that the cargo is delivered to the desired destination in the required amount, due dates, necessary quality and with minimal costs. Only many years later in developed countries scientists have come to the determination that transport logistics will be able to achieve its goal subject to a number of conditions similar to that formulated by the scholar [8].

A special place in the development of modern transport-communication system is occupied by the works of Ukrainian transport theorists. So, the writings of L.G. Zayonchik cover road transport development perspective [68] as well as transportation services exports. Issues of modern maritime transport operation are revealed in works of B.V. Burkinskiy, V.V. Vinnikova, M.I. Kotlubay [30, 99, 100]. Study of L.G. Chernyuk, Y.E. Pashchenko, O.M. Lozhachevskaya [237-239, 164-167] is devoted to transportation systems regional development. Works of M.P. Kovalko reveal pipeline transportation functioning methods and the ways to improve efficiency [151]. A number of authors, namely Ilchuk V.P., Kolesnikova N.M., Pozdnyakova L.A.,

Pasichnik V.I. [91, 177, 217] in their writings explored railway transport problems. Air transport systems are the subject of an in-depth study of the M.M. Dmitrieva, E.M. Zaitseva, O.V. Konikova, I.A. Kozlyuk, O.l. Petrashevskiy, K.A. Polishchuk, V.P. Maslakov, K.V. Marinceva, I. P. Sadlovska L.Y. Filimonuk, Y.A. Cherednichenko, etc. [50, 130, 195].

Development genesis of transport systems self-reliance, their role in political and socio-economic development in our view should be started with geopolitics' works and, in particular, the author of this term - Rudolf Kjellén, scientific review. It is in R. Kjellén's scientific papers autarky ideas are traced [108, 236]. He approached state as a complex structure living organism, developing in space. The state as an organism has not only the "body" in the form of space, but also the "soul", presented by the nation. As noted earlier in this paper (p. 1.1-author's note), Kjellén interpreted management system as the state's ability to exist through the available within its territory own resources use, state position in the international economic turnover and economic policies, including free trade and protectionism issues, as well as colonization aimed at finding new sources of raw materials and markets. Rudolf Kjellén formulates autarchy law as a balance between extremes. A state, according to Kjellén, should be neither purely industrial nor purely agrarian, because then it becomes a hostage of the other states policies, dependent on the global power balance. From an

economic point of view, a state in order to be sustainable must be self-sufficient.

The father of the "geopolitics" term believed that through individual states in-depth examination the most common principles and laws in all states and at all times can best be formulated. The guiding principle is the power of the state. And concludes that the power is a more important factor to maintain the existence of the state than the law, as the law is supported only by the power. He found one more proof of his thesis in the power that is the state is a living organism. And if the law introduces moral and rational element in the state, the power provides it with natural organic momentum.

After the First World War and Versailles agreement Rudolf Kjellén substantiated the three keynotes in global geopolitics thesis. In his opinion these included: expansion, territorial integrity and freedom of movement. Kjellén argued that the United Kingdom was to a greater extent backed by transport communications due to its huge fleet, allowing it to dominate the sea lanes. The second factor was the British extensive colonial possessions. But with regard to solidity, the possession of the English Crown, covering 24% of the entire surface of the globe, were scattered all over the world. This was seen as its weakness. Russia, in turn, according to Kjellén, possessed extensive territory, monolithic structure, but at the same time lacked freedom of movement due to the small coastal area on warm seas and sparse railways network. Thus, the author indicated the vital role of

transport and mobility in self-reliant development ensuring.

Similar attitudes were held by American Admiral A. Mahen ("Marine force on history impact, 1660-1783", 1890), who believed that control over the seas means control over the world. In 1943, in the article "The round world and peacemaking" X. Mackinder proposed a new model that is "Heartland" (USSR) with "Midland Ocean" (United Kingdom and United States) union against Germany. In this article he justified the need to create a new geopolitical entity, the transatlantic community (North Atlantic Treaty Organization-NATO). These authors' conceptual approaches only reinforce the transport component significance integration in territorial supremacy, as well as global integration processes issues.

Representatives of Russian scientific school, particularly the first Minister of railways P.P. Melnikov in several papers pointed to the railway transportation in achieving self-reliant development importance. So according to him "...the system (railway – author's note) must cross the Volga, develop to the East and to the South-East and strengthen the power of the state with all the wealth hidden in its depth" [131].

It should be noted that the results of his trips to a number of European countries with a view to railways construction and operation best practice exploration, along with profound erudition, knowledge and experience enabled P.P. Melnikov to establish a scientific rationale of the Saint Petersburg-Moscow railway construction in his

work "Numerical data concerning the railroads and their application to the road between St. Petersburg and Moscow". He first developed a methodology for basic technical parameters selection and operating costs determination. As a result of these costs in foreign railways analysis the scientist proved the strategic importance of railway transportation in the state problems solution.

A. Pravdin can be called a proponent of his views. In 1838 he published a brochure "On the railways and block wood roads in Russia ". In it the author criticized economic policies doomed Russia to the role of raw materials for the West supplier. "Isn't it better, he wrote, to process own work rather than send it abroad in raw materials and get it back in finished products". He offered to build a railroad from Petersburg to Moscow and then to the Black Sea, convincing everyone that " ... this is the most important thing for Russia. "

Of great interest is the extensive and multi-faceted creative heritage of a great scientist, economist, publicist and public figure A. I. Chuprov, where a special place is occupied by various rail issues scientific-practical development which has retained their relevance at the present time. Valuable papers and conclusions of one of the Russian railway economic science founders cannot be overlooked when selecting a strategy of the country economic recovery and its transport system modernization [3]. His conclusion that no "railway management art creates goods where their country does not" convincingly

indicates the appropriateness of self-reliant domestic economy policy, where material production and transport must be developed in tandem.

In the context of this study conceptual approaches of the geopolitics classical school French representative, Jean Gottmana (1917-1994) is of particular significance. In his scientific works Gottman focused considerable attention in the concept of space. He wished to prove that the territory of a state is not proportional to its power. His main message was that the territory geographical location, its organization, its area as to the communications disposition was of the main significance. The fact that European states having rather limited territories dominated the mankind political life and managed to build empires, manifold exceeding the metropolitan territories is self-evident, according to Gottman. He believes that a territory location primary characteristic is related to the continental area and the sea. It is significant that the majority of civilizations originated exactly on coasts. In this paragraph the author relies on Ratzel and Mackinder conclusions.

Gottman believed that the key concept of political geography is the "circulation" concept (in literal translation from French is movement, displacement, interaction, circulation, turnover), thus emphasizing communications role and importance in modern development environment. In the process of communication differentiation of space, movement of people, goods, etc., occur and develop in a non-random

manner: routes, the road network remains relatively stable and is modified by virtue of the transport technologies progress, or due to human activity centres changes. The specified space organization by means of communications development process is associated with road intersection emergence, where towns as contacts, exchanges and transformations centers were created. Gradually the towns are transformed into administrative and political centres of regional solidarity, attracting and organizing the nearby space, and the "intersection" system with formed cities become the primary network, which constitutes a political framework for a state formation and development. Communications progress leads to the interaction continued expansion and more "symbol systems" and "lifestyles" creation, within which coexist more compatible private "symbol systems" that are, "iconography". That is, according to Gottman, regions, states, and civilizations formation mechanism.

It should be noted that Gottman conceptual ideas are extremely relevant nowadays. European geopolitical region historical development model proves the inevitability of integration processes as a part of European civilization development. At the same time, the author specifies transport and communication systems with the state power level relationship, that is, its self-reliance.

We cannot overemphasize the importance of scientific papers of the Italian school of classical period leading geopolitics Giulio Douhet (1869-1930), an Italian General, military theorist and strategist. Wide popularity in

military circles was gained by G. Douhet due to his military-technical works ("Use of vehicles in the army", "On motors", "On cold"). It is the conceptual ideas of this author are based on strategic air transport and airspace capacity assessment.

Douhet was one of the first to evaluate the military-technical and military-strategic aviation capabilities that Italy used in the colonial war in Libya hostilities.

In this context, Douhet's main work — "Air supremacy" (1921), in which he declared himself as the major military strategist and a public conceiving man, is of our interest. Douhet relied upon contemporary wars mass proportions, which he anticipated would continue in the near future. However, the future wars modality, according to Douhet, cannot hold constant: it is affected by science and technology development. He attached particular importance to aviation, which, according to the author, was intended to play a leading role in future military conflicts. He carefully analyzed comparative opportunities introduced for humanity after the first (earth), the second (sea) and the third — airspace environment conquest. Douhet saw the main advantage not only in the fact that aircraft can move in any airspace direction, but it can also reach the most inaccessible places. The fact is that the aeronautical equipment operating range significantly exceeded the artillery capacity. Aviation development, in his view, will carry out a coup against the military doctrines. From all listed above Douhet concluded domination strategy in the air, which

later turned, in fact, into a national security strategy. It should be noted that the views of G. Douhet are conceptually similar to the ideas of the German and French classical geopolitic schools representatives demonstrated above, but along with this change the air transport importance perspective in peace and war matters. Emphasis on the transport sector and in particular aviation innovation importance as a competitive advantages factor in the works of the author should be noted.

Innovative works of a number of above-mentioned authors deserve particular reference, in our opinion, they provide transport political and administrative studies conceptual framework. So, O. Jensen and T. Richardson in their work "Creating the European space: mobility, power and territorial identity" reveal philosophical-sociological approach to the power and policies issues in their interrelation to the factors transforming the physical space of Europe: high-speed cross-border mobility flows development, urban structures network formation, etc. The authors analyzed these factors on integrated heterogeneous phenomena and processes influence, such as: national and supranational identity, relationship between central and peripheral regions of Europe, urban and rural subculture, policy of polycentric development and sustainable development in the context of relevant European transport policy now and in the future.

Academic views of J. Vaygar presented in "Political aspects of mobility. Transport, environment, and public

policy" are to be noted. In it, the author reveals how drastically increased modern Western civilization mobility has fundamentally influenced political and public perception of transport problems revaluation. Vaygar formulated relevant approaches to the strategic objectives for transport policy "problematic audience" boundaries expanding definition, as well as theoretical and methodological research program. The ideas, proposed by the author, are aimed at achieving the objectives related to the states sovereignty, quality of life, environmental responsibility and sustainable development. It should be emphasized that the issues raised in the work of the author are related to the context of this study.

In the work "Transport, environmental policy and public security" of the same author, in the context of relevant to European transport policy "sustainable development" discourse innovative demand management paradigm, which is designed to replace the traditional approach, focused on the transport services supply growth, is analyzed The innovative approach of the author is attempting to address these challenges through the methodological and theoretical techniques drawn from the social and political sciences involvement.

Special attention deserves theoretical approaches of J. Ross. So, in his work "Linking Europe: transport policy and political process in the European Union" the author proposed a transport perspective development analysis as one of the EU public policy areas causing increasingly sharp public friction and debate. Considering four types of

transport, namely railway, road, air and sea, the author opens a discussion on transport fundamental role in the total European political economy past, present and future.

A book edited by P. Ritveld "Barriers to sustainable transport (transport development and sustainable development concept)" is of particular interest for this study. The main content of this work is to analyze institutions and regulatory systems in transport development role, their impacts on the citizens' behavioral patterns from the point of view of promoting the sustainable development ideas. It should be noted that the leading representatives of world academic science were appealed in the research resulting in international opinion on issues of national transport policies, local initiatives in this area, as well as issues of international transport cooperation representing.

Notorious contribution to the issue-related field under discussion makes a work "Space and transport in the World system", published and edited by P. Chikantelly. The author's theoretical approaches are focused on the intersection of globalization, spatial, topographical and transportation factors, on the international system organization and functioning. At that the core of the study is to examine maritime, land and air transport systems role in commodity and industrial development models formation and restructuring, as well as economic and social behaviour in a capitalist world economy. We emphasize that this work greatly enriches the existing world-system theories and world political economy and

globalization concepts, in which space, transport and communications systems issues are traditionally very fragmentary investigated.

We cannot fail to mention scientific views of Y.A. Shherbanin as to the role of transport in the states foreign economic activities development. In the author's monograph "Globalization: international exchange and transport" a wide range of transport issues in conjunction with the world trade globalization are researched in detail. The author raises conceptual issues of shifts in the role of transport, states foreign economic activities communication aspects in the changed conditions, gives some evidence of the transport links development need.

In N.P. Chukaeva monograph "Transport-information provision" [248] a comprehensive analysis of the potential, in particular for Russia, to participate effectively in the integration processes in the Asia-Pacific region is presented. The author emphasizes that the economic operators in integration projects effective participation will largely depend on ports and railways capabilities. N.P. Chukaeva focuses on transport process information component, which value increases multiple times in information and communication technologies rapid development and improvement era. In our view, this aspect has not been sufficiently described in domestic scientific literature, which motivates the author's study in her work.

Among modern scholars in the context of this work theme scientific approaches of E.I. Zorina [69-71] should

be allocated. She explores self-reliance concept and essence in evaluation functioning economic efficiency of transport systems, and in particular rail transport.

Transport system safety is closely correlated with its self-reliance; therefore we consider conceptual approaches in this plane study appropriate. Thus, among the domestic scientists these issues have been raised in the works of A. Redzyuk, Y.A. Maltsev, A.O. Sobakar, A. Prysiazhniuk, M.L. Sheluhina, etc.

Exploring the globalization development processes genesis, it should be noted that more clearly oriented understanding of globalization as a process of global political, economic and cultural integration, harmonization and standardization is presented in writings of Western scientists. Despite the fairly significant number of scientific papers devoted to this problem they have been dated since 1985, when the term was first announced by American sociologist R. Robertson. Different globalization interpretations have resulted in the fact that scientists representing radically opposing viewpoints are appropriate to be divided into "optimists" and "anti-globalists". These two camps are composed of representatives of both foreign and domestic science.

We offer the "optimists" group to be divided according to dominant conceptual idea on those who are revolutionary ideas supporters and evolutionary approach proponents. So, the first group is composed of Western scientific school representatives (R. Keohane, G. Nai, T. Friedman) and a domestic science representative

(V.V. Trofimov). Their views are based on globalization, covering all aspects of the mankind life, leading to "universal civilization" formation and worldwide peace, prosperity and well-being consolidation. Economic globalization will be followed by a political one, which will bring the matter to the world government.

"Optimists" representatives, who based their views on evolutionary approach, are G. Rosenau and A. Giddens. Globalization is a long-term process which requires states and societies gradual adaptation to a more interdependent world. Sovereign states, in their view, retain authority over its own territory, but supranational organizations influence zone expands and the world order will no longer rotate around a sovereign state axis.

Anti-globalists group includes: B. Barber, P. Buchanan, G. Deimi, D. Korgen, A. Belous, V. Vlasov G. Goldsmith, A. S. Panarin [16, 17, 162]. Pessimists note that the integrated world exposes itself to the danger of becoming dependent on violence based on the few leading regions.

In the context of our research scientific approaches of A. Poruchnik [179] outlined in the monograph "National interest of Ukraine: Economic Self-reliance in Global Dimension " acquire particular importance. In it a comprehensive analysis of the essence of "national interest" category has been conducted by the author and he also revealed national economic interests of Ukraine nature and structure and defined basic mechanisms for their implementation in internal and external areas. The author devotes considerable attention to the problems that

arise in the process of transformational reformation in the Ukrainian economy study, as well as the necessity to achieve economic self-reliance for Ukraine in the context of global challenges on the national ideas and post-industrial development model step-by-step mastery basis.

The foregoing study of conceptual approaches for transport and communication system development as an instrument to achieve economic self-reliance allows summarizing the following:

– chronological analysis of theoretical approaches in the context of the three vectors, namely, transport-communication system as a whole and its structural components development, TCS self-reliant development and globalization processes development confirms the transport component in achieving national strength and power importance;

– accumulated interdisciplinary scientific heritage confirms the need to the whole complex of different approaches to the study of this problem involvement, which case basis should include: system, integrated, synergistic, harmonization and integrative scientific approaches;

– provided conceptual design once again indicates the correctness of the suggested hypothesis, that is, transport-communication system is the transfer factor for economic self-reliance and therefore national security achieving.

CHAPTER 2
SELF-RELIANCE OF UKRAINE GNOSEOLOGY-CONCEPTUAL MODEL

2.1. A MODEL OF ECONOMIC DEVELOPMENT IN THE CONTEXT OF GLOBALIZATION DEFINITION

Term "paradigm" philosophical interpretation study allows it to be explicated as "a system of theoretical, methodological and axiomatic attitudes accepted as a model of the science's new tasks that is shared by all scientific community members" [1, p.731]. G. Bergman was the first to introduce the term into philosophy, but the real priority in its use and dissemination belongs to T. Kun. In his scientific work "Structure of Scientific Revolutions", issued in 1962, T. Kun highlighted the paradigm epistemological and social aspects. In epistemological aspect paradigm is a collection of fundamental knowledge, beliefs, values, and techniques that make up scientific activities. In social aspect paradigm is characterized by a specific scientific community that defines its integrity and boundaries and shares its essence. Paradigm shifts are carried out through scientific revolutions. The author specified paradigm concept by introducing a disciplinary matrix concept, a paradigm synonym-epistemic context. The disciplinary matrix structure includes: symbolic generalizations that constitute a formal apparatus and

language, characteristic of a specific scientific discipline; metaphysical components that determine the most fundamental theoretical and methodological principles of the world-view; values that define prevailing ideals and norms for scientific knowledge building and justifying. Term "paradigm" as an initial conceptual scheme, a model of problem formulation and solving, research methods that dominate a certain historical period in scientific community use definitely limits the content of the concept presented by T. Kun as it is applied "in a less narrow sense and admits alternative paradigms existence, which play a constructive, progressive role, in social sciences possibility" [1].

Paradigm shift in socio-economic systems strategic management is due to changes in global economy, competition and modern era requirements. It is consistent with the continuous search for competitive advantages sources, tools and methods to neutralize challenges and threats to self-reliance and safe development. Thus, to display economic and social development management on self-reliance principles modern paradigm the author believes that the "paradigm cut" presentation, which includes the following components, is essential: competitive environment conditions; strategic management of a socio-economic system development main objective to ensure an adequate response to external environment changes through a mode of action (strategy) development, opportunities search and use; the source of success is potential key elements for economic self-

reliance identification; the main result is goals achievement, competencies formation as well as competitive advantage in ensuring a self-reliant development level availability.

The strategy, which is its methodological basis and practical means of action, is seen as "guidance in new opportunities search and creation" [3, 155]. I. Ansoff in this context noted that "the strategy development is inevitable in a situation of incomplete information where all possible alternatives cannot be envisaged ..." [3, C. 177].

To date, one obvious fact is that there is no integrated schematic model for socio-economic system development management, which could solve a combination of functioning operational and strategic problems. This makes it possible for countries to address not only existing "traditional" concepts but also new, innovative ones that can create a sound and intelligent model to overcome development obstacles and problems of any complexity.

The topic of national self-reliance mechanisms in a qualitatively modernized economic model transformation, convergence and adaptation of countries models to the world economy turbulence, emergence of regional models and signs of future global model of economic development visualization and identification remains relevant and poorly explored. Both national and regional models of economic development are now based on fundamentally new paradigmatic foundations, among which are mainly: business cycles into a single global cycle system

transformation; info-communication component in individual and social capital reproduction importance strengthening; rigid hierarchical boundaries in world economy subsystems gradual erosion with their self-reliance importance simultaneous growth; regulatory functions and competencies between national, regional and sub regional institutions redistribution; social components importance increasing; new management philosophy taking into account information society era peculiarities.

Today, when the world economy is undergoing significant changes and economies of individual countries are not always respond in a timely and adequate manner to challenges and threats the issues of self-reliant and safe development management are becoming a complex scientific and practical task for each country, including Ukraine. Strategies for competitive countries socio-economic development formulation is reflected in the national Governments programmes and is ensured by economic policy measures that should be based on the principles of economic independence and self-reliance, as well as on forecasting and modeling further such development of the economy in global perspective context. Socio-economic system state of development is determined by many indicators, but one of the main factors is reactiveness and adaptability in countering challenges and threats to national security in accordance with chosen and scientifically based development model parameters.

An adequately modernized socio-economic development model should provide any country with a more or less universal tool to meet the operational challenges of the country, while its absence would make it much more difficult or impossible to develop an optimally balanced state economic policy. The lack of such tools would distort the system for determining strategic priorities for socio-economic development, make the country vulnerable to persistent challenges, and result in the Government most progressive reforms poor performance. The future is limited to those countries that effectively manage economic processes, predict prospects, develop and effectively implement their own socio-economic development model. That is why development models practice in the most developed countries acquires the value of studying.

There is no single approach to "economic development model" economic category understanding in modern scientific literature, and the use of this concept is confusing or substituting such concepts as "economic model", "type of economy", "economic bloc", "management type". Current uncertainty about this concept is wreaking havoc not only on the practical activities of politicians and bureaucrats, but also on, and negatively affecting, scientific community.

Therefore, we believe that today studies of the most significant classifications, characteristics and types of countries socio-economic development models in the context of the existing global environment are relevant,

important and necessary for the economic thought further development.

The "economic development model" concept came into the international economy theory in the second half of the twentieth century as basic features of economic systems functioning formalizing and typification method, accumulated information on countries economic situation comparing and systematizing, and was used within the epistemological paradigm. However, the investigated concept essence appeared from the moment of economic thinking inception, when the first theorists and philosophers attempted to build understandable descriptions of reality and simulate an economic situation that could answer the "What if ...?" question. With economic science, which roots are in ancient world teachings and which has always been an integral part of civilization processes development advent, attempts to understand society economic fabric and to provide recipes for economic progress have been reflected in many theories and concepts that changed from one to another, in accordance with society transformation under scientific and technological progress influence. For example, from the second half of the last century, with computer technology, dialog systems, speaker systems, etc. development, popularity of imitation models as means and methods of analysis, forecasting complex dynamic processes in a society has rapidly been spreading. Today, the term "model" is a part of almost all professional areas

lexicon and is a unique, multidisciplinary and trans-sectorial concept.

In scientific knowledge theory model is a central and complex concept playing a system- and essence-forming role. In different areas of knowledge and human activity, the "model" concept content is very different, and "economic models" differ from any others as well as from each other on many fundamental grounds. At the same time, it is common that, firstly, in the broadest sense, economic model is the basis, result and stimulus of managerial thinking; secondly, a model is a schematic description or analogy of a particular phenomenon (process) in a society, and thirdly, a model includes only the most important properties and characteristics of an object under study, and rejects all other superfluous research, that is, it is an idealized and devoid of an unimportant investigation object.

Generalized by the author of this monograph economic models study, which were implemented during the 20th century and proposed in the early 21st century, allowed to identify two main approaches used to identify economic development of countries models evolutionary and managerial essence.

According to the evolutionary approach, certain countries models emergence and operation are based on national, historical, religious, cultural, political, institutional and other characteristics that predetermine country's development possible trajectory. National economic model is based on the latest theoretical concepts,

evolves along with the system of economic and political relations, is complemented by new components and elements, and is also transformed under challenges and threats of existence in the global world influence. It should be noted that the evolutionary approach to date is the most common and popular in the world scientific community and is prevalent in domestic science.

We emphasize that economic development mechanism of the second half of the twentieth century analysis proves the following: The evolutionary approach, which provides absolute priority given to individual elements development, does not allow polyphonic economic reality to be squeezed into a single model framework. The evolutionary approach, with all its historical fairness and scientific value, cannot explain law of development in many national economies. For example, we are talking about the Japanese economy, where business and authorities' interests actually merged. Ambiguous are examples of the US and most European countries economies development. So, in the US, after the Second World War, the predominantly anti-business and redistributive socially-oriented legislation prevailed, compared, for example, with European countries that are generally considered to be socially-oriented. China economic development model in the second half of the twentieth century is considered to be ambiguous and to some extent unique: simultaneous coexistence of two opposing development models, that are interventional (in port cities) and endogenous (in interior regions).

In the context of the evolutionary paradigm, we first observe the use of almost identical imitation strategies for the economic development of many countries after the end of the Second World War, based on financial and technological resources in the United States borrowing and real divergence in countries economic development mechanisms after the 1973 oil crisis. It was at that time that the governments of a number of countries began to actively develop and adapt models to economic systems transformation conditions with a view to competitive advantage.

In this context, the answers to these and other questions can only be found in the focus of human action aimed at finding effective and safe development mechanisms, national competitiveness through the improved self-identification and self-reliance ensuring.

The scientific position of the author echoes the scientific views of V.V. Trofimova and is based on the fact that countries knowingly and purposefully choose and change economic development patterns depending on economic development stage, state and purpose; and the models periodic shifting and adjustment is an evolutionary process that requires their adaptation to the globalization ever-changing conditions, challenges and threats to their own development. Certain economic development models efficiency in the last century does not mean that they can be fully "imitated" or resuscitated in the 21st century agenda, although there is an undeniable value and historical experience But we believe that what

is more meaningful at this stage of human development is the ability to manage its own development processes, including its economic component at the individual, region, country, sub region and global level.

That is why managerial approach to economic development models study seems justified, timely and progressive.

Managerial approach was actively developed and used by researchers and government representatives in the 1990s, when countries selectively targeted and implemented models according to the chosen strategic development goal, while national features, although important, could no longer restrict the country's choice of an economic development model. It should be stressed, however, that differences in different national systems characteristics cannot be equated with different economic development models. This is emphasized by M. Prasad [3.5], D. Couts [5.6], B. Elsner and H. Hanappy [6], who used the term "pattern" to refer to these differences. G. Esping-Andersen [7.2] used the term "economic mode", H. Egberd and K. Esser [8] – economic system type; F. Prior [9] grouped countries into clusters, depending on their macroeconomic indicators importance. In addition, these researchers are trying to find the most common criteria for the country's economic development and, on that basis, identify typical models.

The monograph author proposes to expand the existing approaches to economic development models typing by complementing new classifications, namely, depending on:

– object of economic development level (national, regional, sub regional, global models);

– subject of management (active – model developer and manager are united in the subject, passive– managers use a developed by external subject model);

– initiated in the system changes nature (evolutionary – providing for an object structure gradual modification and revolutionary – providing for the old components with new ones replacement);

– interactions with external environment nature (balanced and unbalanced, which lead to excessive openness or, conversely, to isolation);

– resistance mechanism existence (provides for mechanisms to counteract external and/or internal destructive influences in cases of sudden actions, challenges and threats to safe living absence or existence);

– compensatory mechanisms existence (synergistic, which involve management institutions interoperability and interchangeability, mechanisms to ensure and implement actions in the event of sudden changes in conditions in key components of the model, thus guaranteeing the development mechanism balance, as well as the non-synergistic ones that is the object in certain parameters operation, which exclude the possibility of changes, merging of actors and mechanisms in the system of "crash" mode of operation;

– stages of economic cycle coverage (models of economic development that are primarily based on qualitative and substantive characteristics of economic

systems that characterize cyclical development, including transformation model; economic growth individual stages models, etc.);

– by self-reliance criterion (self-reliant and non-self-reliant).

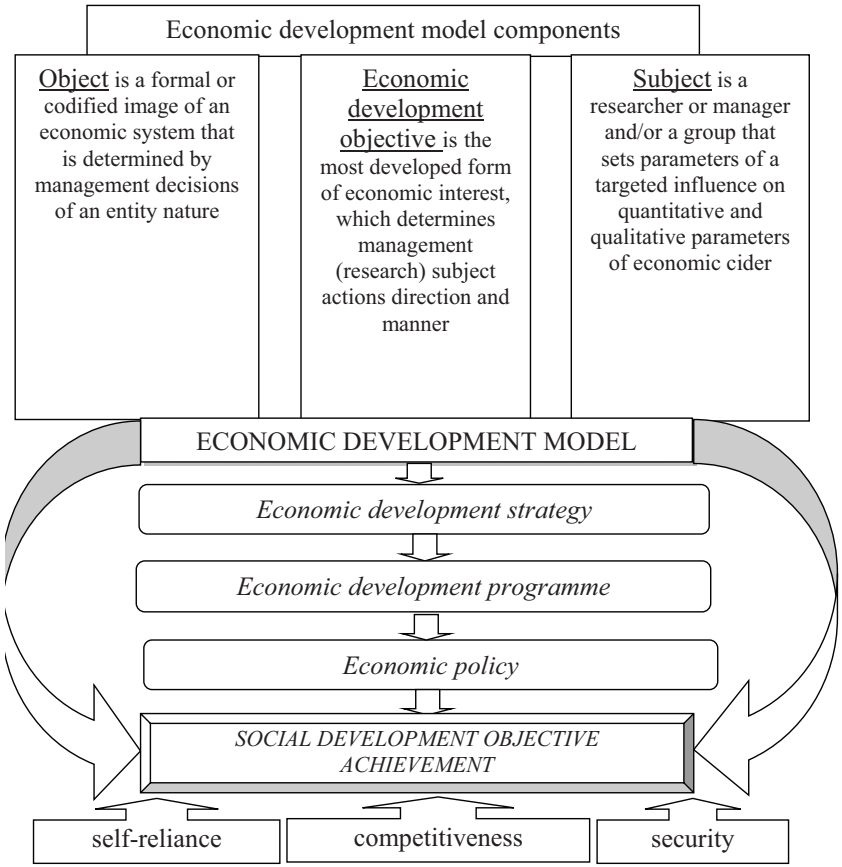


Figure 2.1. Economic development model managerial paradigm

** Source: compiled by the author*

All the foregoing allows us to summarize the following: to date, the managerial approach is evolved into a scientific paradigm that has become more diffuse in the world science and politics of different levels and is becoming a key idea in economic research. It allows to direct scientific research for the objectively existing universal management task solution that is social goals of safe development set by the countries in the conditions of integration into the world community achievement.

The author proposes to study principles of economic development models in terms of theoretical and methodological approach. Systemacity as learning general principle in its cognitive aspect is used as a fundamental tool to find systemic patterns for complex entities and phenomena development and also allows exploring the model as an epistemological structure, which sets a specific way of knowledge and thinking organization. Studying a model in the form of a system means exploring it as interrelated components integrity, which reflects legitimate relationships set, as well as its internal organization, which can exist, function and develop itself.

2.2. UKRAINE'S SELF-RELIANT DEVELOPMENT PARADIGMATIC FOUNDATIONS

World practice the of countries' economic development models implementation and their dynamic transformations in the globalization context require the issue of economic self-reliance rethinking, which in global integration context takes on a new meaning rather than

loses its essential content. Disclosures of self-reliant development patterns will allow correctly determine priorities and choose the most optimal mechanisms for including Ukraine in productive forces global circulation processes. Theoretical and methodological basis for the study of self-reliance development patterns could become the basis for the national development model effectiveness enhancing.

It should be stressed that a country's self-reliance as an economic category arises and is shaped only by global thinking emergence, since it is possible to position ourselves as a self-reliant country only in global environment where global laws are objectively established, non-recognition of which will lead to economic exclusion and economic development inevitable downturn.

Self-reliance as a global world phenomenon means self-awareness level as a self-effective, self-reliant, competitive, sustainable country. In global challenges and threats era, self-reliance must be more than economic activity basic rule aimed at positive result achievement, but the basic development principle, which will become an initial position in country's own development conception and strategy.

Socio-economic development model of Ukraine restructuring is a fundamental scientific problem, which involves, first of all, socio-economic development patterns of countries at the current stage study and effective methods and tools utilization experience to achieve strategic development goals. Theoretical and

methodological system for reforming socio-economic development model as a tool for ensuring country's self-reliance through innovative reforms formulation also determines the state policy principles in the sphere of the country economic, innovative and scientific development. That is why this study is of particular relevance and importance when Ukraine loses organization and development as well as economic independence and self-reliance potential.

The outlined range of problems causes the need for deep scientific analysis, active organizational arrangements and dynamic reforms implementation.

Today, the Ukrainian society faces an extremely complex, historically significant task of a strategy for socio-economic development of the country defining that would meet world development current and long-term natural trends. At the economic development current stage, together with such patterns as global knowledge-based economy emergence, development asymmetry, role of human capital enhancement, economic relations intellectualization and virtualization social and economic development at all hierarchical levels trend is also actualizing. World practice demonstrates that, at present, global integration processes nature and rules are determined by self-reliant countries, which have been able to transform their own economic development mechanisms and take leadership in the world, actively influencing other countries' transformations.

The author considers it expedient to recognize transition to a self-reliant type of reproduction of the national socio-economic system as economic development of Ukraine strategic objective. In the objectives hierarchy, economic self-reliance achievement must be primary, as it is the path that determines national economy competitive and safe development.

As noted earlier, country's economic development model involves economic development objective defining, requirements to the subject definition and ways of the object transforming visualization.

In this case, economic development objective is the most developed form of economic interest, which determines the subject of management direction and manner of action. The subject of the model is a manager and/or a public authority that sets the targeted impact on the system quantitative and qualitative parameters. The object of the model is a formal or codified image of an economic system that is determined by management decisions of the subject nature.

Based on the outlined above conceptual provisions, we will try to establish a socio-economic system of Ukraine self-reliance model.

Despite its global nature and solidity, "economic self-reliance" concept can be explored from the principle, purpose, instrument, and concept and development outcome perspective. As a theoretical synthesis that defines the main idea, content and trends, economic self-

reliance essence is revealed by the following systemic set principles:

– Self-determination;
– Self-consciousness;
– Self-significance;
– Socio-economic system self-organization;
– Self-regulation;
– Self-preservation;
– Self-improvement.

Thus, self-reliance paradigm should be based on the "7S" principles system: self-determination, self-consciousness, self-significance, self-organization, self-regulation, self-preservation and self-improvement.

Self-determination or assertiveness means freedom from someone's will. It is an active process of self-identification and own characteristics, abilities, opportunities and goals by socio-economic system subjects analysis to understand their place in the global system and to choose their place in it. This process essence is to identify and define own position in the context of national and supranational subordination through the "national" and "global" attributive qualities comparing prism. On this basis, their rational connection is ensured and the problem of national identity in the global economic area is addressed. As a conscious process of understanding and assessing global phenomena in society, self-determination involves the need to develop its own position in relation to what happens in it and, thus, becomes a part of the

processes associated with strategically important decisions adoption.

It should be noted that self-determination is a component of national values system, according to which the subjects' activity in the socio-economic system reaches a fundamentally different level — the empowerment level. National self-determination involves finding the most appropriate, available in the national socio-economic system, ways and methods for adaptation to the world trends. The self-determination result is the country's entry to national activity goals, directions and forms, spiritual self-worth and ability to independently make pragmatic decisions formation, mechanisms for their implementation and protection realization.

Self-consciousness in the self-development context is a set of opinions and assessments, scale and importance analysis that reflect current state and future prospects for the socio-economic system development content as well as level and perceptions characteristics. Self-consciousness includes objective components related to its role and functions in social and economic development realization as well as subjective components, which are formed due to interaction with other subjects. Thus, self-consciousness includes self-actualization and self-conception.

Socio-economic system self-consciousness is national economic consciousness nucleus and assessments and rational perceptions system linchpin necessary for economic and social life self-determination. As a process by which a socio-economic system subject perceives itself

as a part of the higher order system, self-consciousness is closely linked to self-evaluation and its activities results analysis, which ultimately leads to the self-improvement.

We note that self-consciousness is not a reality or a static value; it is a development product and is shaped by a process of facts, events, scale of activity and transformation rethinking.

Self-significance or self-worth is a socio-economic system quality consisting in the fact that its objective function is directed at itself. For example, transport system main purpose is to meet the requirements for goods and passengers' transportation, that is, the system is self-significant. This quality is inherent in virtually all stable (long enough) existing systems.

Self-significance is also a vital necessity measure in modern globalization space, where country self-esteem can be suppressed by political and economic pressure from the leading countries. One's self-significance as a factor of self-confidence and self-reliance awareness importance allows to create a positive image of a country and to position oneself as a self-reliant state as well as to act contrary to an example of others "blind" following and not to be guided by outsiders opinions. The pursuit to self-significance must be based on objective achievements of the country and be a condition for effective action self-improvement, since the self-significant world countries leadership know exactly what goals they want to achieve, and know how to achieve them.

Socio-economic system self-organization is socio-economic actors focus and ability to create, reproduce, organize and improve the system organization processes.

Self-organization in modern self-reliant development management paradigm is discoverable through forms and methods of socio-economic system functioning regulation. Self-organization importance lies in the ability to carry out processes aimed at correcting imbalances (breaking the harmony), new elements in organization introducing or outdated ones eliminating.

Self-regulation is a socio-economic system property, which is a result of reactions that compensate for the destructive influence of external and/or internal influences, aimed to maintain internal stability at certain, relatively constant level.

Homeostasis mechanisms include all basic processes of the system functioning regulation contours.

Self-preservation is a socio-economic system ability to maintain its internal structural equilibrium, integrity and quality in specific contexts. It is closely related to such concepts as: survival, equilibrium, ability to survive in any crisis phenomena. It should be noted that self-preservation is directly related to the system adaptation to both internal and external changes.

Thus, self-preservation is an integral part of the system's resilience and reliability.

The self-preservation law essence is that each system should make the fullest use of its domestic resources

(resource potential) to continually withstand destructive external and internal factors.

Self-improvement is the described above genesis processes apex.

Self-improvement is permanent evolution principle, a process of socio-economic system informed, socially and economically-driven development, in which the necessary traits and qualities are purposefully shaped and developed for the subjective purposes and interests of the system itself.

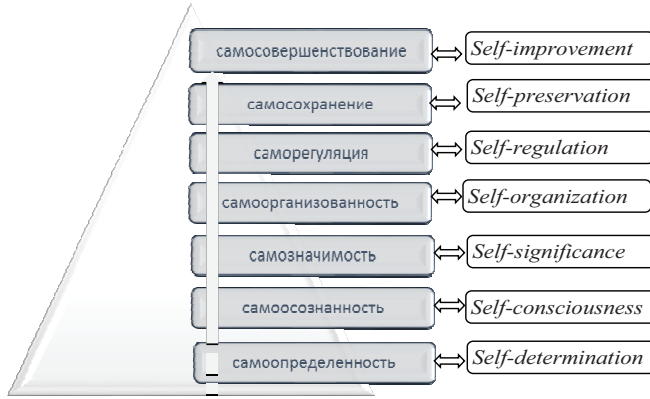


Figure 2.2. Economic self-reliance principles system-wide set

** Source: compiled by the author*

Thus, generalizing systemic interaction of the above "economic self-reliance" principles set, as a general trend (a pattern) can be recognized, which involves clear objectives setting, conditions and objectives creating, methods and tools to achieve self-reliance results parameters in the best and rational way identifying.

2.3. SELF-RELIANCE AS THE NATIONAL DEVELOPMENT OBJECTIVE

The issue regarding national development objective definition significance arises for each country at systemic and/or external shocks moments. This applies in full to Ukraine, where since 2014 domestic crises have been exacerbated by the Russian Federation external aggression.

Objectives for further development setting is an essential managerial task that requires not only social consensus and scientific development, but also the senior management for adopted and implemented managerial decisions of national importance responsibility.

The country leadership paradigm, according to which countries were divided into "leaders" and "periphery", remained in the past that is in the twentieth century. At the present time, in technological changes era, competitive level in global economy likelihood is possible if the self-reliance paradigm is shifted. Meantime, economic self-reliance achievement is a complex dynamic process that requires active and enormous efforts to secure and retain it.

The shock of the first decade of the 21st century, the world financial crisis, demonstrated existing macroeconomic imbalances and asymmetries that effect the world's advanced countries transition to the self-reliant type of development. Countries power modus is now considered in economic self-reliance perspective.

In practice, adopted national competitiveness programmes do not have qualitative characteristics of economic self-reliance phenomenon, and so often do not lead to the desired results.

Coherent socio-economic system, such as Ukraine, target and trajectory should be clearly defined.

In the author's view, Ukraine's competitiveness index in the next reporting period increase is a false objective that does not represent national socio-economic development true priority. According to global ratings, our country ranked 85 of 138 countries in a global ranking that is 6 positions lower than in the previous, 2015.

Since this strategy implies a comparative approach between Ukraine and the most developed countries, it does not always reflect the domestic socio-economic development true quality. Moreover, in current globalization context, when external factors have an unprecedented impact on the domestic socio-economic system, this external world economic conglomerate emphasis is not constructive and irrational.

Obvious is the need to define a new national socio-economic system development trajectory, which should maximally neutralize internal and external challenges and threats negative impact and exploit the country's internal potential. Ukrainian society is now facing an extraordinary historical challenge i.e. to define the way forward for socio-economic development to real rather than imaginary progress, and to that end experience of the world's advanced countries, instruments and the potential

for economic self-reliance comprehensive analysis is essential.

The starting point for updating socio-economic development principles and mechanisms is a "bar" formation, that is an objective that provides the basis for scientifically sound, measurable and time-specific sub-objectives construction. With objectives establishment the future development concepts and strategies main content definition, criteria and forecasting evaluation as well as targeted government activities begin.

In this sense, self-reliance as a socio-economic development objective designation is not an exception, since it is from the moment of this idea realization that a process of purposeful managerial activity to define sub-goals, identify tasks, find ways, mechanisms and resources for the realization of a self-reliance type of economic development begin.

Ukraine' transformation into an economically self-reliant state depends primarily on its transition to the self-reliance paradigm. Self-reliance as a development strategic objective recognition requires the subject of governance significant transformation and the public administration paradigm updating.

The outlined tasks complexity is also due to the lack of firm will and prevailing circumstances to clearly define the country's future development objective and to ensure national development strategy towards that objective stability. It will be particularly difficult to achieve the development objective in the long term, since in the

conditions of frequent changes of governments, sometimes oppositely directed, support for continuity of self-reliant development course is very problematic. It should be noted that the situation in Ukraine is quite dangerous, where the overall development objective is being replaced by various business groups' representatives' small mercantile objectives. We believe that self-reliance in the hierarchy of national-level objectives achievement is the primary, defining path of development and of bringing the economy to the global competitiveness level.

According to the writer's vision, self-reliance, especially economic, idea can and should become an engine for the Ukrainian socio-economic development and the nation consolidation.

2.4. CONCEPTUAL BASIS FOR UKRAINE'S SELF-RELIANT DEVELOPMENT POTENTIAL USE

Ukraine should enter the second decade of the 21st century with a clear model of competitive self-reliant socio-economic development, with global knowledge economy been a benchmark and a guideline.

Current development theories (post-industrial society concept, transformational economics theory, knowledge-based economy concept, Global Network society theory, innovation economy, etc.) operate in such categories as "Information", "Innovation", "Transformation", "Knowledge", "Network", "Internet", and so on, choosing a category as a development priority. Interrelationship and commonalities in different directions, contemporary

qualities of a society in existing theories reflection is the reason for their integration into one adequate whole and the new economy paradigm development.

According to the encyclopedic dictionary, economy knowledge is the highest stage in post-industrial and innovative economy development which is characterized by information society or knowledge society. So far, knowledge economy has been created by the US and partly by the EU.

Knowledge-based economy is also defined as one in which innovation and intellectual capital is in fact the main development driver. It is emphasized that knowledge economy generates high-tech products and provides high-quality services and uses and disseminates knowledge for development and competitiveness, with information, communication and other technologies being introduced. The economy is based on high-performance jobs and highly skilled and innovative personnel [9].

Thus, the knowledge-based economy is an economy the development of which is stimulated by knowledge that becomes the basis of material production due to constant development and innovation, which are based on information resources, products, services, technology and communications. Based on the categories and actual processes that characterize contemporary socio-economic development essence, it can be noted that knowledge economy includes main information and innovation economy features, that is, it has signs of information and

innovation, but knowledge capacity remains the main thing.

According to the author's opinion, economic self-reliance as a socio-economic system development result achievement is possible only on "smart" economy basis. Among main theoretical issues now dealt with by knowledge economy researchers is level of national economy industries and areas in new economic relations involvement determination. While some researchers restrict knowledge economy to certain economic activity types that have intensive use of knowledge evidence, the other scientists, whose positions are shared by the author, are spreading a new type of economic relationship to all spheres of social and economic life.

Attention in the presented monograph is focused on the use of one, in our opinion, having the greatest potential for self-reliance resource that is transport resource of Ukraine. At the same time, economic capacity use to achieve a sufficient level of development nuances should be better understood.

D. I. Cocurin indicated in his work [1]: "Modern economic knowledge has borrowed "its potential" from physics." This is confirmed, in particular, by the fact that in a number of domestic encyclopedia editions the term "potential" was used solely to indicate potential function which, in turn, is "first found in Greene's thesis "An essay on the application of mathematical analysis to the theories of electricity and magnetism", printed in 1828." [2].

As noted in contemporary studies [3], "this notion began to appear in economic literature in the 1920th in productive forces development level integrated assessment formulation". Since then, however, the productive forces potential idea has not been developed, and only after decades Academician S. G. Strumilin introduced "economic potential" concept in 1954.

Most of the works in the field of economics have a spatio-temporal link, which complicates the authors' point of view identification regarding certain terms general content. This is also true for the potential economic research, in which this problem is considered in spatial [4; 5] and industry aspects, including in spheres [6] and other [7] planes.

Potential category multidimensional nature and its internal content heterogeneity underlining are common to economic research. An integrated approach to its study highlights the following aspects:

1) sectoral approach distinguishes national economy different branches and subsectors economic potential;

2) resource approach is based on economic opportunities and the results of different types of public production resources (labour, natural-raw materials, potential of basic production funds) use analyses;

3) territorial approach distinguishes such concepts as selected economic regions, regions of the country, clusters and other territorial units "economic potential";

4) reproductive approach according to which individual phases and stages of expanded reproduction

process potential, i.e. production, distribution, exchange and consumption, their balance degree, as well as opportunities ratio proper understanding and accounting of simple and expanded reproduction of the country's economic resources are investigated;

5) material approach;

6) social approach.

We are close to the scientific position of researchers under the leadership of B. M. Mochalov. According to this team of specialists' opinion, "economic potential, its formation and use can be seen as the sum of economic system potential in the production of wealth, as well as untapped but objectively existing potential for more efficient use of production, natural and scientific and technological resources required by a society to achieve economic growth and better meet public needs "[5].

If we consider a region economic potential through content sides and its individual elements roles in the process of entire social and economic system self-reliance ensuring prism, it can be represented as follows (Figure 6.3).

According to the author, socio-economic system economic potential should be understood as the system's ability to effectively use basic (geo-economic, natural resources, demographics) and functional (logistical, labour, innovative, infrastructural, financial, investment, managerial, entrepreneurial) domestic resources and its opportunities in external conditions, capable in their entirety ensure its economic self-reliance implementation.

In turn, self-reliance potential is a quantitative-qualitative-temporal dimension of the ability to create, reproduce, organize and improve socio-economic system organizing processes with the aim of appropriate criterial boundaries achievement.

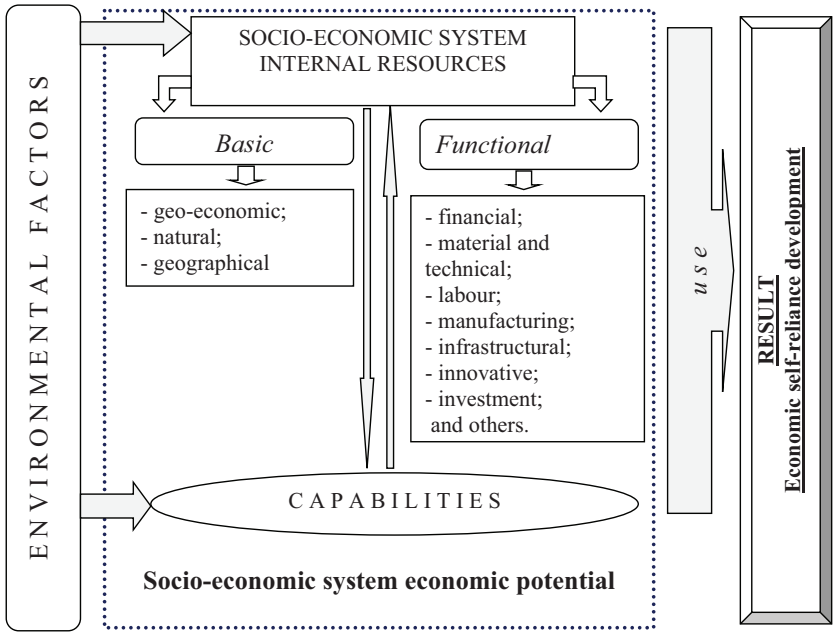


Figure 2.3. Concept of "socio-economic system economic potential" structural content in self-reliance development context

** Source: compiled by the author*

In general, socio-economic system resources, capacities and readiness for innovation, which are meaningful features of economic potential, are essential conditions for temporal systems' economic self-reliance.

CHAPTER 3
TRANSPORT-COMMUNICATION SYSTEM IN THE CONTEXT OF SELF-RELIANT DEVELOPMENT FUNCTIONING METHODOLOGY

3.1. TRANSPORT-COMMUNICATION SYSTEM PARAMETRIC IDENTIFICATION

Any system, including socio-economic one can be described by a series of parameters.

The parametric analysis essence is necessary and sufficient set of indicators characterizing all studied properties of the system specification and dependencies characterizing the total effect of the system or its elements formation [59].

It should be noted that the parametric research method is among the most objective methods of system's analysis, especially for ergatic systems. It is based on quantitative and qualitative properties of the investigated ergatic system and establishing linkages between parameters inside the managing and managed subsystems and between them. This enables interrelated parameters forms of dependencies and their quantitative expression determination on the basis of actual data.

Each system has a number of specific properties that distinguish it from any other similar one. System property

is an objective feature, manifested in its establishment and functioning. They can be described verbally, numerically, graphically, in the form of tables and graphs, functions, i.e. using sign system.

The parametric analysis general procedure begins with the object of analysis definition and its specific properties identification.

So, in national economy transport industry occupies a specific position as an integral part of economic infrastructure. Transport is a part of productive forces of a society and is an independent branch of material production which ensures socio-economic system as a whole proper functioning. It follows that transport activity result is material in nature and is reflected in real products produced by other industries movement.

However, some specificity, which distinguishes it from other sectors of the economy, is inherent in transport, namely:

1) transport does not produce new real product, but is a kind of production process within the distribution extension. Material production process ends when the products (goods) are delivered to the place of consumption, so transportation is a productive process extension initiated, for example, in industry or in agriculture. The production eventual outcome is sold to the consumer in the form of products (goods) delivery and this determines the attitude towards logistics, the rolling stock utilization improvement and transport costs as a whole savings.

2) transport production - transport service - is inseparable from vehicles production process, it is impossible to accumulate and lay in a stock for the future. Consequently, transport reserves involve throughput and capacity, delivery speed and service increase, as well as transport services cost decrees.

3) transport production itself, i.e. transport service, contains no raw materials. The share of wages in its cost is twice as high as that in industry. The costs of depreciation, fuel and electricity make up nearly half of all transport operating costs. It is therefore, increased productivity, improved production capacities and especially rolling stock utilization, fuel and electricity per unit of transport work spending optimization are essential to reduce transportation costs

4) funds allocated to transport development circulation, differ from the funds allocated to, for example, industry and agriculture development circulation. On the transport services market it is not a product in the form of new things, but the production process that is transport services providing is distributed, therefore, requirements for transport systems efficiency and quality include not only the delivery production i.e. transport activities eventual outcome, but also transportation production process (delivery on time, door-to-door, specific service) directly. In this context, transportation process speed and reliability, delivery upgrade and cargo safety improvement, all links in transport system reliability,

transport services quality increase and the system as a whole effective functioning are of particular importance.

5) labour constant required for goods transportation, does not depend on the value of these material assets, but on the weight and distance to move.

6) transport sector pricing, as in other sectors of the economy, is formed on the law of value basis, given this transport services price acquires a particular tariffs form.

7) transport industry is mainly characterized by the linear displacement paths;

8) there is no raw materials in transport sector total consumption expenditure, in contrast to other industries, but huge amounts of fuel, electricity, steel, synthetic rubber, oils and other materials are used.

In addition to the above noted we can assert that transport scope is at the same time the scope of population social activity realization: labour migration, its mobility with respect to access to recreation and culture, education, health, etc. places enhancing. Info-communications sphere development, including transport sector as well, improves the population quality of life through the service that accompanies transport services provision process. It should be noted, however, that about 10 per cent of the working population is employed in all transport sector.

At the same time, transport activity bears social burden as well. It is external to the transport, as it is not included in transport process actors costs and it is expressed in environmental pollutions (air, roads and adjacent territories surface, sea and river

communications, noise, electromagnetic radiation), transport routes depreciation (roads, railways), and is connected with traffic increase that worsens population mobility conditions, etc. In fact, transport functioning correlates directly with social security, because it bears risks and threats to the population health and lives.

Thus, transportation is one of the largest strategic industries, and has close ties with all economy and social sphere elements. With the state further development, its internal and external transport and economic ties expansion increase in production and rise in population living standards transportation importance and its role as a strategic factor will only increase. In the context of our study it should be summarized that transport-communications system is the national socio-economic system structural component with all peculiarities and development laws it implies.

The above-mentioned transport sector functioning features and its significance evaluation confirm that both for Ukraine and other developed countries transport is the basic industry of national economy, an essential part of industrial and social infrastructure.

It should be noted that innovation development acceleration, permanent innovation capacity and mechanisms for its implementation building have led the global communication space integration and have changed economic relations in the civilizational space equal share. Technical factor now is the modern development determinant. It is evident that technological development

serves as a catalyst for slow and/or radical (revolutionary) transformational changes of different types of socio-economic systems. That is, we observe gradual "saturation process" of socio-economic systems techno-technological platform, after all, evolution is based on the "permanent improvement" principle. Goods and passengers transportation system of varying aggregation degrees to greater extent due to information and communication technologies rapid development is not an exception. In such case, it is the economy transport sector that is hardly one of the most important producers and recipients of the process-related, as well as technological innovations. Moreover, extension of info-communication component significance is observed: It serves simultaneously as an integral transport element (production process), and this process servicing element (service). Thus, information and communication systems into the transport system organic integration are obvious. This factor in the context of modern externalities ignoring and focusing only on system transport component does not fully reflect their coherent unity. In support of this, the analysis of scientific and regulatory sources proved to use only the terms "transport complex", "transport road complex", "transport system", "transportation system", that require semantic transformation and correction in constant economic challenges conditions.

In Applicable legislation in accordance with Article 21 of the Law of Ukraine "On Transport" [66] it is stated that "Ukraine unified transport system consists of: public

transport (railway, sea, river, road and air, as well as city electric transport, including underground); industrial railway transport; departmental vehicles; pipeline transport; roads for general use. Integrated transport system shall meet social production and national security requirements; have extensive infrastructure to provide the whole complex of transport services including warehousing and goods for shipment technological preparation; provide foreign economic relations of Ukraine." So, listed integrated transport system components are actually a transportation system component. The "transport system" concept is wider than the "transportation system" concept. Transport system consists of several relatively independent subsystems and involves transportation system, hauling system, preoperational institutions system, objects service system and integrated information system.

Transport complex and transport road complex (TRC) are often referred to as the same and matching by definition concepts. Often they are even used as synonyms of the transport concept. When disclosing the transport complex essence the focus is shifted on vehicles use subject-material side, production and processes which provide transport resources with other types of supporting industries resources cooperation, transport modes activities among themselves and with the industries infrastructure cooperation.

The above definitions emphasize insignificant at first glance difference. So, transport complex is most commonly

identified with transport industry or transport system, simultaneously the vehicles, equipment, as well as communication routes special role for transport and road complex is emphasized and justified. Sectoral and cross-sectoral approaches to the study of the "transport complex" and TRC terms content are also common. So, sectoral approach defines transport complex as enterprises and organizations aggregate, engaged in shipping and transportation of cargoes from shippers to consignees. In turn, transport-road complex is vehicles, communication routes, weight-moving equipment and equipment to ensure the roads infrastructure construction and development aggregate. Hence, TRC notion characterizes transport technical and technological capacities, ensuring its industries efficiency. The cross-sectoral approach application enables us to submit transport complex extended interpretation as a complex, which includes: transport enterprises; rolling stock in good operating condition support organizations; transshipping equipment; carriers; freight forwarders and other contractors; infrastructure and service enterprises. Transport services process as a form of different means of transport technological and economic association and infrastructure facilities organizational unity to meet the needs of the economy in delivering goods and passengers is recognized as the transport complex.

Domestic science existing approaches to the problem of transport sector conceptual framework determining study

leads to several significant methodological generalizations:

– firstly, definitive uncertainty and some "obsoleteness" in regulatory and legal field indicates logical incompleteness and limited efficiency of the transport sector public administration system, in particular what is meant here is the possibility of providing informational sovereignty and transportation and economic space of Ukraine sovereignty;

– secondly, there is a divergence of the control object in the transport field interpretation and the important thing is that the objects do not take into account globalization development processes and international cooperation development. It is referred to the situation in the world, which is characterized by increasing threats - economic, military and information expansion. Traditionally it was believed that precisely military force determines the state power level, subsequently the focus was shifted to the economic strength as a major power factor. Presently a new notion is emerging and information is paid a core role, namely as the state ability to dispose modern information technologies and means of communication. Thus, depending on the original methodological concept scale of the consideration, which is the center of economic discourse, we get very different results.

With this context, the cross-sectoral studies semantic frames require more unified approach to TCS essence modern understanding with a view to effective

management. So despite all of the above described, we offer to study transport- communication system in macroscopic and microscopic aspects.

The author's "transport-communication system" category conception refers to two interpretations. Considering the above conceptual detailing and methodological explanations, as well as the modern world realities, transport- communication system short content, in our view, can be revealed, as follows: *transport-communication system is a system of mechanisms and institutions of transport activities organization, a method to solve transport resources problem and achieve appropriate goals of self-reliant development.*

This interpretation emphasizes transport activities organization, the role of which is increasing with the socio-economic system development and more subjects are involved into its functioning. At the same time, such organization process depends on the existing system of mechanisms and institutions. Finally, in our transport-communication system interpretation its social dimension is put emphasis on when referring to the established society material values as well as the way to solve transport resources problems and achieve relevant goals, namely, the self-reliant development level.

If we resort to more detail and at the same time extent and take the reproductive process into account, it is possible, in our view, to offer another transport-communication system content interpretation: *transport-communication system is an artificial, particularly*

complex spatio-temporal, multifunctional, ergatic, techno-technological, socio-economic and organizational open system that:

– is an aggregate of interacting and independently functioning types of transport to meet the population and social production transportation needs;

– is the point of economic growth and national competitiveness in a globalizing world enhance;

– acts as a transfer factor of national socio-economic system self-reliant development level ensuring;

– acts as an instrument for foreign economic goals and economic integration implementation;

– acts as a resistance factor in external threats countering and national security ensuring.

The proposed interpretation emphasizes the following essential points: transport-communication system is a complex systemic entity with all such entities' properties; this systemic entity is a government administration sphere and performs social and political functions, plays the "circulatory system" in the state complex body role; this systemic entity contributes to national competitiveness improvement; stresses the matters of self-reliant and safe development critical importance; all these economic systemic entity mechanisms and forms directly or indirectly provide the best population and freight owners demand in transport services meeting.

Both proposed interpretations must be added by the fact that an important characteristic of economic systems on the 21st century threshold is their being "tested" by

"self-sufficiency" category, i.e. transport-communication system should be self-reliant in the broad sense if it claims to be civilized and further self-developed in the world evolution present-day conditions. In addition, another transport-communication systems' important characteristic is an adequate security level.

In detailed elaboration of the TCS definition its another very important characteristic is pointed out, that is its temporality. It should be noted that with communication and transport technologies further improvement geographical, political, cultural, social, economic distances will decrease and their timing parameters will be reduced, i.e. "tightened", which ultimately will boost the number of events (quantum activity) taking place in a unit of time and strengthen the reality complexity, linkages and dynamism. That is, we are witnessing imminent saturation of the communicative environment in different dimensions of this phenomenon. Thus, interdependence and communication of transport sector progress and the degree of integration into the global political, economic, information, communication and other systems becomes more obvious, it determines the dominant strategy for the further socio-economic development.

It is logical to investigate transport-communication system as a holistic complementary entity in the space-time continuum. Communications tools and systems together with driven vehicles form interacting in space and time process of transporting goods and passengers.

Acting as the necessary complementary components of this process, they are efficiency, competitiveness and transport safety basic factors. On a related note, scientific argumentation of "transport-communication system" concept use appropriateness of different substantive coverage and in different areas of scientific knowledge is reflected in scientific works of such scholars as S. Akhmetova, K. Akhmetov, A. Gorbunov, I.Godya, S. Komilov, S. Kozhabekova, I. Pyatkina, M. Tulpakov. [244, 242]. However, we believe that this cross-sectoral research issue methodological and practical extent is at an early stage.

Semantic analysis of complementarity proves that complementarity means supplemental, supplemented, complete application to the whole. Complementarity is a supplementary properties or objects coordination collectively forming an integrated whole [107]. Complementarity is the two structures property to correspond to each other in a special way [206]. Complementarity is consistency, the feedback of complementary structures which is defined by their properties [59]. According to the image-bearing expression of J. Watson, they should match (complementary structures - author) each other, like "the key to the padlock" [26].

Thus, at the beginning of the 21st century the validity of complementarity principle, which forms the basis of the transport-communication system functioning, cannot be doubtful.

We interpret *complementarity principle* as transport and communication systems basic attributive functioning principle, which lies in coherence, mutual complement and diffusion of communication and transport structures ensuring based on their properties correlation in space and time. Under *TCS structural elements complementarity* we understand their attributive property to act as interdependence and mutual influence object in a space-time continuum.

It should be noted that the complementarity principle is used in various spheres of human activity. Ignoring this principle in modern transport functioning means objective realities "renouncement" and underestimation, as well as TCS strategic importance restriction. Research papers on this issue comprehensive analysis proves certain contradictions and inconsistencies existence, particularly in domestic institutional and normative spheres. Namely, for example, transport system management supreme body in such countries as Republic of Belarus, Lithuania, Kazakhstan, Kyrgyzstan and Armenia are called "Ministry of Transport and Communications", thereby underlining these subsystems inter-penetration and complementarity fact (this is confirmed by the relevant Web resources content). However, in Ukraine both the previous top management body title "Ministry of Transport and Telecommunications" and the current title "Ministry of Infrastructure" narrows and does not reflect transport complementary components unity and thus disperses effectiveness of management actions on

administration, control and development at the state level. As a consequence, all this is reflected in the state existing normative-legal acts to regulate various areas of the transport sector categorical-conceptual apparatus "obsolescence" and non-compliance with modern realities.

As noted earlier, economic scientific literature on the transport functioning issues study proves preferential use of "transport system", "transport road complex", "economy transport sector" concepts as immanent organizational unity of relatively stable systems (means of transport, related infrastructure, administration) filing their factual structure only in spatial indicators and simultaneous (stochastic) review. But from an objective point of view, we believe that the lack of temporality as transport-communication systems property integrated theoretical and methodological study, which can be a potential to accelerate the pace of socio-economic development, as well as the benefits of being a factor in achieving national security goals to be a significant fundamental drawback.

Methodology based on temporality for open dynamic (dissipative) systems, study of management processes, in which the need to take into account time parameters is assumed, reside at an early stage of formation, despite the attention of many researchers working in specific areas of knowledge, mainly those who are prone to hard calculations.

In this context, the author has conducted a content analysis of the definitions regarding transportation essence on any localization scale, certifying vast

accentuation in their spatial, technical, social and economic characteristics. Transport operation temporal characteristics is investigated quite fragmentary and largely in foreign scientific works.

Temporality or temporal length of the object is the same characteristics as its dimensions in space. "Temporality" in general sense can be defined as the amount of time at which an object or process complete specificity can be identified.

Time serves as transport-communication system specific environment implementing complementarity as stretched in time TCS essential property. In the study of transport-communication system temporality analysis implementation the following is proposed: time environment on TCS functioning influence, use of time as a resource for TCS basic functions implementation, time as the socio-economic development impact on TCS object, cycles as temporary structures in TCS effective functioning. That is, temporality manifests itself as a movement in time, namely means of transport and info-communications ability influence over the time.

Presented above allows to summarize that execution of transport specific functions that are manifestations of its essence, allows it to influence space, time and economy and society as a whole development. Hence, general description of modern TCS development study should focus on the following characteristics:

– spatial;

– temporal;

– socio-economic.

Thus, transport-communication system as a spatio-temporal integral complementary entity can be presented not only as extended in space, but also as extended in time, that is, as having spatial and temporal scope and structure. Space and temporality form values system and structure, as well as means of their expression.

To analyze such spatio-temporal variable in the time of a system, such as transport-communication system, a "status" concept is applied: an object is described as sequentially ongoing a number of the system development stages. However, the system status changing, for example, can be in the form of its structure transformation and its external qualities modification (which, of course, is a reflection of any structural changes).

Moreover, complementarity principle enhances emerging properties of these structures and "... cumulatively have a great energy that leads to stable enough complexes formation"[244].

All of the above proves feasibility of parametric analysis framework expanding and national transport-communication system research, which is the result of an evolutionary info-communications into transport system "combinatorial accumulation" and reflects modern quantitative and qualitative transformations.

New spatio-temporal TCS structure is set on the basis of already existing system with info-communicational components inclusion that only enhances its functioning synergy effect. Thus, we can confidently say that

introduction to the "transport-communication system" notion scientific discourse is the reflection of modern development realities which covers economic agents' relations and interaction system. The logic of combining components into TCS single system is to erect it in a new quality i.e. a macroeconomic policies tool with a view to further development objectives achieving.

TCS instrumentalization is quite economically sound, because, according to our opinion, it is thanks to such its properties as high reactivity and accommodation it would be able to overcome economic system rigidity effect to the various methods of government policies impact. Rigidity (from Lat. Rigidus - rigid, hard) is understood as the system's inability to quickly adapt to the changing environment, unwillingness to change action program in accordance with new situational demands. Therefore, in the context of challenges and threats to safe development, transportation-communication system not just as a term that requires scientific rationale, but as a strategic geopolitical and socio-economic recovery and growth tool rethinking is of particular relevance.

Focusing on transport-communication system as an object of research or design, we use system definition and its essence expression submitted in (243, p. 629), in which it is described as a set of components that are fundamentally necessary for its existence and functioning:

$$TCS \equiv <\{Cond\}, \{Z\}, \{Str\}, \{Tech\}>, \qquad (3.1)$$

where {Cond} is conditions, factors that affect TCS establishment, operation and development;

{Z} is a set of goals for TCS creation, functioning and development;

{Str} is a set of structures (topological, institutional, industrial, etc.) that implement these goals;

{Tech} is a set of technologies that contribute to TCS goals realization.

Transport-communication system is an important part of a socio-economic system discontinuous economic space. Thanks to its integration properties TCS as a socio-economic system develops into some reproduction and consumption of goods system. United economic area essential characteristics and conditions are common economic legislation, monetary system and customs territory unity as well as common infrastructure systems functioning (transport, energy, communications, etc.).

It is worth noting that the united economic area covers not only the entire territory of the country, but also the economic offshore zone (national waters and economic zone with national rights to shipping, mining operations from the seabed) and aerodrome limits (with national rights to air transport, environmental protection and environmental air quota). Transport-communications development determines not only the country economic space structuring that is extensive economic growth, but also the economy qualitative improvement, i.e. the process of intensive growth. Accordingly, TCS functioning is becoming a critical factor in economic development and society as a whole "quality".

The Constitution of Ukraine states that the country's economic space unity is guaranteed, free movement of goods and services and financial flows, competition protection, freedom of entrepreneurship; preventing the establishment of internal customs boundaries, duties, taxes and any other obstacles to the free movement of goods (services, capital) are guaranteed [92].

That particular, in our opinion, stipulates "socio-economic system transport economic space (TES)" concept into scientific terminology introduction. Hence, domestic TCS is an important component of transport and economic space of Ukraine, which is designed to transform socio-economic system potential resources into the real by transport resources address-trajectory transformation into its product-transport services.

The key to “socio-economic system transport economic space” concept essence understanding is revealed in the following definitions to read as follows:

– in the broad sense, TES is the scope of agreed interaction between transport-communication system economic entities within a particular environment;

– in the narrow sense, TES is multilevel poly-structural system complex of technological, economic and managerial relations, reflecting elements in the transport-communication system interaction within a defined territorial space.

Methodologically, parameters and structure of transport and economic space determination is an important issue. Two approaches to TES definition can be

offered. The first approach is based on technological, economic and managerial relationships, processes and phenomena in space close coordination and well-defined spatial boundaries (country, administrative region) restriction. The second approach is all these relationships, processes and phenomena in TES in its coordinates indirect project planning. While spatial boundaries may not be clear-cut and may not coincide with the boundaries of territorial units, as well as intersect and overlap, because TCS entities interest and operation areas are not limited to locality, region, and even country boundaries. The more these intersections, interpenetration and overlaps, the denser TES will be.

Ensuring methodological apparatus for determining TES parameters seems important. In particular, one of the possible options for the transport-economic space parameters defining is a set of indicators characterizing transport system density within a defined territory.

System density (P) reflects transport security area and is determined by the system length (L) to the area (S) ratio:

$$P = \frac{L}{S} \tag{3.2}$$

Communication lines density index (coefficient) (C) is calculated as communication lines density in micro region (L_{MIK}) to communication lines density in meta region (L_{MET}) ratio:

$$C = \frac{L_{MIK}}{L_{MET}} \tag{3.3}$$

Communication lines density index in great detail reflects relative transport routes security area, however, does not take into account traffic density associated with goods production and consumption centers development and location peculiarities. Therefore, for TCS transport infrastructure complete characterization a cargo-carrying density index (C_{DEN}) within a specific TES must be additionally calculated:

$$C_{DEN} = \frac{Q_{out} + Q_{arr}}{S} \quad (3.4)$$

Where

Q_{out} is an outgoing shipments amount;

Q_{arr} is an arrival of shipments amount;

S is a TES certain segment (region, macro region total area).

Similarly, passenger traffic density and TES certain segments additional need in transport routes can be calculated.

To assess certain segment of TES transport system security Engel coefficient (C_E), which is defined as follows can be used:

$$C_{DEN} = \frac{L}{\sqrt{S * N}} \quad (3.5)$$

Where

L is the length of the transport system in a specific segment of TES, km;

S is the area, km^2;

N is population size, pers.

When it comes to public transport, the area is taken as only the residential area (residential development area)

Transport system density characterizes its availability for client object regardless of its topology. For example, for passenger transport, transport line average pedestrian accessibility is connected with the system density by empirical Silbertal formula:

$$I = 1 / (3\delta) \qquad (3.6)$$

Where

δ is transport system density, which is determined by its length to the TES area ratio.

However, the figures only fragmentary disclose transport-economic space parameters. These methodical gaps require a new reasoning and complex methodological instrumentation for the system spatial-temporal assessing development. This aspect allows exploring transportation and economic space of individual, community, each means of transport and TCS as a whole. Depending on its links extent TES structure may include local, areal, regional, national and global dimension.

Transport-communication system of our country includes all types of surface transport (road, rail, trolleybus, tram, and underground), water transport (sea and river), air transport and pipeline.

The state's geostrategic position allows it to be primarily a profitable bridge for goods and passengers between the states of Europe, Asia and the Middle East transit transportation.

The TES territory is 1,316 km from West to East and 893 km from North to South; lies approximately between 52° 20 ' and 44° 20 ' North latitude and 22° 5 ' and 41° 15 ' East longitude. Extreme northern point is the village of Petrovka, Chernihiv region, South - Cape Sarych (Crimea), West - village Solomonovo near Chop town, Transcarpathian region, East - Krasnaya Zvezda village in Luhansk region. Geographical center of Ukraine is located in town settlement Dobrovelichkovka, Kirovograd region.

One of the defining systems for freight and passenger on TES territory transportation is transport-communication system, to which high-level requirements regarding quality, transport links regularity and reliability, goods and passengers security, delivery time and cost are applied in market conditions. In accordance with this transport communications of Ukraine state must meet European integration requirements. Pan-European No.3, Pan-European No.5, Pan-European No.7, Danube (water), Pan-European, No. 9, as well as International transportation corridor Odessa-Gdansk pass through our country territory [153]. EU economic area, although substantially plural, is truly united due to unified infrastructure systems, people, goods, services and capital free movement, common currency (EURO), national economic policies harmonization and a considerable number of state functions supranational governance. In this regard, the integrated transport system for the

successful functioning of a common economic space within the EU importance is difficult to underestimate [75].

Below is transport system of Ukraine diagram with roads of international and national importance. In 2014, the total length of roads amounted to 163,028 km; 1,131,313 thousand tons of goods was transported on them (fig. 3.1).

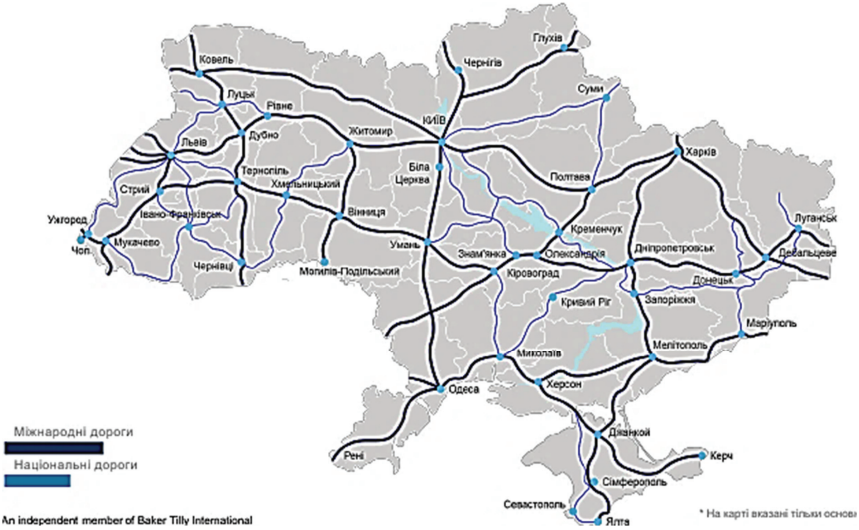


Figure 3.1. TCS of Ukraine road network diagram

The total area of Ukraine, which coincides with the boundaries of the TES, is 603.7 thousand km², representing 5.7 per cent of the territory of Europe and 0.44 per cent of the territory of the world. It is the largest country area located entirely within the territory of Europe. It is the second (after Russia) largest country in Europe. The length of the maritime boundary: 1,355 km (the Black Sea -1,056.5 km; the Azov Sea-249.5 km; across Kerch Strait - 49 km).

Our country is bordered by 7 states: in the East and North-East by Russian Federation (1,955 km by land and the sea border in the Azov and Black Seas is not regulated), on the North by Belarus (1,084 km), on the West by Poland (542 km), Hungary (135 km), Slovakia (98 km), to the Southwest by Moldova (1,202 km) and Romania (608 km by land, sea borders are not regulated). Coastline length is 2,835km.

Maritime transport operates in its own space; geographical and physical properties of which (ice-free Black and Azov Seas) define a strategy for its development and use for different purposes (commercial, tourist, military, etc.). The majority of the rivers belong to the Black Sea and Azov Sea basin, which surround the country from the South.

The largest river is the Dnieper River, with length of 981 km within Ukraine, which divides it in half Among other rivers the Southern Bug (806 km), the Dniester (705 km), the Siversky Donets (672 km), the Danube (174 km), the Tisza (201 km) are highlighted. A tributary of the Vistula, the Western Bug (401 km within Ukraine) belongs to the Baltic Sea basin.

Water transport parametric characteristics include sea and river transport activities characteristic.

Operational length of inland waterways in 2014 amounted to 1,613 km; goods transported thereon – 3,145 thousand tons.

Below is Ukrainian TCS river water transport arteries diagram (fig. 3.2).

Figure 3.2. Ukrainian TCS Sea routes diagram

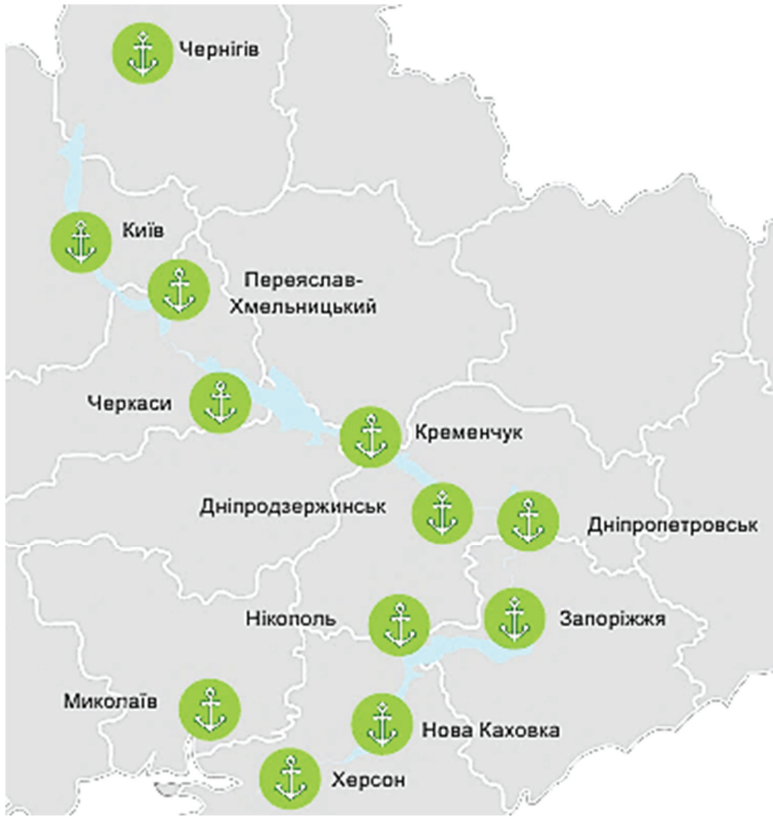


Figure 3.3. Ukrainian TCS river ways diagram

The most developed automobile industry of TCS of Ukraine parameters analysis should be started with motorways length, which amounted in the reporting period to more than 163 thousand km of which about 98 per cent is paved. By paved motorways density, our country ranks first among the CIS countries.

Currently, the automotive industry provides service to more than 9.2 million vehicles, including: 6.9 million cars, about 250 thousand buses, more than 1.3 million trucks and more than 840 thousand motorcycles.

International transport corridors pass through the territory of Ukraine, namely: Pan-European transport corridors No. 3, No. 5, No. 7 and No. 9; corridors of the Organization for Railways Cooperation (OSJD) No. 3, No. 4, No. 5, No. 7, No. 8 and No. 10; Transport Corridor Europe-Caucasus-Asia (TRACECA).

Main parametric characteristics of railway transport of Ukrainian TCS are:

– 6th in Europe and 12th in the world by Railways total length;

– main tracks operational length is 22.3 thousand km;

– track mileage is 24.1thousand km;

– electrified track sections is 9,763 km (63 per cent);

– average number of Railways of Ukraine core activities employees is 385 thousand.

JSC "Ukrzaliznytsia" is virtually a complete monopoly in rail transport in Ukraine.

The railway network of Ukraine territorial structure is presented in Figure 3.4. In 2014, the total tracks length

amounted 20,948 km, 386,277 thousand tons of raw materials were transported on them.

Figure 3.4. TCS of Ukraine Rail network diagram

The Ukrainian railway structure includes:

– 26 railway transportation directorates;
– 1,614 railway stations;
– 120 main railway stations;
– 50 motive-power depots;
– 43 waggon depots;
– 13 passenger wagon depots;
– 41 energy supply distances;
– 66 signalling and communication distances;
– 100 track distances;
– 33 civil engineering distances;
– freight car fleet — 132,500;
– passenger carriage fleet — 7,025;
– number of named passenger trains — 63;
– diesel locomotives pool — 2,447;

– electric locomotives pool — 1,547;

– electrical trains pool —1,547 sections;

– diesel trains pool — 528 sections.

Since 27 December, 2014 upon the NSDC of Ukraine decision passenger and freight traffic with the Crimea, the territory of Ukraine which is considered temporarily occupied by Russian Federation has been terminated [17]. In this regard, passenger trains of the Crimean direction run to Novoalekseevka and Kherson. Delivery of goods in direction to the Peninsula from the Ukraine Mainland is only carried out to the Crimea entry and exit security checkpoint — station Vadim in Kherson region.

Ukrainian TCS aviation industry parameters system includes the following indicators. So, on the country territory in the reporting year, aviation services were provided by 33 companies, of which 21 or 93 per cent are Ukrainian Airlines. Regular flights between Ukraine and world countries were carried out by 9 domestic airlines and 35 foreign airlines from 29 countries. Passenger services between 9 cities for regular domestic lines were carried out by 5 Ukrainian airlines. Domestic and foreign air transportation commercial flights airline were served by 20 Ukrainian airports. In such case 68 per cent of total passenger traffic and 88 per cent of post and freight were carried out through Borispol Airport.

TCS pipeline transport parametric characteristics consist of oil and gas and ammonia pipelines transport network activities characteristics.

In 2014 17 million tons of oil was transported, including: 15 million tons through haulage; 2 million tons to refineries located on the territory of Ukraine.

Ukrainian pipelines system includes:

– 4,700 km of oil pipelines;

– 51 pumping stations;

– 176 pumping modules;

– 11 storage plants with a total capacity of 1,083 thousand cu m.

System handling capacity:

– inlet – 114 million tons per year;

– outlet – 56 million tons per year.

Odessa-Brody oil pipeline characteristics:

– 674 km is linear pipeline portion;

– 1,020 mm is diameter;

– 9 – 14 million tons of oil per year is handling capacity (1st tranche).

Pivdenniy Oil Terminal Characteristics:

– 45 million tons of oil per year – nameplate capacity;

– 14 million tons of oil per year – applicable capacity;

– 7.5 thousand cu m oil per hour is tankers loading working productivity;

– 200 thousand cu m is storage tank capacity;

– 600 thousand cu m is storage tank design capacity.

Oil transportation system of Ukraine development prospects are linked to the economical use of the Odessa-Brody oil pipeline and offshore Pivdenny Oil Terminal situated near the city of Odessa. Possibility of the company participation in international oil transportation

projects is discussed these days. In particular, in Euro-Asian oil transportation corridor project, which is designed for oil supplies from the Caspian region and Central Asia to Ukraine and other European countries?

Marine Pivdenny Oil Terminal caters for simultaneous tankers reception for oil loading and unloading.

These operating conditions provide an opportunity for export oil transfer, as well as oil intake from the sea for the needs of the Ukrainian oil refineries or for further oil transit. Pivdenny Terminal is capable of receiving oil tankers up to 100 thousand tons.

Below is Ukrainian TCS oil pipeline network diagram.

Figure 3.5. Ukrainian TCS oil pipeline network diagram

Gas pipeline system of Ukraine consists of main gas pipelines, distribution networks, storage facilities, compression and gas measuring stations.

It should be noted that the domestic gas pipeline system is second in Europe and one of the largest in the world.

PJSC Ukrtransgaz consists of main gas pipelines stretching 37.6 thousand km in single drawing, with 71 compressor stations of total capacity 5,405 Mw. Throughput capacity at Russia with Ukraine border is 288 billion m³ per year, at Ukraine with Poland, Romania, the Republic of Belarus, Moldova border it is 178.5 billion m³ per year, including the EU countries it is 142.5 billion m³ per year [46].

Figure 3.6. Ukrainian TCS gas pipeline system diagram

Natural gas inflows to Ukraine by 22 main gas pipelines (Soyuz, Progress, Urengoy-Pomary-Uzhgorod, etc.) and outflows beyond the borders of Ukraine by 15. The gas pipelines length is 37.1 thousand km, including

14 thousand km of the piping largest diameter (1,020-1,420 mm).

The system incorporates 72 compressor facilities (122 compressor shops) and 13 underground gas storage facilities with the largest in Europe, after Russia, active gas volume that is more than 32 billion m ^{3} or 21.3 per cent of pan-European Active container. Underground gas storage network comprises four complexes: West-Ukrainian (Pre-Carpathians), Kiev, Donetsk and Poltava.

Gas pipelines network structure that passes through Ukraine is shown in Figure 3.6 Currently, Russia's GTN provides service to Gazprom, GTN of Ukraine - Ukrtransgaz.

Therefore, the represented above transport-communication system of Ukraine parameter estimator gives an opportunity to present its parameters and structure in the national importance context.

3.2. TRANSPORT-COMMUNICATION SYSTEM MORPHOGENESIS

To assess the status and perspectives of national TCS development its structure study is firstly assumed. In accordance with the theory of systems provisions, the structure characterizes system's internal structure in its component parts mutual arrangement and interrelations. Representatives of domestic and foreign science tend to represent the four elements of the transportation system, such as: transport network, mobile vehicles, labour and management system. In our view this presentation of

cargoes and passengers transportation system structure does not sufficiently reveals its essence as it does not reflect TES components linkages and interaction and does not take into account its possible layered composition.

Developing the scientific provisions of transport complex structuring we offer our transport-communication system structural and functional organization point of view.

So, TCS as socio-economic system separate part possesses its attributing: purpose, subject of functioning, structure, subsystems and elements, functions, etc. TCS development managing should be based on this attributing, as well as take into account external environment on its integrity and self-reliance impact.

With a view to self-reliant development transport-communication system should act as structural and functional integrity in terms of the system entities market atomization, government sectors decentralization, as well as empiricism total domination in transport operation methods. In these conditions, elements local target and TCS managers' current motivations naturally dominate the system goal.

To preserve integrity and achieve self-reliant development level TCS should be formed on the unified system-oriented methodology of grounded elements solutions as contributions to domestic transport development unified concept implementation [240].

Economic system functioning is based on four of its objectives: production, distribution and consumption of

various benefits as well as discrete economic space transport integration. The solution of the first three tasks is preceded by its fourth task solution. The importance of the latter is due to spatio-temporal gaps in socio-economic system TES existence [244]. Four consequences result from spatio-temporal discontinuity of this space: a) manufactured products have an exchange value, but they do not have consumer's utility, so they (the products) are only economic system potential commodity resources carrier; b) people in their places of residence may not be included in the scope of production, economic and other relations and, therefore, are socio-economic system potential human resources; c) economic system initial phase of functioning is converting its potential resources (financial, trade, industrial, technological, innovation and investment, labour, human) into real; g) converting these potential resources into the real is based on transport technological resources to transport activities transformation process - gross; d) socio-economic system transport-economic space is a system of benefits reproduction while transport-communication system is its subsystem; e) spatio-temporal gaps in the specified transport link elimination is each resources transformation in TCS functioning consequence.

All the above enables to define *transport-communication system object-matter* as individually-mass and optional (according to the subjects requirements and obligations) transformation of socio-economic system potential resources into the real resources.

Accordingly, TCS functioning object-matter can be defined as follows:

$$F_{ткс} = \text{real}, F_{всэс} = \text{real} : Rпн1 \rightarrow Mпп1(Fтс) \rightarrow Rпн1(Fмс); Rпн2 \rightarrow Mпп2\ (Fтс) \rightarrow Rрн2\ (Fмс), \text{at } Mпп1(Rпн1) = \text{idem}, Mпп2\ (Rпн2) = \text{idem}, Q1(Rпн1) = \text{idem}, Q2(Rпн2) = \text{idem}, \quad (3.7)$$

Where

Мпп1 is socio-economic system commodity resources carriers mass that are transported as freight transport subject;

Мпп2 is socio-economic system commodity resources carriers mass that are transported as passenger transport subject;

Q1 (Rпн1) and Q2 (Rпн2) are aggregate characteristics of consumer quality of socio-economic system potential product and human resources carriers.

Conversion scheme provided in the formula 3.2 provides a chain of TCS manifestations implementation:

a) TCS transport and communication resources into transport services conversion;

b) socio-economic system resources conservative conversion while maintaining the number of Мпп1 (Rпн1), Мпп2 (Rпн2) and qualityQ1(Rпн1), Q2(Rпн2) of its potential resources;

c) the chain of events implementation: $F_{ткс}$=real, $F_{всэс}$= real. The TCS functioning importance is in targeted directorial and mass spatial-temporal gaps in TES elimination by means of transport resources into the transport processes technological conversion (Rтх → Wб)

in order to implement transformation chain of socio-economic system potential resources into the real in accordance with the specified conditions [Habutdinov].

We consider the very notion of transport capacity as: properties aggregate acquired in TCS; acting as resource stock pile that is transport-communication system realized and unrealized potential ratio. In prospect transport potential is the TCS potential capacity for the further development not only by implementing its existing properties, but also by acquiring new attributes [244].

On the basis of the above reason of transport integration into the socio-economic system phenomena TCS *functioning overall subject-matter* is technological resources in the processes of goods and passengers transportation through the use of transport technology and functionality of transport infrastructure transformation ensuring.

In order to implement TCS functioning overall subject-matter its subject configuration, consisting of three interacting functional components is formed: "transport - transport infrastructure - interface".

Methodological bases of TCS development management are disclosed through the appropriate attributing, that is a number of important identifying categories definition that will realize the goal and the overall subject-matter of the system functioning. These include: structure, subsystems, components, functions of the subsystems and components, consumer and additive properties of the components, the components properties

emergent compounds mechanisms, resource and propriety unit, transport-technological unit, system structural and functional organization, integrative system property, components and subsystems development concept, conceptual innovation, subsystems and components conceptual development strategy, conceptual development strategy [227, 228].

We offer our own conceptual reconstruction of transport-communication system structurally-functional organization.

So, passenger and cargo transportation system structure as holistic formation should reflect two aspects: Firstly, ensuring means of transport as a unified system interaction; secondly, transport systems coordinated functioning and various hierarchical levels communication organization. In scientific works of Russian scientists, such as L.B. Mirotin, V.A. Gudkov, Z.Z. Zyryanov [137] is indicated that transport industry unity lies in various means of transport interaction, each of which is a complex system structure and serves as interrelated technical, technological, social, etc. components aggregate. At that, social structural components act not only as transport services consumers, but also as functioning organization and management subjects as well as TCS structural components in transport-economic space interaction subjects. TCS of different levels coherent functioning is primarily based on activities from single center coordination mechanisms.

In numerous scientific writings system configuration is presented in various forms, such as: network-structured, tree-structured, matrix-structured, etc. To describe complex open systems structural links hierarchical tree-like structures are widely used, in which each element of the lower level is subordinate to a higher level element.

Analysis of scientific papers of M. D. Mesarovich [135] and N.Y. Sandakova [196, 197] has contributed to transport-communication system structural configuration concept rethinking. So, fundamental principles of hierarchical multi-level systems theory of M.D. Mesarovich are based on hierarchical systems special classes' identification, such as strata, levels, layers. They differ in the various principles of the components relationship within a system-level and various higher subordination levels interfering right into the components of the lower subordination level relations.

N.Y. Sandakova proposed a transport system of a region stratified model. Transport system structure stratified model analysis provided by the author enables us to fully agree with M.D. Mesarovich main theoretical provisions, make adjustments to N.Y. Sandakova proposed structure and propose our own vision of transport-communication system structure as a macro system.

We emphasize that these works refer to transport system at regional level internal structure. Its structural configuration is based on system's components aggregate

distribution on physical, technological and organizational strata. It is our belief that such structural form does not cover and does not reflect the specificity as well as information and communication component of transport services system role. After all, according to the proposed structure of N.Y. Sandakova all structural components of information-communicative subsystem as a subsystem of TCS should penetrate into each stratum (physical, technological, organizational). Subject to the foregoing, we consider it appropriate to structure transport-communication system according to functional strata, such as:

– transport;
– transport infrastructure;
– interface.

In this context, we share the views of R.A. Habutdinov, who presented a similar vision of goods and passengers transportation system configuration, but at a regional level only and suggested the author's theory of transport and technological energology and vehicles energy resource efficiency [227]. Generalization of conceptual approaches to structural configuration of the integrated transport-communication system at the macro level and our own scientific position for its functional and structural organization involves the three strata (transport, infrastructure, and interface) with the relevant levels and modules emphasizing. According to our vision TCS multilevel hierarchical structure vertical decomposition should include:

1. Functional stratum "Transport" (FS 1), which is designed for institutional, technical, technological and financial-economic transport processes implementation, resulting from transport technology use in transport inputs into the transport activities product (transport services) conversion. FS 1 basic properties, which must be taken into account when TCS improving, is excessive energy and resource transport intensity and transport as a sphere of material production technological paradox.

Technological paradoxes in the transport sector are: a) product form (materiality, rather than substantivity) b) product distribution methods (simultaneous production and consumption) c) transport operations dislocation (terminal transactions point disposition with motor operations spatially-distributed deployment); g) labour product development instruments on the subject of labour impact (there is kinetic activity of the first and relative passivity of the other).

It should be noted that in the existing methodology of transport system operational and economic analysis the FS 1 specified properties are not taken into account. This reduces the existing methodological approaches to TCS modern development management effectiveness.

The TCS stratum "Transport" configuration is an active subject-implementing component. It is composed of complex structural elements - levels, represented by all types of transport: "Motor vehicles"— FS 1.1, "Railroad transportation"— FS 1.2, "Maritime transport"— FS 1.3, "Inland water transport" — FS 1.4, "Air transport"—

FS 1.5, "Pipeline transport"— FS 1.6, "Trackless trolley traction"— FS 1.7, "Tram transport"— FS 1.8 "Underground transport" — FS 1.8.

The specified means of transport composition represent TCS individual isofunctional subsystem, as they perform identical functions (perform identical transportation processes by converting internal resources).

In turn, the isofunctional subsystems structure of each mean of transport (TCS levels) consists of three integrated elements, namely:

a) appropriate mean of transport administering superstructure;

b) internal technical-technological base;

c) operating and trajectory-network transport activities area.

Note that, for example, "motor vehicles administering superstructure" is a decentralized managerial body. This significantly affects motor vehicles functioning and development management. Each TCS isofunctional subsystem complex component is divided into subcomponents (modules), corresponding to its internal structure. So, "means of transport administering superstructure" integrated component could also be structured on the basis of TCS subjects reference by forms of ownership, type of activity and the like. Each "means of transport" isofunctional subsystem performs its own economic-self-contained operation. Its functioning mechanism is transportation process implementation on

the basis of technological procedures and internal resources into product activities - transport service - conversion processes. Structural improvements of every TCS level must be given its systemic role in goods and passengers transporting technological process.

Based on the identified roles and conditions it follows that each level, all strata and TCS as a whole improvement should generally be based on staged integrated innovation strategy for transportations technological success complex improvement (resource-efficiency, security, and performance). Transportations technological success strategy complexity is due to the fact that sub-strategies such as "Traffic safety" and "Traffic performance" are based on the same procedures for transport technology resources attracting and converting. It should be emphasized that the transportations technological strategic objectives success implementation is achieved due to the properties and interface mechanisms of information and communication system as a TCS subsystem.

2. Functional stratum "Transport infrastructure" (FS2), which is a passive process-providing system component. In turn, it consists of three integrated structural elements - levels:

a) terminal infrastructure;

b) information and communication infrastructure;

in) technological-service infrastructure.

The designation of these stratum levels FS2 is to ensure transportation operation processes (transit and

trajectory defined). Unlike the active stratum FS 1 "Transport", which directly implements TCS operation common object by converting internal transport resources, structural elements of FS2 refer to passive subsystems. The purpose of their improvement is transport technological success assistance.

3. *Functional interface stratum (FS3*), which is suitable for:

a) TCS active and passive parts emergent compounds internal effect implementation with all structural elements joint functioning;

b) external communications with socio-economic system elements.

TCS internal interface provides:

-useful objective elements interaction;

- resource elements of various subsystems additive properties connection to implement such new properties as emergence in TCS phenomenon;

- consumer qualities and resources media properties in transportation product - transportation service - transfer, as well as factors influence from one element to another transfer.

With regard to the beneficial interaction in TCS internal interface, what is meant here is these kinds of interaction mechanisms as organizational, economic, managerial, technological, information, as well as interaction mechanisms.

TCS external interface elements are: transport resources market, transport services market, mechanisms

of interaction with public authorities and mechanisms of system structural elements with external environment interaction.

Functional strata and their structural elements (levels, modules) aggregate which ensure TCS functioning overall subject-matter joint implementation generates its objective structural organization. Within the framework of the latter objective collaboration and emerging compound of its functional strata additive properties and the system corresponding structural elements that are levels and modules is performed.

Note, cargoes and passengers transportation system functioning overall subject-matter implementation can be an individual (in the framework of transport per transport connection) and mass (transport processes in all TCS transport links). TCS processes operation object implementation quality can be: successful, partially successful and unsuccessful. Transportation process successfulness is not only technological, but also economic (e.g., transport services profitability).

TCS processes operation object implementation quality (transport and infrastructure securing process successfulness) is determined by factors of individual and mass phenomena successfulness.

Transport emergence is formed by technological resources media production and additive properties combining in transport product creation processes (transport services) on the basis of transport and technological mechanisms locally-trajectory use in

accordance with transport technologies procedures. These procedures, among other things, provide communication and contacts mechanisms locally-trajectory use. Thus, technological resources additive properties connection, as well as transport technology internal interface mechanisms, as well as communication and contacts mechanisms on the basis of transport and traffic-regulating technology procedures generates TCS transport infrastructure emergence effect, which manifests itself in the form of transportation resource-transformational process realization.

In this context, we can distinguish:

– TCS terminal emergence, which is manifested in the form of individual or mass effects of initial and final transport operations throughout the terminal network providing;

– TCS communication emergence, which is implemented in the form of mass effects of providing transport connections communication lines and transport-communication network flows connection through locally-trajectory interface mechanisms, communication mechanisms and traffic-regulating technologies.

TCS system emergence enables to get socially useful result, that is effective transport work for cargo (passengers) in transport-economic space moving, and is the result of all three types of subsystems emergence joint manifestations in all transport links. *The system emergence effect is the basis for integration properties of transport- communication system formation.*

Thus, we understand *TCS integration property* as the system's ability to integrate discrete economic space of a socio-economic system through transportation resources into transport services massive technological transformation, based on system emergence effect address-trajectory use with reference to economic agents' motivations and mutual obligations.

The above TCS attribution allows formulating the following types of its functions:

1. Objective function:
   – transport integration function of the country economic complex based on the system elements functioning overall subject-matter implementation;
   – transport-technological activity function;
   – capital turnover function.

2. TCS elements production and additive properties emergence combination functions:
   – terminal infrastructure production and additive elements technological combination functions;
   – transport production and additive elements and properties technological combination functions;
   – trajectory elements of TCS transport-communication infrastructure processes providing properties topological combination functions.

Note that transport technology resources media, as well as terminal and technological-service infrastructure elements are given production properties. These properties are seen in transport product creation process, as well as in this process preparation. In turn, all three

TCS functional structural elements are given additive properties (strata "Transport", Terminal and technological-service infrastructures).

3. TCS structural components and subsystems objective interaction function:

– means of transport internal system interaction function;
– elements of the system transportation-communication infrastructure interaction function;
– elements of terminal system infrastructure interaction function;
– functional strata with socio-economic system external environment objects external interaction function;
– transportation resources conversion processes and transportation operations infrastructural support function;
– system current functioning support function.
– TCS conceptually-innovative development function.

Performing the above functions, the transport-communication system would contribute to the achievement of self-reliant development level by its structural elements properties improving. Such development vector is essential for transportation technologies in domestic TCS future development and improvement, as well as integrating it into globalized socio-economic system, subject to the transport success (performance, security, resource efficiency), as well as systematic technological resource synergy.

Outlined TCS attribution allows not only forming its structural and functional organization, but also proposing self-reliant development concept of the last due to resource-synergies effect in it.

Stratum "Transport" in TCS structural and functional organization is the active part of the system that directly implements the system basic processes, that is internal technological resources converting whereon transporting goods and passengers' technological process is directly based. In turn, stratum "Transport infrastructure" infrastructural subsystems, namely communications subsystem, terminal infrastructure and internal inter-elemental technological interface subsystem internal are designed to provide the process relevant stages. This leaves important methodological requirement. It is that, for the development of active stratum "Transport" energy resources synergies and transportation process technologically intensive reproduction principles are used, and the remaining passive strata and subsystems should facilitate those principles implementation throughout transport-communication system. First of all, this requirement must be implemented in the technological means of internal interface subsystems realization: in the terminal technologies (transport-terminal interface), in traffic-regulating technologies (inter-subsystem transport-communicative interface), as well as in transport-technological units' technological mechanisms (inter-element transport-road interface).

The conceptual idea formulated as *"systemically-technological resource synergy in TCS structural and functional organization. Resource synergy* is the combined effect of goods and passengers technological transportation mass phenomenon increasing successfulness by improving TCS structural and functional organization. The resource synergy combined effect will be achieved through an integrated implementation of all strata and three interrelated subsystems strategies and sub-strategies, that are locally-trajectory transport operations performance, security, and resource efficiency .

In Figure 3.7 transport-communication system structural scheme, which corresponds to the four integrity attributes is presented: destination, object of functioning, structure and emergence. This scheme shows the TCS functioning essence that is RTX movement and transformation, as well as RIIII Terminal movement. RTX technology resources equipped quantum movement from entrance (market) to outputs (transport services market) is implemented by two trajectories: terminal (from the initial to the final terminal) and communications (along communication routes and roads). RIIII potential consumer resources quantum moves on terminal trajectories as connected to RTX passive mass.

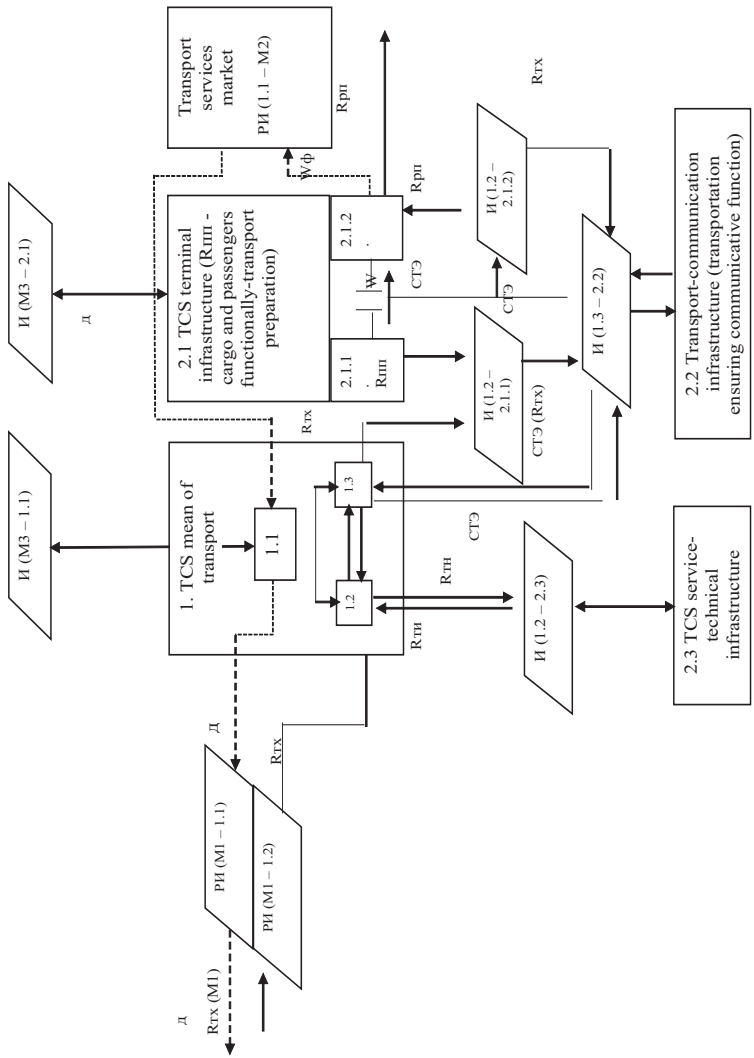


Figure. 3.7. Transport and communication system of Ukraine structural and functional organization chart

Designations:

– М1– transport technological resources manufacturers;

– М2 – transport services consumers;

– М3 – state authorities;

–1.1– managing transport superstructure;

–1.2 – resource and technological transport base;

–1.3 – transport-technological process;

– 2.1.1– primary terminals (RPP pre-transport preparation);

–2.1.2 – end-point terminals (RPП after-transport preparation);

– РИ (...) – market interface elements;

– И (…) – interface elements;

– Δl – spatio-temporal gaps;

– Д – cash flows;

– RTX – technological resources;

– RTИ and RTH – TCS functioning and none-functioning elements;

– СТЭ –system ergo technology elements (vehicles with goods);

– RПП and RPП – potential and real consumers' resources (goods and passengers).

RTX movement reason is their conversion to physical transport product WΦ, RTX → WΦ (TCS functioning product as transport technologies result). The specified conversion is performed as a result of transport technologies substantive components adequate (according to traffic conditions) applying.

So, on the basis of sufficient reason we can assert that TCS effective structural and functional organization would contribute to the domestic socio-economic system self-reliant development achievement by virtue, on the one hand, system emergence and intergenerational property, and on the other hand, successful resource synergies in it. The possibility of obtaining resource synergy in TCS is subject to cumulative effects from transport resource efficiency increase and country economic complex potential preservation.

Submitted TCS morphogenesis methodology enables to summarize as follows. So, proposed by the author approaches to transport system structural and functional organization are based on the need to calculate conditions of contemporary socio-economic systems functioning in a globalizing world. This particular proves the feasibility of new "socio-economic system transportation and economic space" concept in scientific terminology.

The proposed conceptual approaches to transport-communication system structural and functional organization consider rethinking of information and communication component essence and significance in goods and passengers transportation system functioning. TCS effective structural configuration contributes to resource synergies in it achieving, which in turn would serve as a basis for national self-relianceand socio-economic system development security. The research of theoretical and practical aspects of self-reliant and safe development of the socio-economic system in general, and

TCS in particular serve as a motive for the author further research.

3.3. TCS FUNCTIONAL ANALYSIS

Special attention in the work is paid to the existence of such a phenomenon in transport-communication system activities as TCS main development factors functional binary i.e. simultaneous presence of factors of positive-negative qualities heteropolarly affecting transportation system development.

For such ergonomic systems as transport-communication system this phenomenon assumes particular significance from the security development perspective. TCS development factors binary qualities can be illustrated by a person as an active factor in transportation system development. His integrated positive property is undeniable and logically understandable, since the system management process, transportation process improvement, labour and product activities by introducing innovation does not occur without human active intervention. At the same time, in accordance with binary principle the last may be given negative qualities or anti-qualities as well and carry a threat to lives of pedestrians, passengers, as well as harm the environment, etc.

This is fully reflected in factors functions binarity in transport-communication system safe development.

We believe that TCS functional apparatus binarity in its essence and economical nature is expressed through

heteropolar factors combination on safe development influence by relevant effects of its implementation (table 3.1).

Table 3.1

Characteristics of transport-communication systems safe development functions binarity

Factor	*Development Functions*	
	Optimistic Scenario	Pessimistic Scenario
Human	- ensures transport system progressive development	- serves as a source of anthropogenic hazards and threats to TCS functioning
Means of transport	- guarantees implementation of TCS PF; - protect from internal and external externalities effects;	- serve as a source of technological hazards and threats to TCS functioning
Infrastructure security: ***- transport;***	- guarantees implementation of TCS PF; - ensures transport services quality	-makes it impossible to implement the TCS PF; - serves as a source of risks and threats to TCS functioning realization
- communicational	- serves as a unified transport and communications matrix to perform TCS PF	-makes it impossible to implement the TCS PF; - contributes to transportation system deingression; - serves as a source of risks and threats to TCS functioning realization
Communication security	- provides transport service occurrence	-makes it impossible to implement the TCS PF; - contributes to transportation system deingression;

Factor	*Development Functions*	
	Optimistic Scenario	Pessimistic Scenario
		- serves as a source of risks and threats to TCS functioning realization
State regulation efficiency borderline	- organizes, motivates and monitors TCS within the TES functioning; - provides TCS transport safety and transport security;	- destabilizes transportation system functioning; - contributes to TCS subjects and objects uncontrolled functioning; - TCS transportation security system deregulation
Legislative and Regulatory support	-provides legislative, legal and normative regulation for TCS subjects and objects within the TES functioning:	- TCS within the TES functioning system deregulation; - contributes to transport system de-ingression
Financial-economic support	- provides resource for TCS subjects and objects performance	- destabilizes transportation system functioning; -makes it impossible to implement the TCS PF; - contributes to transport system de-ingression
Organizational and management support	- provides TCS safe development organization and management	- TCS within the TES functioning system deregulation; - contributes to transportation system de-ingression; - serves as a source of risks and threats to TCS functioning realization

** Source: compiled by the author*

Functional analysis is usually carried out concurrently with a study of the management system structure. It is carried out to determine the system dynamic characteristics by examining the process of its state over time change based on functioning algorithms (methods, techniques, principles). We can say that functional analysis is aimed at detailed study of the system functioning.

System analysis of any object, including TCS, is a multidimensional operation considering the test object from different perspectives. In fact, this analysis begins at the system object representation stage when its primary function (PF) is defined. At this, system type functional analysis can be carried out in two different ways.

The first way is that it starts from PF and the first step is transition from PF to its fragmentation, separation into smaller functions (sub-functions). This separation can be carried out again, while moving down to the next fragmentation level. Since all functions that service PF are linked in time and space, a structure can be built. The next step is to define each function (sub-functions) performers, i.e. system elements (in this case, subject-specific transport-communication system), which in reality are responsible for its implementation (legislative authority, executive authority, supervisory authority, etc.). This registry of activities related to the main life function (MLF) ensuring is very important, as it is in this plane the system as a whole development reserves are absorbed and diagnosed.

The second way for the system functional analysis implementation is that each of the system elements is considered along with its links with other elements and these links, actions or agents they provided and task performed and figured out. Then analysis of links completeness is checked (as each link connects at least two elements, it should be reflected in the corresponding symmetric functions of these two elements. It should not be forgotten that the function is not only any active action, but also a potential for such action. Finally, note that sometimes the object of this function impact is itself the subject of impact.

The result of system functional analysis is recommended to be presented in the form of a table with the following structural elements:

– function subject (active system element);

– function (impact or potential actions);

– sub-function (if available);

– subject of impact (system element, internal or external environment element (super-system));

– object of impact (receiving element of the system, only in the case of a transfer or receipt of the action outcome);

– function execution degree (lacking, normal, excessive).

This table actually is one of the main sources of information potential points of administrative influence application to optimize the system.

Comparing the TCS functioning processes with other socio-economic system branches, six types of TCS technological paradoxes can be emphasized:

1) TCS activities product form - the form is material, but not the real;

2) transport-communication system functioning product distribution - creation and consumption is synchronous;

3) technological resources substance (RTX) into the TCS functioning product transfer inconsistency - RTX resources are transferred into the product in converted rather than real form;

4) transport operations spatial dislocation forms inconsistency - terminal operations are dotted, and transport operations are performed in trajectory spaces;

5) instruments of labour on the TCS functioning product effects inconsistency -object of labour is moved and its real essence remains unchanged, unlike other industries, where the result of influences is the change of the real substance of the subject characteristics);

6) TCS accounting and physical product form quantitative and qualitative inconsistency [227, 228].

Functions of transport-communication system analysis, their role in maintaining political and economic stability are particularly relevant and important areas of research, given the events of recent years in Ukraine. The necessity of preserving for the country a certain space for maneuver, the capacity to adapt to rapidly changing external environment conditions set priorities for Ukraine to ensure self-relianceand development security at all

hierarchical levels of economic space (individual, company, region, country).

Identifying security threats and their neutralization ways justification is provided for today methodological development imperative of domestic economic research of the above trends.

Ukraine is situated in South-Eastern Europe, in the zone of three huge geopolitical arrays that are Euro-Atlantic, Eurasian and Islamic. This can be seen as advantages and huge problems, but such position, this unique civilizational space plays a pivotal role in the Ukrainian State self-reliant and secure development.

Recently, within economic theory framework, economic area theory of economic space gained popularity in the Western countries and in Ukraine. It should be noted that economic space is not just a set of different economic relations between businesses, regions and countries, it is characterized by a heterogeneous density of linkages, different kinds of preferences and dependencies, including external and internal environment.

In considering the place of Ukraine in geopolitical and geo-economic areas, it is advisable to take into account dynamic changes in the system of international relations, characterized by a new quality of relations, as well as new dimensions of traditional and non-traditional threats and challenges arise. The emergence of new threats and internal and external environment turbulence strengthen is a source for the entire set of scientific and practical political, military and strategic, energy, industrial stability and development of adequate forms and ways of

overcoming them review. Space as an economic policy instrument has certain resource-objective and control-communication qualities. With this in mind, the space is treated as a source of resources, as the object of interest, and as the environment for economic actors and authorities interaction [244].

In this context, we believe that the key urgent task of public administration is domestic resource urgent mobilization and the leading industries of national economy structure strategic adjustments in order to improve socio-economic system stability recovery speed. According to A.V. Kenduhov "speed is a vital economic factor. Time is a key economic resource. Ukraine economy new paradigm is to mobilize all national resources for domestic production urgent upgrading "[243].

To the fullest extent we can state the exclusive importance of transport-communication system in domestic socio-economic system stabilization ensuring and self-reliant and safe level of development achieving. It is the transportation system is in force to overcome temporal and spatial barriers. Transport-communication system of Ukraine is one of the few ways of state spatial resource into geo-economics effective instrument conversion, as well as one of the few real opportunities in terms of new geostrategic frontiers.

Transport-communication system of Ukraine, taking into account basic system functional capabilities, we believe, will secure resource synergies achievement and act as transfer-factor in achieving self-reliant and safe level of development without significant public

investments, only through available transport capacity, due to control mechanisms strategic structural adjustment [240]. Unfortunately, the key to understanding transport system strategic role and possible range of positive results has not found integrated theoretical and methodological basis.

In the process of TCS basic features and its functional properties revealing, we have studied foreign and domestic scholars' writings. It should be noted that in scientific transport literature various functions of transport sphere, that is, those that affect society activities in one way or another, are presented in very scattered, desultory, incomplete and irrelevant to the modern concept form.

Understanding and justification of the author's position regarding transport- communication system functions analysis and functional properties have been contributed by the results of the study of N. R. Leontyeva, however, we consider intension specifically on the functions carried out by transport-communication system with the aim of socio-economic system development stimulating to be true in the context of self-reliant and safe development. However, proposed by N. R. Leontyeva transport functions as a sphere of human activity classification, which is built on the principle of these functions multilevel subordinations requires rethinking in the context of the imposed "transport-communication system" concept and globalization conditions for its development (table 3.2).

Table 3.2

Transport-Communication System Functional Classification

Criterion of classification	*Function*	*Characteristic*
Socio-economic system development stimulation	innovative development stimulation	innovation growth for the State effective development
	self-reliant development stimulation	ensuring the state economic and political power growth
	integration development stimulation	stimulation to economic subjects unification and their cooperation deepening with a view to effective development
	cooperative development stimulation	socio-economic system internal links optimization in order to improve overall competitiveness
	regional development promotion	effectiveness of regional socio-economic system by TCS "growth points" development
	globalization development stimulation	globalization international relations development

Criterion of classification	*Function*	*Characteristic*
socio-economic system survival	economic	providing services for goods and people physical movement in space
	financial	financial sources for self-development formation and national socio-economic system self-reliance supporting
	social	providing equal access to all members of society to socio-economic infrastructure within the range of transport availability, improving the quality of life and standard of living
	cultural	providing access to cultural sites locations
	political	ensuring unity and integrity of Ukraine, implementation of state decisions
	defense	ensuring mobility of troops and military equipment, military strength of the state factor
Ensuring socio-economic system reproduction development	organizational	distribution of productive forces, specialization and cooperation of labour, access to resources, productive activities organization, distribution process organization
	distributing	population resettlement and migration, spatio-temporal gaps elimination, losses of raw materials and products decrease, working capital release

Criterion of classification	*Function*	*Characteristic*
	stimulating	range of activity growth, increase in performance, cost savings, commodity supply decrease
socio-economic system service infrastructure ensuring	informational	goods whereabouts, distance, time, and transportation conditions, weather conditions, availability of seats in passenger transport, cost of transport services, etc. timely and reliable information provision
	logistic	integration, stages and participants of the process interaction ensuring, physical distribution, material flow management based on accompanying information to deliver the goods at the right place in the required time with minimal costs
	transit	ensuring transport security through the territory of Ukraine
	trading	TCS subjects demand in necessary transport services meeting, product listing formation
	support services and repair	necessary conditions and production facilities for maintenance and repair of vehicles, as well as communication channels ensuring

** Source: compiled by the author*

So, at the highest first level of general classification *transport-communication system primary function (PF)* that is socio-economic system needs in transport and communications services satisfaction is presented.

As an important postulate we stress that transport-communication system being the country institutional matrix and carrying out the reproduction process, cannot exist separately (self-reliant, private), since its main functional property, i.e. society and the state life support systems reproduction is lost. The author's position is justified that TCS of Ukraine is an important state techno-public infrastructure, which is one of the priorities in socio-economic system self-reliant development ensuring processes.

Implementing classification reconstruction we offer to start with the block of functions that stimulate socio-economic system development. We stress the TCS exceptional importance in innovative development stimulation processes, as the transport essence is hardly the main manufacturer and recipient of innovations.

TCS incentive function of socio-economic system self-reliance level ensuring is closely intertwined with financial function. It is the financial function by transport-communication system implementation provides an opportunity to increase cash flow in the state budget revenues thereby increasing its self-reliance level.

Naturally, integration and cooperation effectiveness in domestic socio-economic system functioning will only increase with TCS active assistance. Also, it is logical that

transport-communication system plays a positive role in globalization and regional development processes.

We suggest starting studying socio-economic system life-support functions block with *TCS social function*. So, the social function is reduced to citizens health and performance enhance by reducing transport fatigue in daily trips (according to analysts, productivity drops to 10-15 per cent, if travel time exceeds 40 minutes, and even more, if the time of waiting for transport is longer than 15 minutes). TCS development helps to improve population mobility, improves cultural level and public mood. Such an indicator as transport accessibility increases the level and quality of life through the implementation of material and spiritual values exchange among the population, ensuring the timely movement of people to culture and recreation places.

By studying the classification spectrum in more detail, we offer to distinguish spatio-temporal and functional properties. Certainly, transport, primarily, is the human activity result, aimed at goods and passengers moving. But as a more complex concept it should be seen as an ergatic system, where a person is responsible for this system elements work and communication.

If earlier transport was investigated exclusively in terms of its economic, political and social efficiency, it now becomes a matter of human existentialism: it provides new spaces for human activities, such as possibilities to overcome distances in a short period of time that allows to speak about a new perception of space and time, as well as control over these two categories appearance. Transport is

a human instrument in the "war" over time and it is therefore TCS spatio-temporal functional properties emphasizing is proposed. It is manifested in the reduction of people, goods and information movement time by means of transportat-communication system.

TCS *Information function* recently has become increasingly important especially in security issues consideration context. Whereby, we consider it in the context of national security, regional transport, business entity (e.g. company) and personality.

Since TCS main functions implementation is impossible without a well-functioning communications system and communications and information function can be attributed to socio-economic system service infrastructure provision. This refers to goods whereabouts, distance, time, and transportation conditions, weather conditions, availability of seats in passenger transport, cost of transport services, etc. timely and reliable information obtaining ability. The information in this case allows providing a TCS service.

Humanity creates, improves artificial means for transportation, accumulation, analysis and storage of information in order to improve speed, reliability and security. Modern means and media of communication provide an opportunity to "transport" information not only in space but also in time [4]. Therefore, it can be argued that TCS speed and info-communications increasing expands social transport availability range.

Thus, *TCS social function* is its abilities to provide equal access for all members of society to socio-economic infrastructure within transport accessibility range.

However, *TCS cultural function* should be mentioned, it involves the aesthetic values distributing and consequently contributes to the population educational and cultural level.

Transport-communication system *economic function* is to provide services for goods and people physical movement in space (between different regions within the same country and in the international traffic between individual states). It should be noted that transport acts at the same time as the employer for many people (according to the variety of analytical data transport sector employs up to 10 per cent of the global working population, that is why transportation process is regarded as the most labour intensive), and material resources consumer (up to 60 per cent of petroleum products, 20 per cent of world steel production, 80 per cent of lead, 70 per cent of synthetic rubber, 40 per cent of varnish-and-paint materials). Essentially, vehicles perform the role of a kind of "warehouse on wheels"; at any time they accumulate about 25-30 million tons of various cargoes.

Within TCS economic function framework its functional properties must be clearly identified:

First, the system is a public production process necessary element. Production process is ensured through different kinds of resources (material and human) transportation organization, thus changing their geographical location, taking into account the needs.

Interdependence is obvious: material production serves TCS development important prerequisite, but in turn, it is the transport-communication system that is an essential prerequisite for national production basic industries development.

Secondly, TCS maintains/provides service distribution chain, bridges the gap between production and consumption, which in turn are divided into gaps in time and territorial gaps. Gaps in time are a consequence of the fact that there is an interval of time between production and consumption of goods. Hence, transport main objective is timely delivery of goods within a certain period of time ensuring. Territorial gaps arise from the fact that there is a geographical distance between producer and consumer. In this regard transport objective is transportation services in any geographical point of the world providing.

Summarizing all the foregoing, we conclude that TCS economic function "permeates" and intertwines with almost all functions in this classification, as it provides an opportunity to identify their implementation economic effect.

Particularly noteworthy in the affected issues context is *TCS financial function,* which consists in financial sources for national socio-economic system self-development and economic self-reliance formation.

Note that transport as well can cause gaps between production and consumption. It is connected with technology, logistics and transport accessibility development. Thus, transport creates conditions for

production of goods organization where it is effective and arranges their transportation as efficiently (for example, franchise companies development). Thus, we can offer three more functional properties of TCS definition - spatial conflicts overcoming.

Committee of Internal Transport of UN Economic Commission for Europe experts specify that transport makes it possible to overcome spatial conflicts and is designed to stimulate other useful activities [33]. National strategy should be based on the existing transport resource as such, which would contribute to domestic socio-economic system self-reliant safe development level achievement.

Of even greater importance is transport-communication system resistance property in relation to external aggressive manifestations, as a result of economic sovereignty supporting. It is referred to economic expansion in other countries and national interests of Ukraine restriction. It is possible to resist expansion only by protection mechanisms (resistance) in that field developing and having economic and technical conditions to implement them.

Thus, *TCS resistant property* definition and accentuation in the context of economic, political, informational, military sovereignty is defined by us *as the system ability to ensure national security*.

In today's context, we attach particular importance to TCS *political function*. It is manifested at regional, national, sub-regional, and international levels. Transport-communication system enables to physically

unite the nation, shaping the economic ties between the regions of the country and people who live on its territory.

Existence of the country's prolonged political instability, characterized by threats to ensure the national unity and spiritual commonality of Ukraine, inefficiency of adoption and implementation of government decision-making mechanisms must be admitted. In this context, transport-communication system acts as a bridge between the regions, thereby ensuring territorial and national unity. Poorly developed transport infrastructure poses a threat to the national security. For example, today in areas where accessibility is limited it leads to the "transport vulnerability" and as a result to the country loss of integrity threats.

At the sub-regional level (in the immediate environment area) Ukraine is a big (by size and population) state with significant potential. As the heiress of the USSR in Central and Southeastern Europe and the Black Sea region, Ukraine should play a significant role in establishing a new system of world order. For it, resolving conflict situations in the Balkans, Caucasus and Transdniester and forming equal partnership models with Poland, Turkey, and Belarus as powerful regional neighbours is vital [67]. The dominant role hereof is played by the existing TCS transit potential. However, at this level, Ukraine is losing its position as well. In particular, it is referred to a partial loss of control over the Black Sea fleet, which is of great strategic importance; weakened influence on Balkan markets, due to the closure of the Danube transport network; it has not yet managed to

overcome difficulties with Euro-Asian transportation corridor introduction. Ukraine, as one of the connecting links between the West and the East, due to TCS has a chance to focus significant flows of international exchange of resources, goods and information on itself.

Thus, transport-economic system enables the state to implement foreign economic policy. Integration into the global space and realization of the country transit potential, forming a strong base for the successful integration of Ukraine into the world transport system, improving domestic transport providers access to foreign markets, strengthening the country's role in shaping international transport policy and transformation export-transport services into one of the main sources of national income should become one of the main strategic objectives. In the context of chronically negative trade balance hardly the only option for the country economic stabilization, excepting its role of raw material appendage, is to concentrate efforts on export-oriented transportation industry development. The use of Ukraine's transit potential could become not only a priority in transport-communication system development, but also independent point of national economy growth.

Thus, TCS political functions include the following functional properties: sovereignty and territorial integrity of the state ensuring, internal and foreign policy interests' implementation, foreign economic relations development.

TCS defense function is the least studied direction by virtue corresponding to the closeness of this field of research. However, we note that security functions and

strategic goals of the country depend primarily on transport-communication system security level, first and including the entire perimeter of Ukraine borders. TCS production capacity technical condition, as well as its infrastructure as a means of troops and military equipment mobility ensuring remains one of the most important public objectives. Moreover, we believe that transport-communication system of Ukraine should be considered as military strength of the state factor and subject of focus of specialists studying policy and defence. All structural components of TCS development [94] provide the ability to meet the mass transit of the armed forces and material resources of Ukraine organization in mobilization plans and strategic actions of the Ukrainian army implementation, military units maneuvering empowering dynamic.

Ensuring military security of the state in modern conditions is closely intertwined with the timely identification of military-political and military-economic goals of the neighbouring states:

- to the North and East - it is Russia, with one of the most powerful armies in the world (its population is around 1 million 200 thousand people) and nuclear weapons commit an aggressive action towards the project of a single economic space realization, while simultaneously increasing defence expenditure; uncertainty of the state border with Russia in the Sea of Azov and Kerch Strait continues;

- to the South - it is capacity of the Black Sea fleet in Crimea occupation, as well as Turkey's increasing

influence to Ukraine through the Crimean Tatar issue and increased competition for energy transportation projects from the Caspian region to Europe;

- to the South-West- it is a "frozen" Transnistrian conflict existence; threat of activation of Romania attempts to prevent Ukraine's economic projects in the region implementation and destructive Romania, aimed at gradual erosion of Ukrainian statehood foundations in areas densely populated by ethnic Romanians in Ukraine; additional destabilizing factor remains internal political situation in Moldova permanent worsening;

- Energy risk is associated with attempts of the conflict situation in matters of oil and gas supply and transit aggravation by Russia;

- Struggle for spheres of influence and boundaries redistribution;

- Terrorism expansion;

- Ethnic aggression and radical Islam expansion.

Thus, in the context of military security ensuring, domestic transport-communication system is a serious integration (or disintegration) tool in force field expanding process that is political influence and strategic presence, so tasks of protecting the interests of the state solving are obliged to take into account its critical role in appropriate defensive power ensuring.

Further we offer functional unit to ensure the socio-economic system reproduction analysis. This unit includes the following new functions:

-*Organizational*, which involves efficient organization of productive forces by transport-communication system

successful implementation, significant impact on labour specialization and cooperation within certain regional groups framework. In addition, it is by means of transport and communication access and uninterrupted provision with all kinds of resources task is successfully solved. Due to sufficient conditions for TCS effective functioning availability the problems of choosing the most appropriate forms of organization production process and distribution are solved.

This TCS function with many others, for example, defense, logistics, etc. intermingling and interweaving should also be noted.

-*Distribution*, which is TCS essential role and significance in population resettlement and migration, including labour. Historically, "... resettlement pattern, chains of cities, highways confirm this commitment to "fostering landscape" large inertia, despite the enormity of changes of a scientific and technical progress century." So, TCS "... as domestic experience demonstrates, is the carcass, which forms the area to one or another form of industrial environmental management giving it a specific configuration".

-*Stimulating*. It is referred to strategically meaningful for socio-economic system development TCS role to increase production, productivity, all kinds of expenses cost-cutting and commodity in circulation decrees.

And finally, the last unit provided by TCR functional classification reveals its role in socio-economic system service infrastructure ensuring. This functions unit

include: informational, logistics, transit, trade, as well as service and repair functions.

Apparently, *TCS logistic function* is increasingly gaining development momentum that can be seen not only as a service function, and in fact socio-economic system contemporary life-support function. All transportation participants' integration and interaction enable to deliver objects "door to door", in the right place and time, and possibly by several means of transport.

In our view, in the nearest future *transit* will play a particularly important role, and in many ways it serves as a part of political viability of Ukraine. In this context, it is clear that domestic transport-communication system as a natural land bridge between the two poles of the global economic system (Europe and Asia) is capable of stimulating our state self-reliant development.

Transportation systems effective and smooth functioning is achieved in many ways by appropriate infrastructure availability, which enables vehicles maintenance and repair at optimum time. This could include the following items in the transport process service: gas stations, coffee shops, hotels, etc.

CHAPTER 4
ASSESSMENT OF TCS OF UKRAINE SELF-RELIANT DEVELOPMENT AND ITS STIMULATION MECHANISM

4.1. ASSESSMENT OF TRANSPORT-COMMUNICATION SYSTEM OF UKRAINE DEVELOPMENT AND ITS SELF-RELIANCE LEVEL DIAGNOSTICS

4.1.1. TCS of Ukraine current status

In a period of globalization and macroeconomic stagnation challenges, the need for transport-communication system as priority area recognition, capable of generating gross domestic income into the state budget and becoming one of the main tools to ensure national self-reliance, which means security, is strategically significant. Its value has increased even more after the political crisis and military actions on the territory of Ukraine during the 2014-2015.

In terms of globalization Ukraine ranks 47th among the world countries. The index of globalization level of the world's countries (KOF Index of Globalization) was established in 2002, at the KOF Swiss Economic Institute, with the participation of the Swiss Federal Institute of Technology. The index is positioned as a combined indicator that allows to evaluate a country's integration into the global space scale and to compare different

countries on its components basis. All examined within the index countries are valued at 24 indicators, joint in three main groups of global integration: economic globalization, social globalization and political globalization. In 2013, the study covered 187 countries in the world.

In Figure 4.1 the ranking of the countries (sampling) on globalization level is presented.

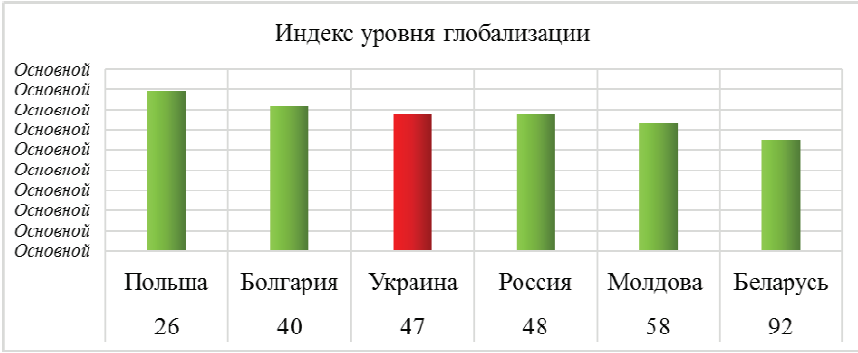


Figure 4.1. Ukraine among the countries of the world globalization level rank, 2013.

Source: http://gtmarket.ru/ratings/kof-globalization-index/info#ukraine

The ranking of neighboring countries confirm potential opportunities for Ukraine to raise globalization level in the short term availability, including due to the domestic transport-communication system development.

A more detailed assessment of our country in the world ranking of global competitiveness in terms of infrastructure quality is held by the World Economic Forum (WEF) (fig. 4.2).

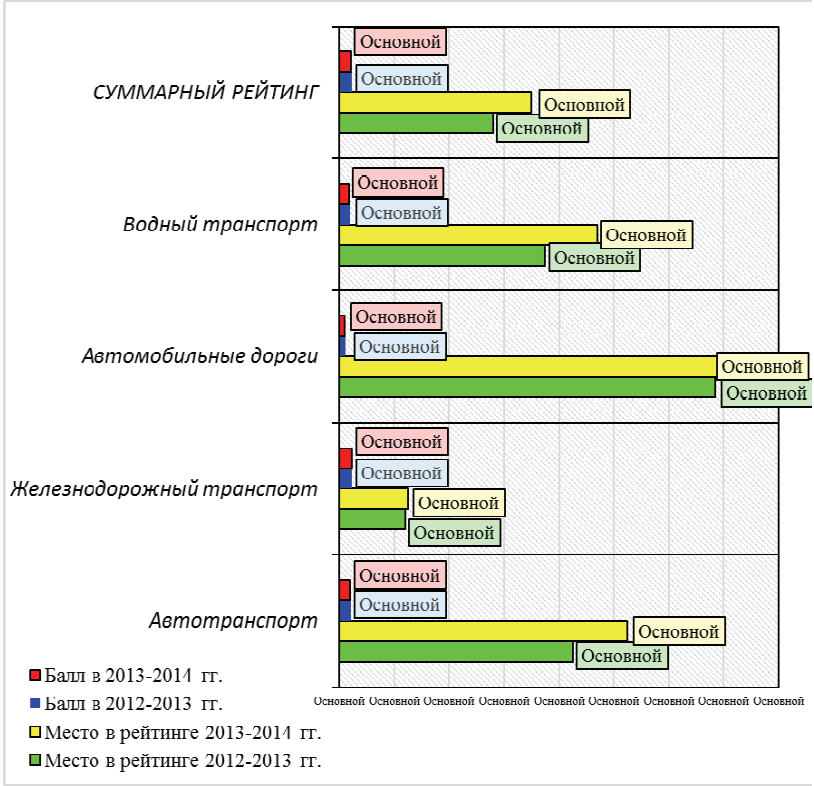


Figure 4.2. Global competitiveness indexes by TCS of Ukraine means of transport and infrastructure (WEF)

Source: http://www3.weforum.org/docs/WEF_Global CompetitivenessReport_2013-14.pdf;

When calculating ranking data from international organizations is used, including the United Nations, the Organization for economic cooperation and development, the World Trade Organization, World Bank, International Monetary Fund and other institutions, as well as approximately 60 partner institutions worldwide. The business climate in the countries covered by the study is

estimated on the basis of analysts' opinions, interviews with transnational corporations' top executives and management specialists. The final data compilation is carried out on the inverse ratio basis: 2/3 — statistics data and 1/3 — expert estimations.

As you can see from the chart, the total domestic transport-communication system rating has shifted from the 56th position in 2012-2013 to the 70th position in 2013-2014. Thus, a more detailed analysis of the indicator dynamics shows competitiveness deterioration in air transport (offset from 85th to 105th), highways (offset from 137th to 144th), water transport (offset from 75th to 94th). For the amount of grades only the rail transport remains stable over the analyzed period – 4.5 points.

We deem it reasonable to conduct an analytical review of TCS overall development first, and then summarize it with transport-communication system self-reliant functioning diagnosis during the reporting period.

Thus, in Ukraine, as in other developed countries, transport is one of the largest basic branches of economic system, an essential part of the industrial and social infrastructure. Transport communications combine all parts of the country, which is a necessary condition of its territorial integrity and its economic space unity. They link the country with international community, being simultaneously material basis of ensuring foreign policy and foreign economic relations of Ukraine and its global integration.

Figure 4.3. TCS of Ukraine international transport corridors scheme

Advantageous geographical position of Ukraine determines international transport corridors passage through its territory, namely:

-Pan-European transport corridors No. 3, No. 5, No. 7 and No. 9;

-Organization for Railways Cooperation (OSJD) corridors No. 3, No. 4, No. 5, No. 7, No. 8 and No. 10;

-Transport Corridor Europe-Caucasus-Asia (TRACECA).

Transport services, warehousing and courier activities in total volume of realized services share in 2014 amounted to 39.5 per cent, which is the highest indicator in the structure (fig. 4.4).

Figure 4.4 Volume of realized services by types of activity in 2014 distribution (in % of total) [46]

The second place is occupied by information and telecommunication services, the share of these services amounted to 20.6 per cent. This suggests services of transport-communicative system of Ukraine strategic importance in the state budget revenue filling.

Analysis of TCS services scope change implemented by types of transport in value terms reveals the following trends. Thus, gross revenues in the interval since 2010 to 2014 increased by almost all indicators.

Only as a result of the postal and courier activities implementation a decrease in revenues to the 2010 level

and recession to the previous year by 14.9 per cent was recorded (Table 4.1).

Table 4.1

TCS services implemented in the context of 2010-2014 activities dynamics.
(including VAT, UAH million.)

	Volume of services sold			*Volume of services sold to the public*		
	2010	2013	2014	2010	2013	2014
TOTAL *including*	**251,522.8**	**357,068.1**	**360,561.9**	**58,439.5**	**80,974.2**	**78,837.7**
Transport, storage, postal and courier activities:	100,766.0	135,791.4	142,579.4	17,275.2	21,781.4	19,482.3
- transport activities;	53,383.8	71,652.3	78,411.7	13,810.1	19,230.7	17,685.1
- warehousing and support activities;	43,339.6	59,369.6	60,109.8	2,635.6	1,734.3	1,134.2
- postal and courier activities	4,042.6	4,769.5	4,057.9	829.5	816.4	663.0
Information and telecommunications	60,890.2	72,679.6	74,271.8	18,559.9	20,666.7	18,466.3

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

Along with this, TCS services sold to the public volume indicators tend to decrease across all means of transport. So, TCS services total amount of proceeds during 2014 was

UAH 2136.5 million smaller than the amount of the previous, 2013.

In gross domestic product structure resulting from all sectors of economy operation, transport, warehousing, postage and courier activities range from 7.1 to 8.0 per cent of added gross value in the analyzed period (fig. 4.5).

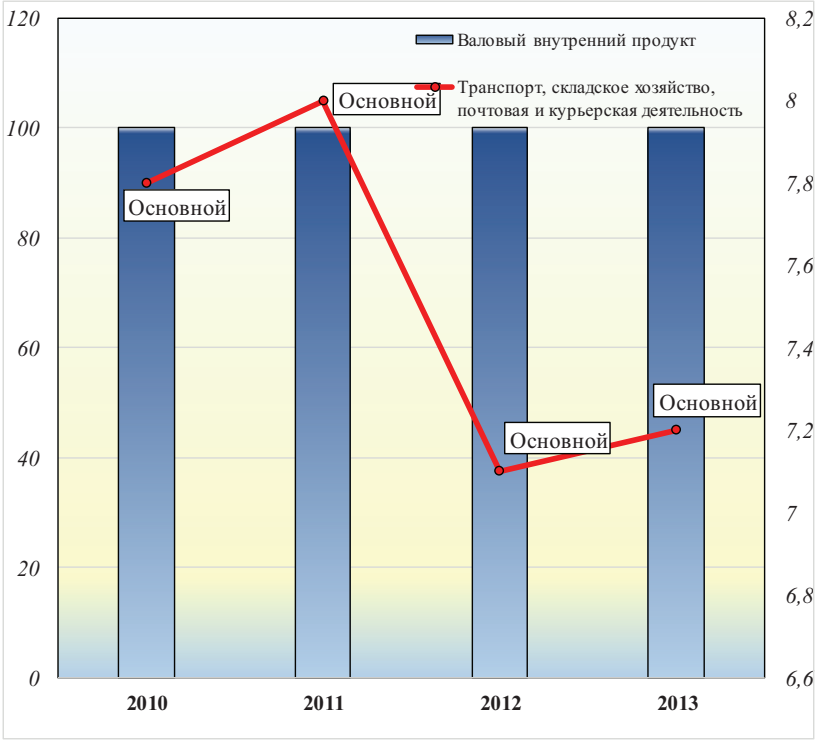


Figure 4.5. TCS added gross value within the GDP scope dynamics, % [46]

At the same time, for an objective insights government budget expenditures and TCS managing subjects functioning costs should be investigated.

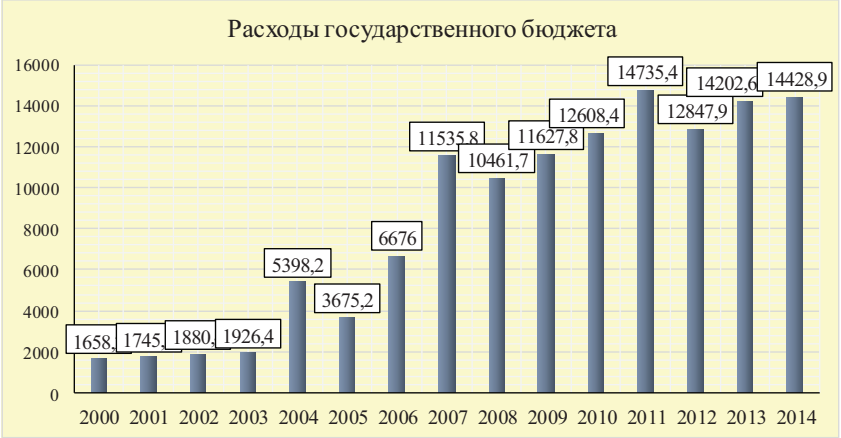


Figure 4.6 Government budget expenditures on TCS of Ukraine functioning, UAH, million. [46]

As you can see from the presented diagram 4.6, in the review period the tendency of increasing transport-communication system industries budgetary financing is observed. However, it should be noted that during the reporting 2014 less funding than it was in 2011 (the highest funding rate) was allocated. The highest funding amount was allocated in 2011 – UAH 14,735.4 million due to the football championship Euro – 2012 preparation. However, the level of inflation and rising fuel prices, as well as needs are not covered by the allocated state funding.

In Figure 4.7 the dynamics of capital investments in transport-communication system of Ukraine from 2000 to 2014 is presented. Graphical data give an idea of quite appreciable capital investments differences amplitude by the years of the analyzed period.

So, the highest amount of capital investment in transport sphere was implemented in 2012. The level of this indicator in the reported 2014 approaches to the statistics level of 2004-2005, which cannot be even compared in terms of macroeconomic development.

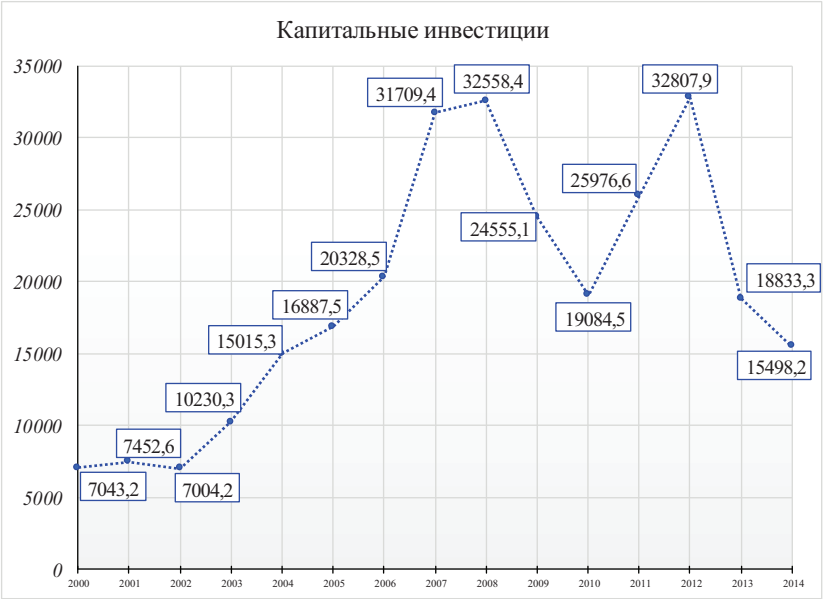


Figure 4.7. Capital investments in transport-communication system of Ukraine dynamics, million UAH. [46]

On the basis of the provided information extremely negative trends of such a strategically important sector of domestic socio-economic system financing can be summarized.

Information on dynamics of engineering goods production that provides TCS entities with equipment of

domestic manufacture complements general idea (Table 4.2).

The data in the table suggest that transport equipment production for the period of 2011-2014 reduced substantially, in some positions, the reduction was at almost four times. This demonstrates not only the TCS production capacity advantageous import, but also the national industrial complex development prospects.

Table 4.2

Engineering products of Ukraine outputs

	Year			
	2011	2012	2013	2014
Cars, total, thousand, pcs.	97.5	69.7	45.8	25.9
including: - vehicles with an internal combustion engine up to 1500 cm^3	61.2	42.6	25.5	15.3
Lorries, thousand pcs.	3.2	2.9	2.0	1.2
Buses, thousand pcs.	3.7	3.6	2.6	0.9
Trolleybuses, pcs.	224	149	….	59
Trailers and semitrailers to carry goods, thousand pcs.	26.2	21.7	29.2	34.3
Freight wagons and wagons-platforms, railway or tramway, not self-propelled, thousand pcs.	52.7	47.8	25.3	5.8

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

Analysis of foreign direct investment in the transport sphere of Ukraine should be separately emphasized. As a rule, foreign investors study the conditions of the future project in detail on the pre-investment stage. Therefore, the volume of foreign invested resources depend directly on the economic and political well-being of the country, as

well as the government support in the investor rights guarantees. If the risks of investing are not comparable with the size of future profits or there are significant risks of capital losses (profits), as a rule, it is a sign of unfavorable investment climate for all potential investors and it leads to the investment market "freezing".

In Figure 4.8 direct foreign investments volumes analysis for 2000-2014 is presented.

For the purposes of further forecasting the data is transferred in UAH at the official exchange rate in effect on the relevant date.

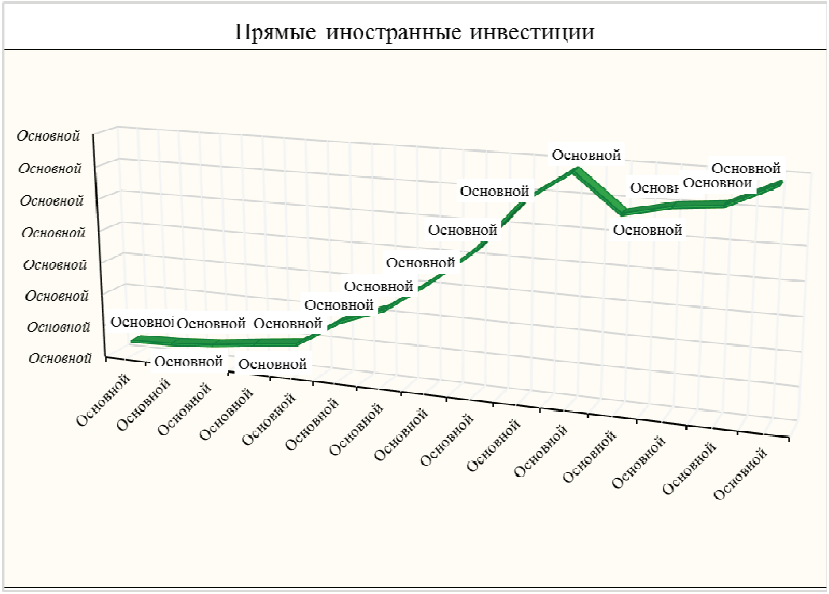


Figure 4.8. Dynamics of foreign direct investments in transport-communication system of Ukraine, UAH million [46]

Introduced data series demonstrates a positive trend of increasing foreign capital invested since 2011. During

the reporting 2014 investment amount was approximately the same as investments in 2010. In general, these trends are likely related to Ukraine by EU countries support due to the aggressive actions of Russia.

Innovative activity of transport-communication system enterprises is one of the progressive development indicators. Table 4.3 presents analyses of developed and implemented advanced technologies in 2013-2014.

On the basis of the data presented for the past two years, decrease in the number of TCS innovative enterprises to 26 units can be concluded, although in general, the specific gravity of all IAC for Ukraine the indicator is 1.38 per cent higher in the reporting year.

Table 4.3

Developed and implemented advanced technologies at TCS enterprises for 2013-2014 characteristics.

	2013	2014	Frictions 2014 from 2013. (+ ; -)
Total innovation-active companies (IAC) TCS, units.	***229***	***203***	***26***
% of the IAC total number	10.87	12.25	1.38
Among them: -developed advanced technologies	3	1	-20
-used advanced technologies	228	203	-25
The number of the used advanced technologies by companies in the sector	810	754	-56

**Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/*

Negative indicators are recorded in the reporting year for the number of both developed and used advanced technologies by TCS entities. Primarily, this is due to the hostilities in the industrial regions of the Eastern Ukraine and overall macro-economic stagnation.

The situation is similar in the field of used inventions, utility models and industrial designs (Table 4.4). Inventive activity at transport-communication system of Ukraine enterprises decreased at 19 points, utility models use – at 36, industrial designs use – at 4.

Table 4.4

The number of inventions, utility models and industrial designs used in TCS enterprises activity *(units)*

	2013	2014	Frictions 2014 from 2013. (+ ; -)
Number of inventions used	50	31	-19
Number of utility models used	49	13	-36
Number of industrial designs used	4	-	-4
Among them: -inventions developed at the expense of the state budget	7	1	-6
-utility models developed at the expense of the state budget	-	-	-
-industrial designs developed at the expense of the state budget	1	-	-1

** Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/*

Budget financing of inventions and utility models introduction during the 2014 was not carried out that once

again confirms the entities predominant interest in providing competitive transport services themselves.

A comprehensive study on transport-communication system development should reflect the enterprises dynamic performance characteristics in this field.

On 01.01.2015 on the territory of our country there were 14,868 businesses that operated in the field of transport, warehousing, postal and courier activities. 92.2 per cent of them were small enterprises, 7.6 per cent were medium and 0.2 per cent large. The total number of employed workers totaled 754 thousand people

They sold TCS services in the amount of UAH 198,975.1 million. It should be noted that 53.1 per cent of the total revenue was received by large enterprises while small businesses received only 14.4 per cent of the total gross income. Enterprises worked at a loss, the amount of which totaled UAH 26,307.3 million. Only 61.5 per cent of the total number of enterprises worked at a profit, which amounted to UAH 9,198.8 million during the reporting period.

Consolidated analytical evaluation of enterprises of transport, warehousing, post and courier activities functioning from 2010 to 2014 is filed in Table 4.5.

The data in the table show the following trends. So, in 2014, it was 1942 less operating enterprises than in the previous, 2013. In addition, a sharp decline in the number of permanent employees was recorded - 157.2 thousand persons less than the previous year. This year the record-breaking loss for the period was received.

Table 4.5

Enterprises of transport, warehousing, post and courier activities functioning main economic indicators 2010 - 2014

	year				
	2010	2011	2012	2013	2014
The number of enterprises, units	13,603	14,792	15,472	16,810	14,868
including, %: -large enterprises	0.3	0.2	0.2	0.2	0.2
-medium-sized enterprises	9.1	8.7	8.4	7.7	7.6
-small businesses	90.6	91.1	91.4	92.1	92.2
The number of employed workers, total, thousand persons.	928.5	923.1	937.1	911.5	754.3
Number of employees, total, thousand persons.	924.5	919.0	930.5	907.9	750.8
Sales of services, total, million. UAH.	14,3791.5	18,4764.3	212,299.8	207,138.3	198,975.1
including, %: -large enterprises	60.9	62.3	58.0	57.2	53.1
-medium-sized enterprises	28.5	26.5	28.7	28.8	32.5
-small businesses	10.6	11.2	13.3	14.0	14.4
Net profit (loss) million. UAH.	1,348.7	2,839.8	3,127.7	-1,423.4	-26,307.3

** Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/*

An analytical study of TCS of Ukraine functioning is appropriate to be started with transport capital evaluation.

Transport capital of Ukraine consists of: 20.9 thousand km of railways; 159.5 thousand km of paved roads; 4.8 thousand km of trunk pipelines; 1 thousand km of

ammonia pipes; 1.6 thousand km of operational river waterways with direct access to the Sea of Azov and the Black Sea; 40.1 thousand km of gas pipelines [46].

By Global Enabling Trade definition, transport and communication infrastructure is among the key factors in the of international trade opportunities development. An analysis of the four major indicators of the world's economies to international trade openness is presented in the study:

1. Access to the internal market.
2. Administrative control at the borders.
3. Business climate.
4. Transport and communication infrastructure.

The ranking was compiled in 2014; the study covers 138 countries around the world. Ukraine ranks 83 in this index (fig. 4.6). This is not the best indicator, such countries as Moldova and Russia are rated lower positions (92 and 105 respectively). For example, Bulgaria ranks – 70, Romania – 75 and Poland – 45.

Among 155 countries of the world according to the World Bank, Ukraine ranks 102 in logistics performance index (LPI) [397]. Note that this is the lowest indicator among the neighboring countries. Poland ranks 30, Romania – 39, and Russia – 94. In international experts' opinion, the reason for this is the lack of attention to transport services and infrastructure in the single economic complex system.

Analysis of foreign trade cargo traffic through the territory of Ukraine dynamics is presented in Table. 4.6.

Analysis of the data in the Table indicates that the largest proportion of all cargo traffic in foreign trade activities in 2014 was performed by rail transport – 42.76 per cent or 143,934.63 thousand tons.

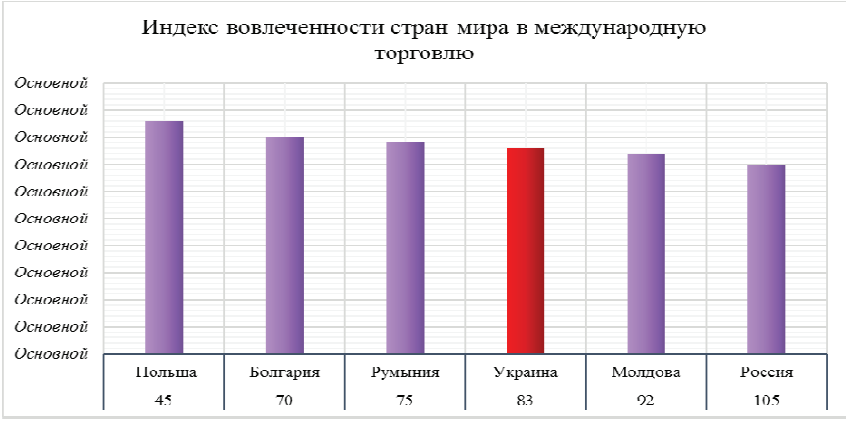


Figure 4.9. Ukraine's rank in the index of world countries in international trade involvement, 2014.

Source: http://gtmarket.ru/ratings/the-global-enabling-trade-index/info#ukraine

Table 4.6

Foreign trade cargo traffic across the borders of Ukraine, thousand tons

Year	Total	Including		
		Export	Import	Transit
2000	369,106.82	85,723.67	99,382.65	184,000.50
2005	419,623.86	121,316.84	92,741.82	205,565.20
2010	373,695.88	142,977.89	78,364.21	152,353.78
2011	402,547.14	155,597.71	95,706.45	151,242.98
2012	378,055.06	170,854.63	82,306.52	124,893.91
2013	371,819.23	175,558.40	76,134.24	120,126.59
2014	336,610.21	174,543.55	60,073.29	101,993.37

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

They carried the largest number of total exports, as well as imports of goods – 47.08 per cent and 53.87 per cent respectively. Pipeline transport occupies the leading position in the transit of goods. In the reporting period, they transported 64.51 per cent thousand tones of all cargo through the territory of Ukraine. There is virtually no performance in foreign economic activities in river transport and air transport, which indicates the existing capacities in these TCS means of transport operation inactivity and potential opportunities for their activation in order to ensure self-sufficiency.

With the in freight demand in the world increase, there is a need in modernization and all means of transport in Ukraine better interaction with a view to its active participation in transit transport market. Infrastructure and organizational processes modernization will provide an opportunity for Ukraine to compete with alternative East-West routes through the Baltic States, Belarus, Poland, the Black Sea and the Balkans, as well as through the Bosporus [397].

Detailed assessment of foreign economic freight traffic across the country's borders in 2014 is presented in Figure 4.10 and in table 4.7.

So, in Figure 4.10 the structure of foreign economic freight traffic flows across the borders of our country during 2014 is presented. It should be emphasized that Ukraine is an export-oriented state, 51.9 per cent of all cargo flows were exported out of it. Imported cargo volumes during this period are almost twice lower at 17.8

per cent. Along with this, a decline in all three indicators compared with the previous 2013 is observed.

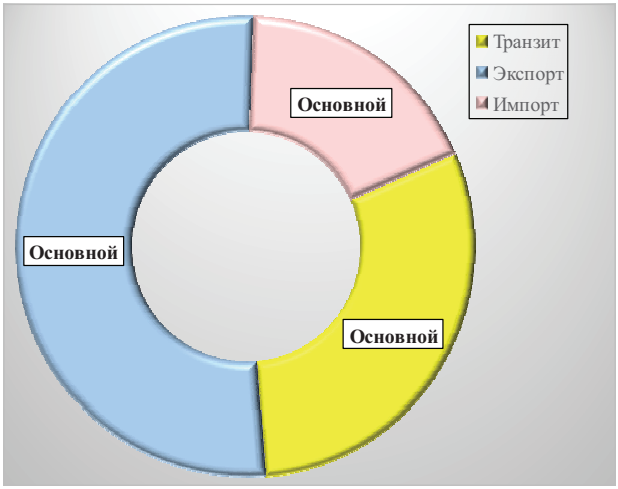


Figure 4.10. Structure of foreign economic freight traffic across the borders in 2014, % [46]

Dynamics of cargo flows analysis from 2000 to 2014 (Table 4.7) gives a general idea on the major indicators variations. So, the largest volume of cargo flows in foreign economic activities was recorded in 2005.

Decrease in transit traffic that could be considered a negative trend is of concern. So, during 2014 the volume of 101,993.37 thousand tones of goods was transported, this figure is almost twice lower than in 2005. Figure of cargo import decreased by one-third and amounted to 60,073.29 thousand tons, which is considered a good trend of the external trade relations development.

TCS export-import operations analysis in the context the countries of the world are presented in Fig. 4.11.

Table 4.7

Foreign economic freight traffic across the country's borders in the context of main means of transport in 2014, thousand tons

	Total	Including		
		Export	Import	Transit
TOTAL, *including:*	336,610.21	174,543.55	60,073.29	101,993.37
- road transport	23,587.06	8,475.27	9,247.93	5,863.86
- railway	143,934.63	82,176.17	32,360.17	29,398.29
- maritime transport	2,095.52	1,130.67	167.60	797.25
- river transport	16.96	-	16.96	-
-air transport	1.94	0.64	0.14	1.16
-pipeline transport	74,283.41	-	8,487.21	65,796.20
-other	92,690.69	82,760.80	9,793.28	136.61

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

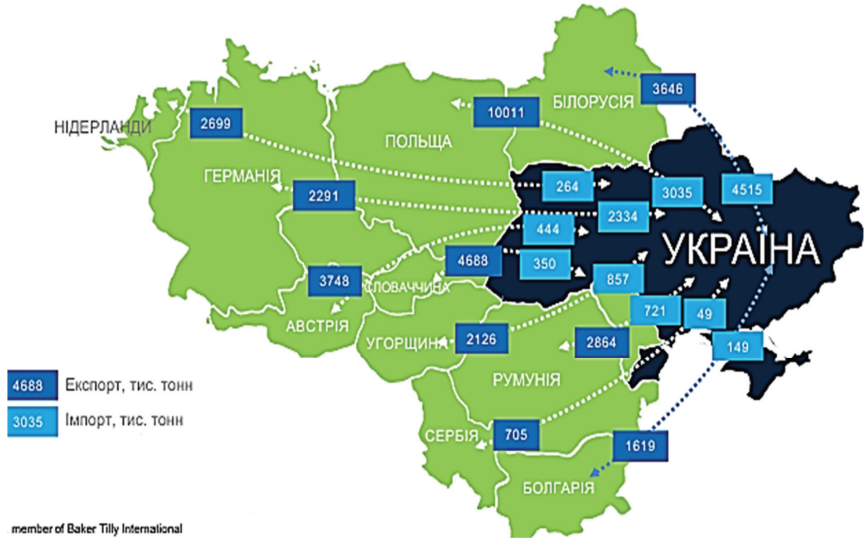


Figure 4.11. TCS of Ukraine export-import services flow scheme

A significant share of both imports and exports of transport- communication system of Ukraine services form the countries of Europe, at that a large part of the product movement pertains to the countries that are located on the rivers Danube, Rhine and Main.

To date, traffic between Ukraine and Euro zone countries is catered by road and rail transport. Our country has not yet enjoyed the obvious advantage of river transport, because it has much worn out fleet and an adequate infrastructure condition.

TCS of Ukraine services exports detailed analysis in the dynamics from 2010 to 2014 demonstrates the trend of revenue from exported services declining virtually at all structural components of the system (Table 4.8).

Table 4.8

Transport- communication system of Ukraine exports of services

USD, thousand

	Year				
	2010	2011	2012	2013	2014
Transportation services, total	**7,835,176.2**	**9,051,096.3**	**8,531,843.0**	**8,305,848.5**	**6,101,923.5**
among them: - maritime transport services	1,234,311.6	1,211,735.0	1,241,240.3	1,123,732.6	850,878.8
- river transport services	72,735.7	82,952.1	63,091.2	42,299.6	46,342.3
- air transport services	1,181,929.8	1,501,094.1	1,510,704.9	1,333,178.2	1,071,262.5
- railway transport services	1,487,123.1	1,776,751.6	1,586,646.9	1,613,856.3	1,098,830.7
- road transport services	254,043.4	396,997.5	452,364.2	478,396.4	459,623.7
- pipeline transport services	3,357,722.5	3,755,012.3	3,248,222.6	3,335,629.6	2,207,902.0
- other auxiliary and additional transportation services	221,384.0	298,050.3	396,577.3	333,723.9	330,069.7
- postal services and courier services	25,745.3	27,748.9	29,818.1	44,649.5	33,725.3

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

With revenues from export operations overall decrease at 26.53 per cent compared with the previous year and indicator stagnation practically by all means of transport services is observed. Only river transportation services export received revenue growth of USD 4,042 thousand. It should be noted that even the improving trends in river transport and the rate of exports in reporting 2014 was 1.8 times less than the rate of 2011.

TCS services import dynamics for 2000-2014 is shown in Table 4.9.

Table 4.9

Transport- communication system of Ukraine services import

USD ,thousand

	Year				
	2010	2011	2012	2013	2014
Transportation services, total	**1,178,914.9**	**1,592,324.7**	**1,727,384.9**	**1,716,437.5**	**1,376,552.3**
among them: - maritime transport services	143,070.3	147,516.8	202,830.1	195,795.1	243,651.7
- river transport services	1,214.8	1,009.6	372.6	360.8	1,087.6
- air transport services	447,611.9	686,126.2	641,287.7	643,550.4	431,037.6
- railway transport services	463,495.6	599,759.9	643,002.6	626,973.1	431,305.2
- road transport services	108,526.9	141,561.0	194,594.4	197,221.1	189,804.7
- pipeline transport services	600.4	542.2	877.5	3,512.2	52,588.0
- other auxiliary and additional transportation services	10,180.2	12,228.5	17,986.0	33,714.4	15,717.7
- postal services and courier services	4,214.8	3,580.6	3,380.6	15,293.9	11,359.7

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

We consider a positive trend that total imports of transport-communication system services have been decreasing over the years since 2012. So, during the reporting 2014 services for USD 339,885.2 thousand was imported that is 19.8 per cent less than in 2013. Along with this, in areas such as gas pipeline transport services imports the value increased many times during the reporting year. This is due to the rupture of economic relations in this industry with Russia as a major exporter of oil and gas and almost total energy dependence on imports in our country. So, in 2014 services for USD 52,588.0 thousand was imported, that is 14.8 times more than in the previous year. In addition, growth of import indicator on marine and river transport is also recorded.

General description of the amount of transported cargo by all TCS means of transport for 2000-2014 is presented in Table 4.10.

Freight traffic in TCS of Ukraine has increased since 2001. The emphasis has gradually shifted from freight transportation of bulk raw materials to the goods in the form of semi-finished and finished products, which surely have compared above transportation cost per ton. This has significant implications for the necessary cargo flow for TCS self-reliant level of development. A trend of increasing transport containerization and multimodal transport of goods can be considered as a positive development in this regard.

2009 was the first year since 2000, during which the volume of both freight and passenger transportations in

Ukraine decreased across all means of transport. Reduction in traffic volumes began in summer 2008, but a significant decrease was observed in 2009, which reflected the global financial crisis impact.

Table 4.10

Cargo transportation by TCS of Ukraine means of transport

Million, tons

	Year						
	2000	2005	2010	2011	2012	2013	2014
Transport total	**1,529**	**1,805**	**1,765**	**1,887**	**1,853**	**1,837**	**1,623**
including: - railway	357	450	433	469	457	444	386
- maritime transport	6.3	8	4	4	4	3	3
- river transport	8.3	13	7	6	4	3	3
- road transport, total	939	1,121	1,168	1,253	1,260	1,261	1,131
including auto enterprises	99	106	99	118	122	126	131
-air transport	0.0	0.1	0.1	0.1	0.1	0.1	0.1
-pipeline transport	218	213	153	155	128	126	100

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

The analysis shows that the largest share of freight transportations in the TCS of Ukraine on volumes pertains to the road and rail transport. So, in 2014 2.9 times more cargo was transported by road than by rail transport.

Along with this, it should be noted that volumes of total profits of these industries are nearly on par with air

transport, which accounted for only a few percent of the tonnage.

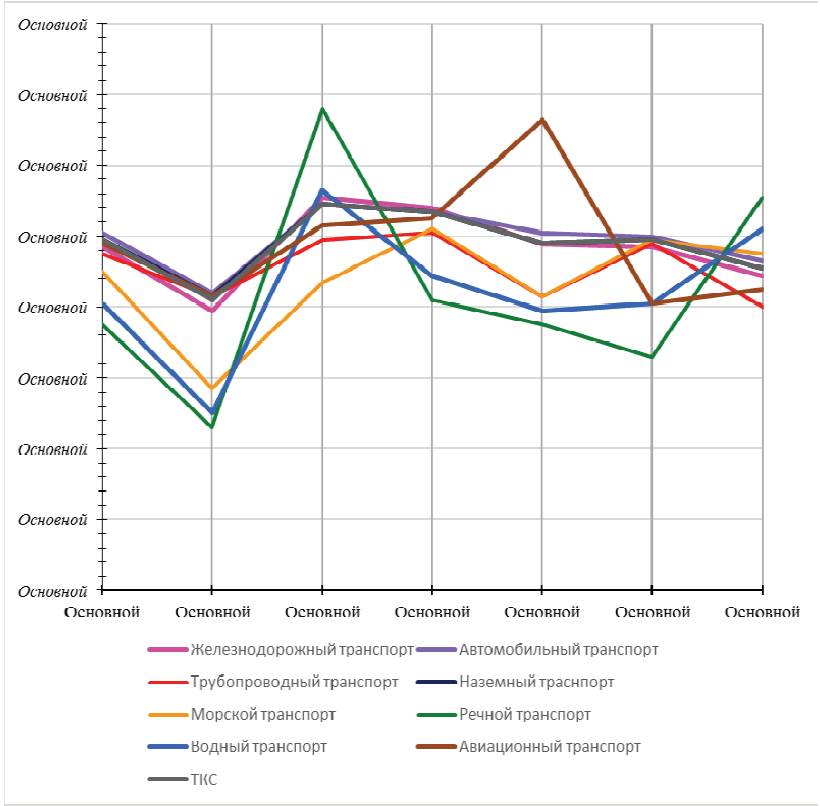


Figure 4.12. Traffic volumes by TCS means of transport indexes (in% to the previous year) [46]

Analysis of turnover for that period indicates that the indicator level during 2014 is less than in 2000. The highest overall turnover was achieved in 2005, but in terms of means of transport, the situation is different. So, in 2005, the year which could be termed as the pre-crisis period, the highest rate was recorded in such means of transport as: pipeline (198.1 billion tons/km); river

(6.3 billion tons/km); maritime (9.6 billion tons/km). Fluctuations of traffic according to other means of transport indicate instability in domestic transport services market, and exposure to the influence of positive as well as negative functioning factors.

Table 4.11

Dynamics of TCS of Ukraine turnover by means of transport, billion. T/km

	Year						
	2000	2005	2010	2011	2012	2013	2014
Transport total	**394.1**	**473.6**	**418.7**	**445.7**	**412.6**	**399.6**	**353.6**
including: - railway	172.8	224.0	218.1	243.9	237.7	224.4	210.2
- maritime transport	8.6	9.6	5.2	5.1	3.6	3.2	4.1
- river transport	5.9	6.3	3.8	2.2	1.7	1.4	1.3
- road transport, total	19.3	35.3	53.9	57.3	57.5	58.7	56.0
including auto enterprises	5.8	11.6	17.0	17.4	19.9	20.5	20.7
-air transport	0.0	0.3	0.4	0.4	0.4	0.3	0.2
-pipeline transport	187.5	198.1	137.3	136.8	111.7	111.6	81.8

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

Analysis of the overall dynamics of the passengers' transportation in terms of means of transport in dynamics from 2000 to 2014 is provided in Table. 4.12. As we can see, from 2000 to 2005, the greatest performance is recorded in this time interval. This is due to the fact that

in the country in that period general rise in economic development was observed and after the global financial crisis of 2008 a decline of economic indicators that directly correlates with the decline in the purchasing power of the population was recorded.

Table 4.12

Passengers' transportation by TCS of Ukraine means of transport

Million, persons

	Year						
	2000	2005	2010	2011	2012	2013	2014
Transport total	**7,780**	**8,200**	**6,845**	**6,980**	**6,813**	**6,623**	**5,902**
including:							
- railway	499	445	427	430	429	425	389
- maritime transport	4	11	7	7	6	7	0
- river transport	2	2	1	1	1	0	1
-air transport	1	4	6	8	8	8	6
- road transport (buses)	2,257	3,837	3,726	3,612	3,450	3,344	2,913
- trolleybus	2,582	1,903	1,204	1,346	1,345	1,306	1,097
- tram	1,381	1,111	714	798	800	757	770
- underground	754	887	760	778	774	775	726

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

Thus, the volume of passengers in 2014 by many means of transport is not only smaller in comparison with the previous year, but is lower than in 2000.

In particular, in the reporting year 13.4 per cent less passengers was transported by rail transport, 50 per cent less by river transport, 57.5 per cent less by trolleybus, and 44.2 per cent less by tram and 3.7 per cent less by

underground. However, the shift to increasing traffic volumes of road transport is observed, which is understandable due to the comparatively lower rates over air, maritime and rail transport.

Figure 4.13. infographics allows evaluating the trends data in passenger transportation development.

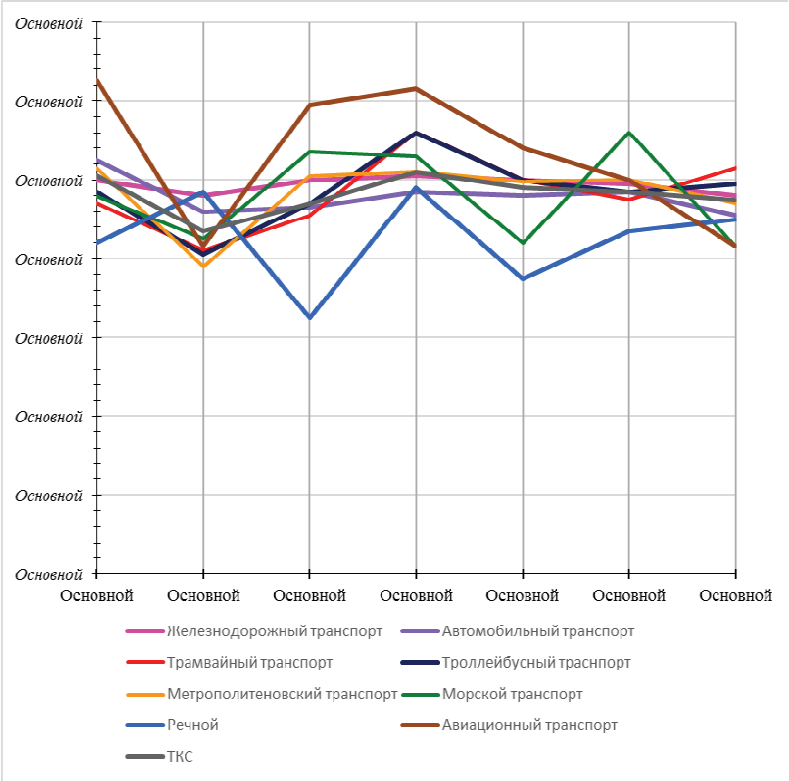


Figure 4.13. Passenger transportation volumes in terms of TCS means of transport indexes (in% to the previous year) [46]

Diagram 4.14. allows to visually assess the distribution of passengers in terms of means of transport in the reporting 2014.

Road transport acts as a leader in passenger transportations, 49.36 per cent of the total volume was transported by it. Passenger transportation by maritime transport was not recorded at all during the reporting period. The lowest proportion in the structure belongs to the river transport (0.01 per cent), air transport (0.11per cent) and rail transport (6.6 per cent).

This situation indicates that there are untapped reserves of domestic TCS development.

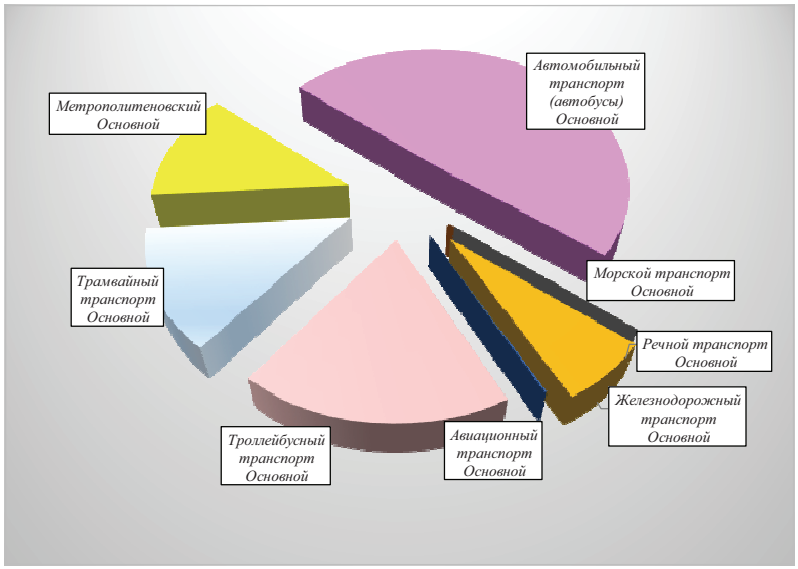


Figure 4.14. Distribution of individual means of transport in total passenger transportation volume, 2014. [46]

Dynamics of passenger traffic for the period from 2000 to 2014 confirms the total decline in 2014 (fig. 4.15). As you can see, the greatest value of passenger traffic was recorded in 2005 and a relatively stable period from 2010

to 2013. During the reporting period, the rate was registered at 6.8 per cent less than in 2000.

Dynamics of passenger traffic presented in Table 4.13. shows ambiguous trends in all means of transport.

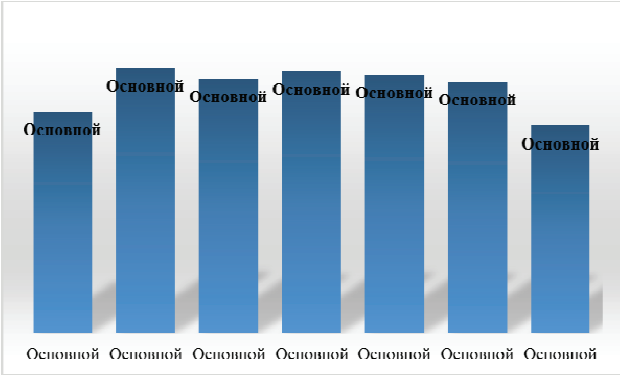


Figure 4.15. Passenger traffic dynamics in the context of all means of transport for 2000-2014, billion persons/km [46]

So, steady increase in air transport (1.7 billion persons/km in 2000 to 11.6 billion persons/km in 2014), as well as persistent decline in rail transport (51.8 billion persons/km in 2000 to 35.9 billion persons/km in 2014), trolleybus transport (from 16.8 billion persons/km in 2000 to 6.4 billion persons/km in 2014) and tram transport (from 9.0 billion. persons/km in 2000 to 4.3 billion persons/km in 2014) is fixed. Fluctuations i.e. indicator instability is observed on road and underground means of transport.

According to the National Bank of Ukraine, hryvnia (UAH) devaluation in 2014 already amounted to 50 per cent. And according to the Ministry of Finance of Ukraine, the inflation index in March, 2014 amounted to 3.4 per

cent. All of these factors adversely reflected on the real income of citizens that is prices rose and revenues impaired.

Table 4.13

Passenger traffic by TCS of Ukraine means of transport, billion persons/km [46]

	Year						
	2000	2005	2010	2011	2012	2013	2014
Transport total	**113.1**	**135.8**	**130.0**	**134.1**	**132.3**	**128.3**	**106.3**
including: - railway	51.8	52.7	50.2	50.6	49.3	49.0	35.9
- maritime transport	0.1	0.1	0.1	0.1	0.1	0.1	0.0
- river transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-air transport	1.7	6.1	11.0	13.8	14.4	12.6	11.6
- road transport (buses)	28.8	52.5	52.0	51.5	50.3	49.0	42.6
- trolleybus	16.8	11.2	6.9	7.8	7.8	7.6	6.4
- tram	9.0	6.5	4.0	4.4	4.5	4.1	4.3
- underground	4.9	6.7	5.8	5.9	5.9	5.9	5.6

The real incomes of citizens of Ukraine were reduced by 10 per cent and the poverty rate increased by 30 per cent, which threatens effective economic reform. This was announced by the Minister of Finance of Ukraine Natalia Yaresko [http://economics.lb.ua/state/2015/04/25/303039_rost_bednosti_ukraintsev_ugrozhaet.html]

GFK Company In Terms Of Market Research regularly measures the purchasing power of the population and provided data for 2014. The most solvent

state in Europe is Lichtenstein, the last in the ranking is Moldova. Ukraine is among the poorest states in Europe.

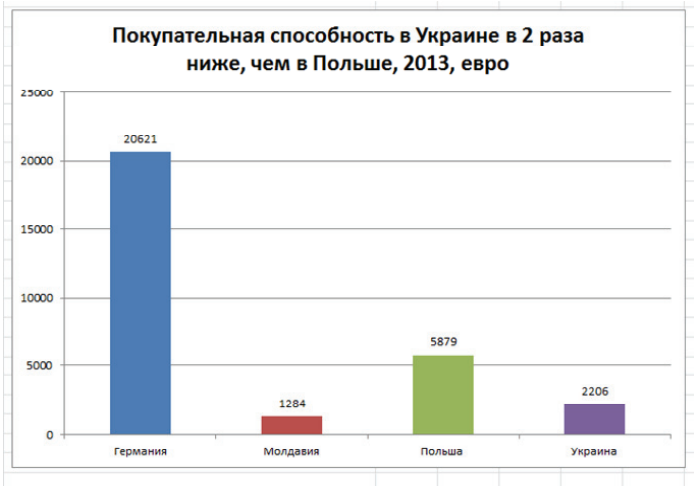


Figure. 4.16. Ukraine in the rating level of purchasing power, 2013.

Source: http://socium.com.ua/2013/11/purchasing-power/

Level of purchasing power, of course, is affected by the population wage levels. Analysis of the dynamics of the average wage levels of employees in 2000-2014 is presented in Table. 4.14.

The data at the table shows that for the analyzed period the size of nominal wages increased, the increase ranged from 5.5 to 33.7 per cent. However, it should be emphasized that the real wages in the period, for example, decreased by 6.5 per cent, which is amplified by the negative effect of rising prices for utilities, food, commodities and, of course, travel.

Table 4.14

Average nominal and real full-time workers wages

	Nominal wage, UAH.	*In % to the previous year*	
		nominal wages	real wages
2000	1,806	133.7	106.3
2009	1,906	105.5	90.8
2010	2,239	120.0	110.2
2011	2,633	117.6	108.7
2012	3,026	114.9	114.4
2013	3,265	107.9	108.2
2014	3,480	106.0	93.5

Source: Statistical compendium "Ukraine in figures, 2014, https://ukrstat.org/druk/publicat/kat_r/publ1_r.htm

Increase in consumer goods prices, particularly those that are directly connected with transport-communication system operation is presented in Figure 4.17.

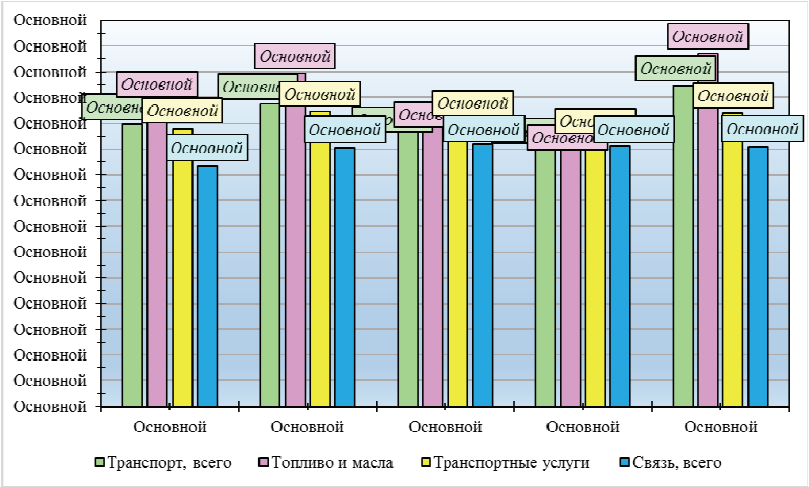


Figure 4.17. Consumer price indices for goods and services (in% to the previous year) [46]

Having analyzed indices of prices for fuel and oil, communication and transportation services for 2000-2014,

we can summarize the steady increase in the prices of all products (services) of the specified group.

Maximum hike in the price of fuel and oil in 2014 should be made particular mention, which cannot but affect the price of travel and the number of trips per inhabitant (Table 4.15).

Table 4.15

Number of trips per inhabitant of de facto population in an average year in terms of means of passenger transport

trips

	Year						
	2000	2005	2010	2011	2012	2013	2014
- railway	10	9	9	9	9	9	9
- maritime transport	0.1	0.24	0.14	0.15	0.13	0.15	0.001
- river transport	0.04	0.05	0.02	0.02	0.02	0.01	0.01
-air transport	0.02	0.08	0.13	0.16	0.18	0.18	0.15
- road transport (buses)	53	82	81	79	76	74	68
- trolleybus	142	107	67	75	76	74	120
- tram	103	85	56	63	63	60	113
- underground	145	187	145	148	147	146	253

Source: State Statistic Service of Ukraine http://www.ukrstat.gov.ua/

Exploring the number of trips per inhabitant dynamics of de facto population in an average year in terms of means of passenger transport, we can conclude multidirectional trends of TCS means of transport. So, for example, the picture on underground transport is the best - the indicator increased from 145 trips per year in 2000 to 253 in 2014. On road transport (buses) situation is

characterized by a slight variation and in 2014 rated 68 trips that is 15 trips more than in 2000. Tram public transport rate in 2014 almost returned to the level of 2000, and is 113 trips a year. Slight decline is recorded on trolleybus and rail transport.

Along with the above presented analytical data, it should be noted that according to international experts estimates on the level of social progress Ukraine ranks 62 in the world's countries ranking leaving back Belarus, Moldova and Russia (66, 70 and 71 in the ranking, respectively) (Figure 4.18).

The Social Progress Index is a combined indicator of the international research project of The Social Progress Imperative that measures achievement of the world's countries in terms of public welfare and social progress. It was designed in 2013 under the leadership of Michael E. Porter, a Chairman of The Social Progress Imperative, professor of Harvard University, specialist in strategic management and international competitiveness. In determining a country social progress success over 50 indicators in three main groups are recorded:

1. Basic human needs — food, access to basic medical care, shelter, access to water, electricity and sanitation services, personal safety level.

2. Fundamentals of human well-being — access to basic knowledge and literacy, access to information and communication, health care, environmental sustainability.

3. Human development opportunities — level of personal and civil liberties, human empowerment to make decisions and realize their potential.

Rating was made in 2015 and covers 133 countries.

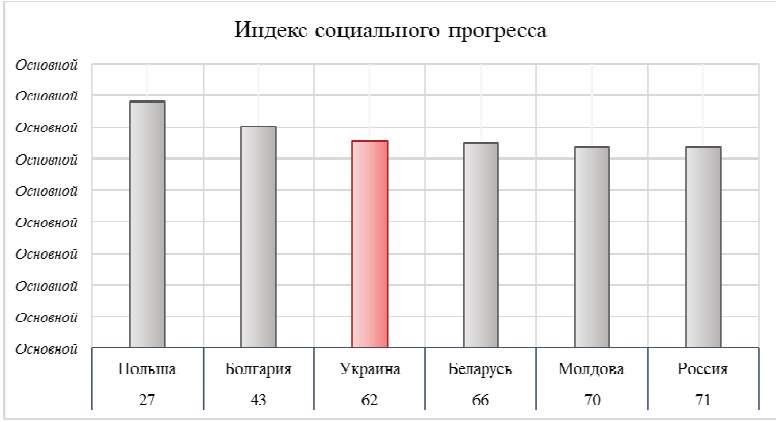


Figure 4.18. Ukraine's rank among the countries of the near abroad on the social progress level, 2015.

Source: http://gtmarket.ru/research/social-progress-index/info#ukraine

The car ownership level is considered to be one of the most important indicators of the population well-being: the higher is the level of the population well-being, the more likely they purchase a car. Raising the car ownership level leads to a significant change in public infrastructure; increase the mobility of people and economic advancement of the people.

The car ownership level is an indicator of passenger cars by the population of the country availability, which is calculated as the number of individual cars per 1,000 inhabitants. Any road vehicle (except two-wheeled vehicles), intended for passengers and luggage carriage,

with a capacity from 2 up to 9 persons, including the driver is understood under a car. It is calculated according to the methodology of the International Road Federation, based on national statistics and international organizations data. "World Road Statistics" database, which is updated annually, serves as a source of information.

Figure 4.19. Ukraine's car ownership level among the CIS countries, 2012.

Source: http://gtmarket.ru/ratings/passenger-cars-per-inhabitants/info#ukraine

Submitted diagram only confirms the low level of the population of Ukraine well-being as compared to the neighboring countries.

Information and communication component of TCS of Ukraine development analytical evaluation is extremely difficult, since integrated statistical data are not available.

In this regard, we have conducted a study of analytical materials presented by international organizations and reflecting Ukraine's position in the world rankings. A more detailed analytical evaluation of the TCS

communicational system in terms of means of transport will be presented in the relevant sections of this work.

So, the International Telecommunication Union, ITU, a specialized unit of the United Nations in the field of information and communication technologies (ICT), has researched the ICT development in the countries of the world in the period from 2011 to 2012. The result of the study was a report on Measuring the Information Society 2013 containing ICT development ranking in 157 countries. South Korea has made the most headway in the area of ICT development; Ukraine ranks 68 in the ranking.

The information and communication technologies development index (ICT Development Index) is a combined indicator, which characterizes the countries in the world achievements in terms of information and communication technologies (ICT) development. The index was developed in 2007 based on 11 indicators, which are operated by the International Telecommunication Union (ITU) in its assessments of ICT development. The index brings 11 indicators into a single criterion that can be used as a tool for comparative analysis at global, regional and national levels. These indicators relate to access to and use of ICT, as well as these technologies practical knowledge, in particular: the number of fixed and mobile phones per 100 inhabitants of the country, the number of households with a computer, the number of Internet users, literacy levels, and so on.

Almost two-thirds of the 30 leading in the ranking countries are European countries where a joint regulatory

framework and a clear set of priorities, goals and objectives have helped the countries to develop into advanced informational economies. Among the 30 leading countries are also economies with high levels of income from the Asia-Pacific region (Australia, Macau S.A.R. (China), Singapore and New Zealand), as well as the United States, Canada and Barbados from the Americas region.

Despite the ICT widespread diffusion throughout the world, there are considerable differences between developed and developing countries, with an average index values twice as high in the developed world than in the developing countries. As you can see, in the report Ukraine ranks 73 out of 166 countries of the world (Figure 4.20).

Figure 4.20. Ukraine's position in the ranking of countries by the level of information and communication technologies development, 2014.

Source: http://gtmarket.ru/news/2014/11/24/6988

Generalized characteristics of transport-communication system in Ukraine modern development reflect general trends of a crisis in the country as a whole. However, the presence of a large transport capacity, which can be used in order to achieve the TCS self-reliant level of development, should be noted.

4.1.2. TCS self-reliance level diagnosis. Self-reliance balance

Opportunities and results of a new direction of harmonious management based on the optimal proportions method ("golden section") usage, in relation to the structure of the socio-economic system balance, in particular for transport-communication system of Ukraine. A prerequisite for the existence or the beginning of a sufficient evolution process of a complex market socio-economic system is the existence of "golden section" in its structure.

"Golden section" is widely known primarily as a principle of dividing a segment in the following ratio: The whole refers the bigger part as a bigger part refers to the lower (Fig. 4.21)

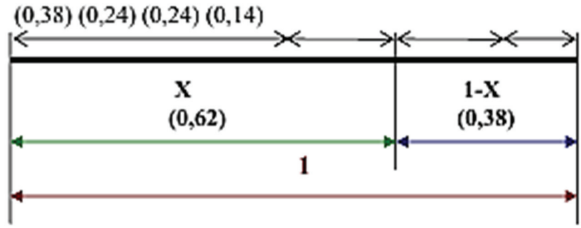


Figure. 4.21. "Golden section" geometric interpretation

The basis of harmonious management as an element of an administrative system method is the theory of traditional "golden proportions": parts of different sizes are in a specific ratio to each other and to the whole. The greater the number of "golden section" proportions, the higher the level and opportunities for the development. In Fig. 3 it is clearly seen that a single segment division occurs in the ratio: 1/x = x/ (1-x). This equation solution on the first stage of division has the following proportions: a larger section x ≈ 0.62 and the smaller one ≈ 0.38; and on the second stage of division 0.38 + 0.24 = 0.62 and 0.24 + 0.14 = 0.38. This division provides, first of all, any system to external factors sustainability and the ability to restore its balance with the lowest cost (losses).

The idea of balance is the basis of any socio-economic system rational functioning. Its essence is that all costs should be offset by the system revenues. Balance models creation is based on the balance method that is a mutual comparison of available resources and needs in them.

This fully applies to transport-communication system functioning which is governed by the balance principles should finance its needs mostly at the expense of its own resources. Balance self-reliance formula is as follows:

$$\underset{(100\%)}{ЗФ_{ТКС}} = \underset{62\%}{СФП_{ТКС}} + \underset{(38\%)}{ПФП_{ТКС}}, \qquad (4.1)$$

where, $ЗФ_{ТКС}$ *is the* cumulative cost of the TCS functioning, UAH million;

СФП$_{ТКС}$ is the income from own internal sources of transport-communication system funding resources, UAH million;

ПФП$_{ТКС}$ is the income from borrowed (external) sources of transport-communication system funding resources, UAH million.

The optimal ratio of own (internal) sources of TCS costs financing to attracted (external) sources should be 62 per cent: 38per cent. It is identical to the "golden triangle" ratio or "golden section" rule [12].

Thus, the above allows defining the self-reliance balance.

Self-reliance balance economic content is a macroeconomic model, which reflects the ratio between own (internal) and attracted (external) sources of socio-economic system operation total costs funding.

On the form self-reliance balance can be presented in a form of table, which is proposed in the following aggregated form (Table 4.16).

The calculated self-reliance balance data allow determining the socio-economic system self-reliance level.

Self-reliance level determining indicator is the specific weight of own sources of socio-economic system functioning costs funding. Thus, the system will be self-reliant if the value of this indicator falls within the boundaries of "self-reliance corridor", that is from 62 to 100 per cent.

Table 4.16

Transport-communication system self-reliance balance

Article	Sources of financial resources	
	Own, UAH million.	*Attracted, UAH million.*
1. Gross income, total *including:*	+	-
-net income (loss);	+	-
-tax revenues;	+	-
-other non-tax revenues;	+	-
- income from exports;	+	-
- income from transit;	+	-
-income from capital transactions.	+	-
2. Transfers, total *including:*	+	-
- public administration bodies transfers ;	+	-
- foreign Governments and international organizations transfers;	-	+
3. Credit resources, total *including:*	+	+
- lending at the expense of the State budget;	+	-
-lending by financial institutions.	+	+
4. Investment, total, *including:*	+	+
-capital investments;	+	-
-foreign direct investment	-	+
∑ financial resources sources	+	+
Sources of financial resources specific weight, %	+	+
∑ TCS cumulative costs, UAH million.	+	
BALANCE	100%	

** Source: compiled by the author*

Socio-economic system self-reliant development dynamics can be represented as a graph, where 62 per cent is a minimum self-reliance border, and 100 per cent is self-reliance maximum level. We offer a more detailed graphic interpretation of the data obtained and self-reliant development of the system trends analysis to be implemented by calculating deviations from the median of the "self-reliance corridor" (M_e) as an indicator of self-reliance average level at 81 per cent. The graph allows determining the value of the system self-reliance level at a specific point in time series as below/above average self-sufficiency.

We offer to determine transport-communication system of Ukraine economic self-reliance level during the reporting 2014 by means of aggregate self-reliance balance (Table 4.17).

As you can see from the data presented in the Table transport-communication system of Ukraine in 2014 did not reach self-reliance level that is, it was non-self-reliant. Proportion of own funds is 0.72143 per cent less than the minimum self-reliance border and accounted for UAH 276,389.638 million.

More detailed analytical diagnosis of TCS self-reliant development for 2000-2014 and a forecast up to 2025 is presented in section 6.1. of this work.

Summarizing all the foregoing *self-reliance* can be represented as a mode (method) of socio-economic element or a system as a whole management, which covers functioning expenses primarily at the expense of own

(internal) sources of funds revenue (from 62 to 100 per cent).

Table 4.17

TCS self-reliance balance, 2014.

Article	Sources of financial resources	
	Own, UAH million.	*Attracted, UAH million.*
1. Gross income, total	258,843	-
2. Transfers, total *including:*	21.0	870.02
- public administration bodies transfers ;	21.0	-
- foreign Governments and international organizations transfers;	-	870.02
3. Credit resources, total *including:*	2,027.438	160,176.367
- lending at the expense of the State budget;	2,027.438	-
-lending by financial institutions.	-	160,176.367
4. Investment, total, *including:*	15,498.2	13,601.95
-capital investments;	15,498.2	-
-foreign direct investment	-	13,601.95
∑ financial resources sources	**276,389.638**	**174,648.337**
Sources of financial resources specific weight, %	61.27857%	38.72143%
∑ TCS cumulative costs, UAH million.	**451,037.975**	
BALANCE	100%	

On the basis of transport-communication system development current state analytical study, there is no

doubt about the need for comprehensive mechanism to promote state support of self-reliant development in the system after the detailed study of factors and reserves.

4.2. TCS SELF-RELIANT DEVELOPMENT FACTORS AND RESERVES ANALYSIS

As noted, transport system is compared to the circulatory system of a human body, on the arteries of which goods and services flow, the functions of the state are carried out, labor and educational migration of the population is supported. However, to date, according to our calculations, the system is non-self-reliant and transport services market covers only Ukraine's economy and population in transportation basic needs. At the same time, it should be noted that TCS services remain of a quite poor quality, non-competitive by costs and unsafe. We consider transport-communication system to be an important factor of economic growth, self-reliant development tool and competitive advantage for the national economy within the world economy creation, which is especially important given transport markets in Europe integration and trade between the EU and Ukraine intensification.

Over the past year the situation in transport-communication system of Ukraine suffered some serious shocks: access to five sea ports and two airports in the territory of the annexed Crimea was lost, Donetsk Railway, which accounted for up to 45 per cent of domestic freight transport was blocked; eastern borders for pan-

European road corridors through Ukraine providing a significant proportion of transit traffic were lost.

The totalities of these shocks were associated with problems of country's economy shrinking. As a result, the volume of passenger traffic, compared to 2013 decreased from 5 to 17 per cent depending on the means of transport. The volume of freight traffic decreased by about 10 per cent, mainly in the traditional for Ukraine steel and coal industries. Sea and river ports of Ukraine declined cargo handling by approximately 5 per cent, which negatively affected the results of TCS domestic infrastructure [218].

In addition to external shocks, which weakened transport-communication system of Ukraine, there were also a number of internal system contradictions, the neglect of which predetermined the stagnation of transport sector in the future and serve as a threat of principal transit potential losing which is the major source of budget revenue.

We offer an analysis of basic contradictions of TCS of Ukraine modern development in order to justify major reserves for further self-reliant development.

The main contradiction, which brings a real threat of losing self-reliance in transport sector and its self-reliance level drop, is the imbalance between simple and expanded processes of TCS fixed assets reproduction. It should be noted that technical resources supply (vehicles, infrastructure), which is one of the most capital-intensive sectors of economy, was established back in Soviet times, and now is almost completely worn out and requires large

long-term investments for its development. As noted earlier, the capacity of the state is now limited and own resources of enterprises is not enough, because they're headed, at best, to "survival".

Public-private partnership mechanisms application has not been extended due to sufficient regulatory framework to implement the mechanisms of public-private partnerships and appropriate safeguards for the investors' rights absence in Ukraine.

Next, the second contradiction is the mismatch between existing market mechanisms and TCS market of services state regulation efficiency. The fact of the matter is that there is a monopoly in potentially competitive segments of transportations on a railway transport in Ukraine, and management system of public transport companies is inefficient and leads to unsatisfactory results. It is not just the "unprofitability", but the inability to update its own rolling stock and obsolete transportation infrastructure reproduction on a parity basis with the state and private investors.

And, finally, the third contradiction is connected with the necessity of state policy of TCS development adaptation to new challenges and new demands to transport systems and markets functioning. This is an accentuation on world trends in commodity markets development, and mobility of the population increasing, and on the conditions of Association Agreement with the EU terms. At the same time, transport of Ukraine development strategy for the period up to 2020 has not yet

received development in specific policy documents. Moreover, for the midterm, there is no approved transport development program, except for the program of public roads development up to 2018. From this it can be concluded that the development of road, railway, water, aviation, public means of transport and system of communication of Ukraine takes place, to a large extent, by inertia.

Thus, the existence of aforementioned "contradictions tangle" makes TCS a risk factor for the state and, more importantly, ineffective in terms of national security ensuring.

To overcome the crisis, it is necessary to implement a set of measures and take advantage of all reserves aimed at admission of private capital and promotion of competition, as well as strategic planning introduction to ensure development of TCS of Ukraine transit potential.

Undoubtedly, a positive factor is that Ukraine has an extensive system of transport communications. So, in 2014 (without taking into account the temporarily occupied territory of Crimea, Sevastopol, and territories of the anti-terrorist operation) the length of highways was more than 163 thousand km, of which nearly 98 per cent is paved. By the density of paved roads Ukraine occupies the first position among CIS countries. However, their condition is a negative factor. Thus, according to the State Highway Service of Ukraine the Ukrainian economy losses from poor quality roads in the country increased 2.7 times - up to UAH 55 billion a year since 2001 to 2013.

As we see, in spite of satisfactory performance freight traffic has potential for growth.

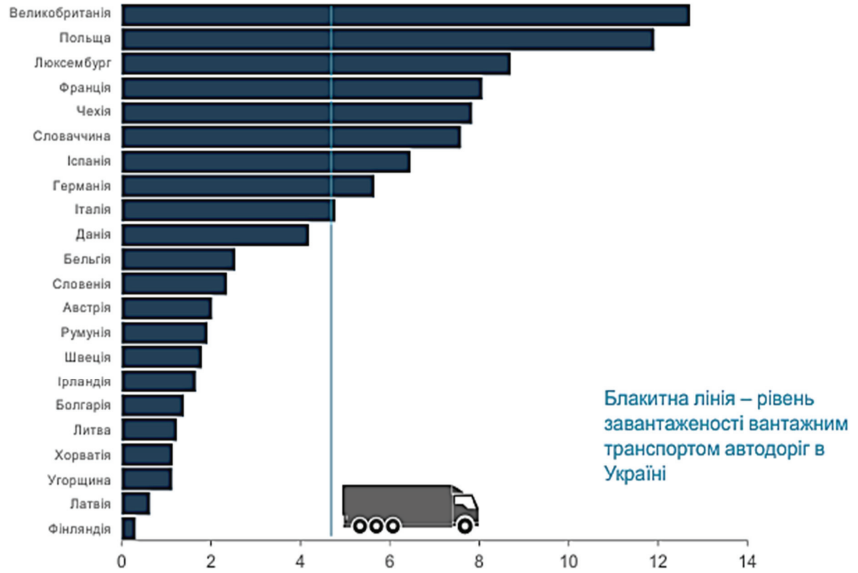


Figure 4.22. Roads congestion. Road freight congestion coefficient [150]

So, perspective directions of Ukraine and the EU cooperation are additional volumes of transit through the territory of Ukraine attracting and ITC network with new directions of movement branching: Europe – Caucasus – Asia with a branch of the highway Budapest – Belgorod-Dnestrovskiy – Odessa with access through the Kerch ferry to the South of Russia and the Caucasus; TRACECA (the Grate Silk Road); the Black Sea – the Baltic Sea involving additional cargo flows from Turkey (forward) and from the Nordic countries (in reverse); the use of the waterway of the Dnipro River and exit to the Caspian Sea through the Volga-Don direction; participation in the

"North-South" ITC implementation. In this context, attention should be drawn to the Ukrainian – Latvian cooperation in transit traffic field.

A negative factor in road transport is the fact that the mechanism of transportation services tariffing is not fully worked out, with practically no quality and cost of TCS services control, especially in passenger transportations. In addition, the level of traffic safety is unsatisfactory, which tends to deteriorate, and transport processes energy efficiency is low.

One of the essential problems of road passenger transport is the presence of irregular passenger transportations as well as shadow income and shadow labour market as a result of the "gray" economy significance.

TCS road network has some disadvantages: pavement quality is unsatisfactory, the industry requires European standards for construction, repair and maintenance of roads introduction. According to the World Economic Forum's report on global competitiveness-2014 the quality of roads in Ukraine is one of the worst in the world: Ukraine ranks 139 among 144 countries. For comparison: Poland ranks 89 (relatively with 105 ranks a year earlier), Georgia ranks 65. Only roads in the Republic of Moldova, Mozambique, Libya, Guinea and Timor are worse than the roads in Ukraine.

In connection with the European orientation of the state's foreign economic relations, an important problem has arisen in transit and transport infrastructure

development, and particularly highways and customs transitions. Many have already been done: more than 80 international and inter-state checkpoints have been built and opened. Among them: Novy Jarilovichi with traffic performance of 1,000 vehicles per day, Yagodin 1-2,100, Ustyluh - 600, Shegini - 1,500, Krakovets - 5,000, Chop - 3,300 vehicles daily and the like. The border with Poland Krakovets checkpoint has become one of the chains of the L-4 Lisbon-Caucasus highway. Specially equipped car terminals (avtoports), placed at the entrances to the border contribute to the cargo flow speed. Such avtoports already operate in the crossing area of the Ukrainian - Hungarian border. In addition, Eurocorridors standards provide the duration of crossing the border by buses and passenger cars in 15 minutes, trains in 20 minutes, and trucks in 60 minutes. None of these conditions is fulfilled in Ukraine [218].

In the sphere of passenger road transport there is a significant number of small carriers with a non-optimal structure of the bus fleet (81.2 per cent of the entire fleet of buses belong to the carriers who own 1-5 buses), their vehicles are mostly obsolete, inefficient, and environmentally hazardous. In addition, illegal passenger transportations presence distorts the market, in particular under the guise of special regular and special non-scheduled traffic.

Low level of technical-technological and economic parameters for the most types of domestic vehicles which do not meet international standards, leads to an inevitable

loss in world competition on transit services market. Therefore, foreign transport and forwarding companies are expanding into the Ukrainian transportation market. Particularly acute this situation is felt in maritime and air transport.

It should also be noted that privatization, public-private partnership development, investment attraction, technical innovation and technological modernization issues are extremely unsatisfactory in transport sector, even the industry workers minimal social needs are not met, and security and control system is destroyed.

With regard to the gas and oil pipelines network, Ukraine has one of the most powerful gas transportation systems in Europe (second after PAO Gazprom), the pipeline length is over 35 thousand km. Projected capacity allows to pump more than 250 billion cubic meters of gas in forward and reverse directions, while the transit system is actually used by the only user that is Russia's PAO Gazprom.

Importance in a consortium creation for modernization and use in multilateral format is a positive and strategically important factor. According to international experts, this asset is estimated at USD 27-29 billion. .

In addition to gas transportation system, Ukraine possesses a wide network of oil pipelines, some of which are not currently used. The southern branch of the world's largest oil pipeline Druzhba which is currently connected with built in 2004 the Odessa-Brody pipeline capacity utilization can be considered as an inventory. A positive

factor in this regard is the negotiation process intensification since the end of 2013 between Ukraine and Poland in terms of extending the pipeline to Plock city, which will allow transporting the tanker Caspian oil from Odessa sea port to the Polish refineries.

Factors and possible reserves of self-reliant development in rail transport analysis are as follows.

Freight volume transported by rail in 2014 decreased by 11per cent compared with 2013.

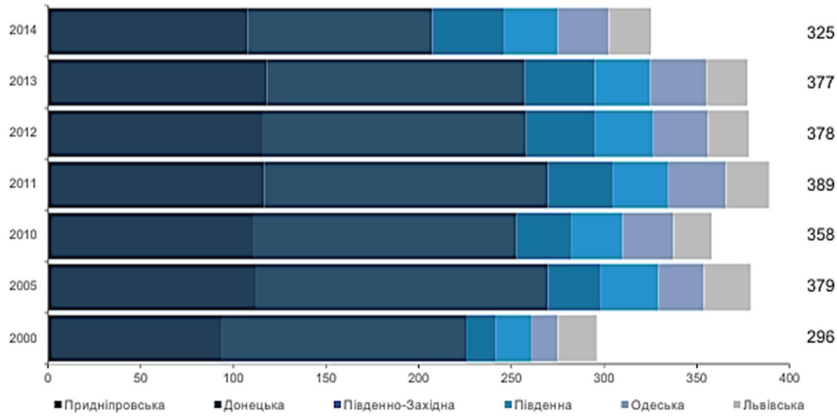


Figure 4.23. Freight transportations in the context of JSC Ukrzaliznytsia structural units' dynamics [150]

The reason for this negative phenomenon is the war in the East of Ukraine and rapid decrease in exports to the Customs Union countries, which was primarily carried out by rail and road.

Operational length of railways of general use amounted to 20,948.1 km, 48 per cent of which are electrified. Note that the railway network of Ukraine length ranks third in Europe. In addition, railway

transport in the system of transport communications of Ukraine role is strengthened by the fact that the main transport trans-European corridors pass through the territory of the state: East — West, the Baltic — the Black Sea. In particular, the trans-European railway line E-30, originating in Berlin, crosses Ukraine on Mostyska—Lviv—Kiev route and goes further to Moscow. A significant factor, which can be attributed to the negative group, is the domestic tracks width, which does not comply with European standards. This leads to the border downtime, while railway workers are "changing wheels".

The number of TCS inventory rolling stock is a positive, but its physical and moral condition i.e. depreciation is clearly a negative factor.

So, the overall composition of the inventory of locomotives is 3.9 thousand units, of which 43.6 per cent are main-line electric locomotives, 17.9 per cent are main-line diesel locomotive and 35.9 per cent are shunting locomotives.

In rail transport the problems that significantly affect its further development have exacerbated:

— fixed assets of the industry high degree of depreciation, particularly of traction rolling stock;

— lack of public investment in the sector despite the provisions of Art. 10 of the Applicable Law of Ukraine "On Railway Transport";

— lack of competition, and hence the lack of motivation for an industry business entity to improve its work efficiency and services quality, as well as expand their list;

— strict government regulation of tariffs for railway transportations, which does not allow timely reaction to changes in the situation on transport services market;

— a significant financial burden by the state social functions on "Ukrzaliznytsya" (preferential categories of passengers transportation, obligation to carry suburban passengers on tariffs, which are significantly below the costs) [218].

So, the absolute majority of Ukrainian railways traction rolling stock was built according to the technical specifications of the 1960s and mostly almost fulfilled the normative service life. If main-line electric locomotives fulfilled the normative service life by 71.6 per cent, main-line diesel locomotives — by 99.4 per cent, and shunting locomotives — by 91.3 per cent.

The situation is not better with the fleet of cars — the average wear of freight cars is 89.65 per cent, including open railroad freight cars — 88.5 per cent, grain-carriers — 95per cent, cement carriers — 92.2 per cent. The average age of the entire fleet of passenger cars is 27.5 years with total 86 per cent wear out. At the same time, 61.3 per cent of passenger cars have been used for more than 28 years.

It is necessary to divert from monopolies, particularly in rail transport, and attract private investors to establish passenger, freight and locomotive companies that will bring competition to the market and will gradually update the rolling stock, improve comfort and safety.

One of the significant reserves that would provide additional financial resources required for self-reliant development is piggyback traffic on "Ukrzaliznytsya" network. So, in the early 2000s, two international piggyback routes were launched — the first is the Viking (Ukraine-Belarus-Lithuania), and then the Yaroslav (Ukraine-Poland). Both routes were launched as piggyback routes in 2003, and at the same time they received the first loading and by the end of the year more than 1.5 thousand road trains (the Viking — 0.25 thousand, the Yaroslav — more than 1.3 thousand) on the territory of Ukraine were transported . However, sustainable growth of piggyback routes download has never took place, but it existed, that prompted Ukraine to start another piggyback route train Kiev Express (Ukraine—Hungary — Austria) in 2006 [213].

To date, Ukraine has lost key transit volumes associated with Russian transportations; domestic and export cargo base are decreasing, all this makes the Ukrainian transporters not just look for a new download, but completely change the ideology to stimulate customers, attracting small and fractional lots. European carriers, having lost Russian freight traffic axis, enhance the search of alternatives at the expense of Central Asia and the Middle East markets, and here the geopolitical potential of Ukraine (and "Ukrzaliznytsya" in particular), it turns out, to be quite opportunely. Finally, reform processes in Ukrainian transport sector have been launched helping, among other things, to establish

horizontal intra-industry communications, vital for innovative types of cargo communications development. If you look at transportations statistics at EU — Ukraine route, the main cargo is transported by the sea, while the railway is not loaded. Moreover, the cargo exchange by railway is limited geographically — it is carried out, mainly, with the neighbours of Ukraine, such as Poland, Czech Republic and Romania. Further is a huge "white spot", covering the Benelux countries, Germany, France and Italy that are precisely those markets in which Ukraine might obtain the most high-margin transit.

Piggyback routes the Viking, the Yaroslav, Ukraine—Hungary—Italy, Ukraine—Slovakia—Austria—Italy and Ukraine—Hungary—Austria are relevant for the Ukrainian side even today. The first two could have been launched today, but there are a number of problems. Unfortunately, the Viking and the Yaroslav as piggyback routes have not yet been demanded due to the higher fare for transportation, lack of regular service and outdated transportation technology, that is, domestic rolling stock obsoleteness.

In the midterm Ukraine can expect a certain part of transit loss from China to Belarus, the Baltic States, Eastern Europe, as well as parts of Chinese imports to Ukraine. This, above all, will affect container transportations. However, if the Ukrainian customs works efficiently and quickly serves loads, it may be possible to avoid a 2009-2010 scenario, when part of the containers went to the Baltic, from where was transported to the

territory of Ukraine by the Viking train. The domestic side should intensify efforts to attract cargo base on Mediterranean - Black Sea destinations, and it is here that intermodal transportations are becoming the most urgent.

Regular flights between Ukraine and countries of the world in the first half of 2015 were conducted by 8 domestic airlines into 38 countries and by 33 foreign airlines from 26 world countries. On domestic regular lines, passenger traffic between 8 cities of Ukraine was carried out by 5 Ukrainian Airlines. Cargo and mail transportations were performed by 18 domestic airlines, a large part of these transportations is carriages by chartered flights to other countries within the UN humanitarian and peacekeeping programs framework, as well as according to contracts and agreements with other customers. 79 per cent of the total traffic volume was performed by Antonov ASTC, Airline Maximus Air, UIA, Aircompany ZetAvia, Airline Urga and Aviation Company Ukrainian Helicopters. Commercial flights of domestic and foreign airlines are served by 20 Ukrainian airports.

Against a complex political and economic situation background there has been a steady decline in air transportation demand, which, on the one hand, is due to the purchasing power of the population decline, and, on the other hand, is due to events both directly in civil aviation and in the country as a whole: The Boeing-777 of Malaysian Airlines crash, the Crimea annexation by Russian Federation. Airports of Donetsk and Luhansk do not operate, Crimea airports are outside the actual control

of Ukraine, domestic and foreign airlines are reducing the number of flights on certain routes or even cancel them, the number of flights in the airspace of Ukraine has significantly reduced [218].

A positive factor is that Lviv and Odessa airports have launched an experiment to introduce the principles of the "open skies" regime. On September, 19, 2013 Ukraine received the 1st FAA (Federal Aviation Administration of the USA) category. Based on FAA audit it was found that Ukraine complies with all International Civil Aviation Organization standards (ICAO).

In our view, the domestic water transport potential is not fully implemented. Thus, the TCS of Ukraine marine sector in the Black Sea – Sea of Azov basin includes 13 continental seaports with a throughput capacity of 262 million tons per year.

Figure 4.24. Waterways diagram and TCS infrastructure. Seaports [150]

The most potential and developing are the five ports, they are the Big Odessa ports (Odessa, Yuzhniy, Ilyichevsk), Nikolaev and Mariupol.

The Ukrainian shipbuilding and merchant fleet have been in a crisis for a long time, there is no industry support by the state measures. There are not many ships under the flag of Ukraine. In the period from 1993 to 2015, the total deadweight of Ukrainian merchant fleet has decreased 13 times and now equals to about 477 thousand tones (0.027 per cent of the total world fleet deadweight).

Today mainly foreign shipping companies operate in the market of maritime transportation of goods to and from the ports of Ukraine. These companies' ships annually transport 160-170 million tons of national export-import cargo and receive more than USD 3 billion income. Unfortunately, Ukrainian exporters and importers have no economic incentives to participate in external logistics business [150].

With regard to Crimea annexation Ukraine has lost 5 seaports. It should be noted, however, that the ports of mainland Ukraine in 2014, managed to offset losses and increase turnover, including at the expense of the traffic that previously went through the Peninsula, given that the proportion of the Crimean sea ports in the total cargo turnover in 2013 amounted to just 7.65 per cent.

A negative factor is that significant financial resources are lost through port infrastructure disuse. So, for example, Ukrainian companies sell about 90 million tons of their products and usually implement export contracts

on FOB terms. Signing a contract on FOB terms, the seller (Ukrainian exporter) is obliged to arrange and pay for the delivery of the goods to a Ukrainian port and their loading on the buyer's selected ship. Under these foreign economic contract conditions a foreign buyer pays (freight) for the cargo transportation to its port. The price of this freight, taking into account the country's export-import potential, is about USD 3 billion in one year. The state should combat for this price.

All maritime countries in the world promote conditions for economic dividends from export-import freight to be received by national companies and forwarded to state budgets.

What is necessary for Ukrainian exporters to sell goods at least at the buyer's port under the CIF terms (delivery of goods by sea to the port of destination, its insurance, export and customs clearance, loads on the vessel chosen by the seller and this vessel freight)?

This is possible when state creates relevant promotional terms and conditions for the Ukrainian exporter to sell its goods at the buyer's port. In this case, the revenue from maritime logistics, as part of the goods delivery cost, will be received by the shipping company determined by the Ukrainian seller. In order for the Ukrainian exporter to choose a Ukrainian shipping company, the cost of chartering a ship under the Ukrainian flag should be less than the cost of market freight.

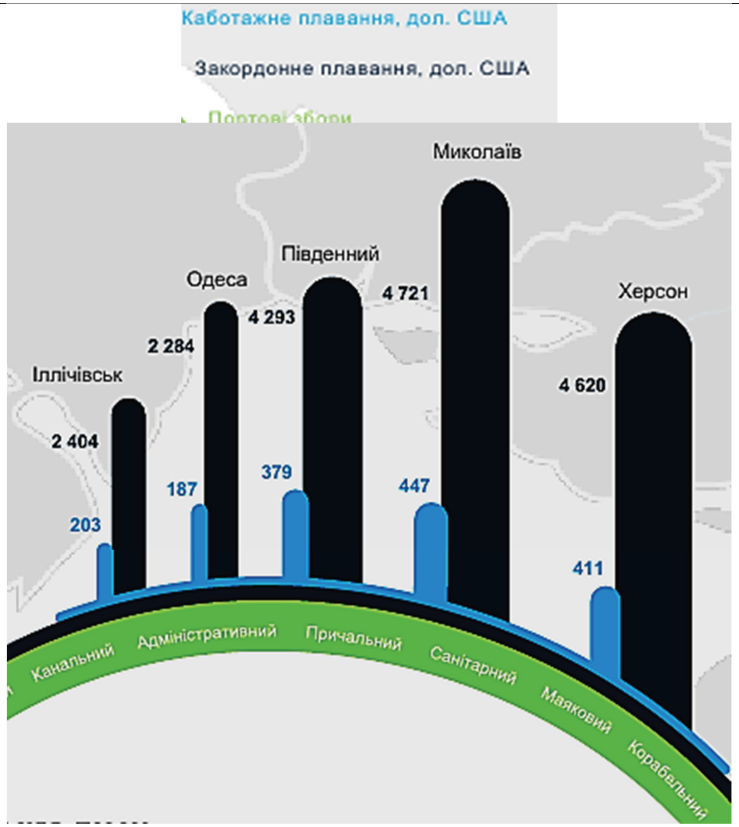


Figure 4.25. Calculation of TCS of Ukraine maritime transport financial capacity of ports infrastructure funded with ports dues levying [150]

This can be achieved by providing the Ukrainian shipowner with fixed freight discounts within 20 per cent, and the discount should be offset by the government tax incentives. Only this way the Ukrainian business can master freight market and revive national merchant fleet.

Also, the high level of competition in the Black Sea region should not be discounted. At the same time, Odessa,

as the most developed seaport of Ukraine, is inferior to the ports of Novorossiysk and Constanta according to the water area depth, the quay line length and free zones availability. A similar situation exists in the ports of Yuzhniy, Ilyichevsk, Nikolaev and other Ukrainian ports with even lower competitiveness indicators.

Program documents on TCS port sector reform development is a positive factor. According to experts, the transfer of Ukrainian ports property into concession will attract at least UAH 1 billion to the state budget. Commercial sea port Yuzhniy is planned to be the first to privatize. However, it should be emphasized that international practice provides for the transfer into concession of those assets, the use of which is not profitable and requires renewal at the expense of investments. In this case, the country possesses the ports infrastructure, which now allows earning considerable profits. As for the Big Odessa ports, in particular Yuzhniy port, in terms of financing package for 2016 nearly UAH 2.5 billion out of UAH 3.5 billion (or more than 70 per cent) is allocated for capital investments in these ports. This situation has led to low power ports (up to 3 million tons per year) level of attractiveness deterioration for foreign investors and national entities which can privatize them, except the Big Odessa ports. We believe that the way out of this situation lies not in profitable large strategically significant seaports of Ukraine concession, but in concession of small, potentially lucrative, but requiring significant investment ports [218].

It should be noted that Ukraine has a unique shipping company, i.e. PJSC Ukrainian Danube Shipping Company, which can become the basis for the Ukrainian Navy restoration. After the "loss" of more than 400 ships this company is still "afloat", but in recent years it has been working on the brink of unprofitability. It now has five marine crafts, three hundred and twenty river crafts (including 75 self-propelled), as well as four passenger crafts designed for 140-150 people. These crafts so far serve goods and passengers transportations along the Danube (from the Delta to the port of Kelheim (Germany) and the North Sea river ports) [150].

This enterprise urgently needs government assistance to support its inland waterway market competitive position and maritime transport further development.

It is also necessary to develop and implement individual rules on the foreign exchange earnings use for the crafts life support (supply of fuel, food, repairs and disbursement bills in foreign ports payments) and tax pressure including VAT relief for the Ukrainian shipping companies that provide Ukrainian export-import cargoes transportation. These tax rates should be at the "white" offshore zones level.

One of the incentives for the fleet development should become a legislation norm to simplify registration rules for ships under the Ukrainian flag.

Only this way, Ukraine as a maritime state, will be able to posses and develop its fleet, increase budgets revenues and preserve many maritime professions.

Without the national fleet, the Ukrainian sea economic complex has turned into a port economy.

Figure 4.26. Calculation of TCS of Ukraine maritime transport financial capacity of ports infrastructure funded with pilot escorts fees [150]

Ukraine has a fairly high navigable rivers capacity. The main navigable waterways are 3 navigable rivers, which are the Dnipro, the Danube and partly the Southern Bug, two of which are in the TOP-5 of the largest rivers in Europe. On the navigable rivers of Ukraine there are 16 river ports and terminals with a throughput capacity of 60 million tons per year.

In many countries of the world river transport plays a tangible role in the sphere of states economic activities, as well as in the daily life of the citizens, because it preserves the environment and provides low cost of freight

transportations in terms of one conventional ton of cargo. At the same time, in terms of energy consumption, it is 5 times more efficient than rail transport and 10 times more efficient than road transport [1].

On all ethnographic lands of Ukraine there is a fairly high navigable capacity of rivers. The length of the river navigable exploited ways amounts to 6.2 thousand km, including canals that make up 200 km. In the Soviet period the length of all rivers with length of 10 km and more in Ukraine amounted to 90.4 thousand km, and navigable waterways amounted to 4.8 thousand km (of which 1000 km artificial).

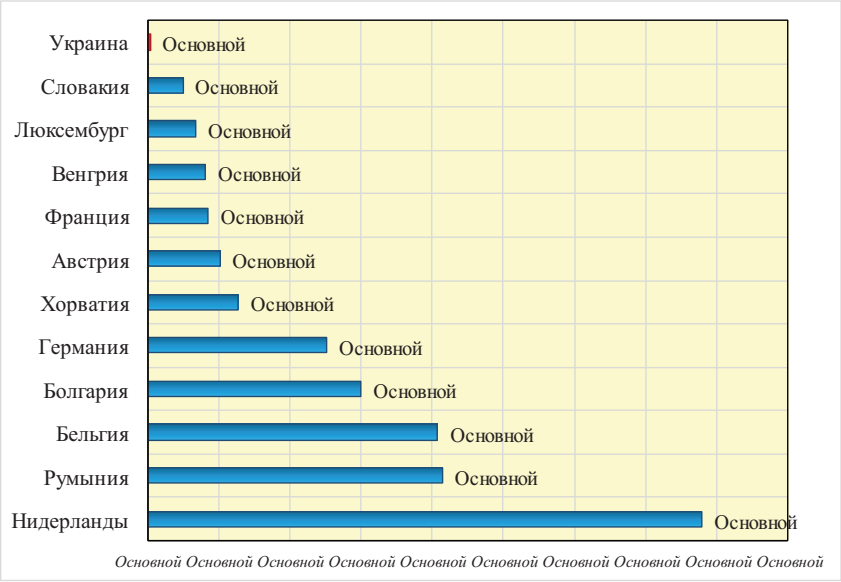


Figure 4.27. Inland waterway transportations share in the context of the EU countries and Ukraine in 2014,% [150]

The navigable routes of the Dnipro is 1,205 thousand km and its streams (the Gums — 520 km and the Pripyat — 60 km), the Danube — 160 km, the Bug — 155 km and other so-called small rivers are traditional to use [2].

Up to 90 per cent of the total volume of river transportations are performed along the Dnipro and its largest tributaries, i.e. the Desna and the Pripyat [3]. The remaining 10 per cent are performed along the Danube and other rivers. Among them: The Desna River (to the North of Chernigiv), the Styr, the Gorin, the Dniester, the Southern Bug, the Seversky Donets, the Ingulec, the Psyol, the Vorskla, the Orel, that are also navigable rivers, but do not play a significant role [4].

Passage height under the bridge in Cherkassy is limited to the 12 m level (11 m during high water). Lowest bridges in Dnepropetrovsk and Kremenchug have a passage height of 8.50 m, but these bridges can be moved apart.

A navigable section, such as the Perov Canal, which shallowing cause problems with the goods from the mouth of the Dnipro to the Danube of the Ukraine territory transportation, is a negative factor that directly affects and causes logistics problems in river transport. Failure of the guaranteed project depths in the Dneprodzerzhinsk-Zaporozhye section can also be noted. This complicates cargoes delivery through the section and causes the cargo owners to either split the cargo in small batches or use ships with less draft.

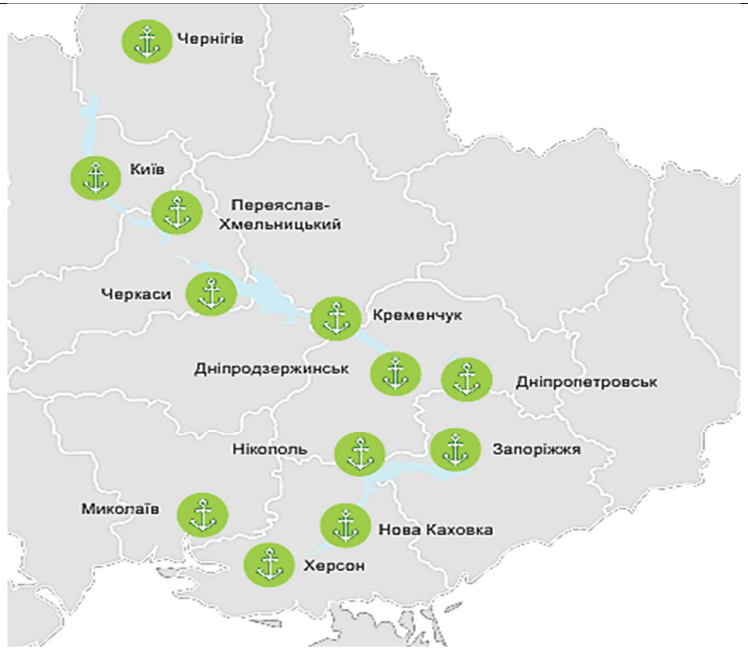


Figure 4.28. TCS waterways and infrastructure diagram.
River ports [150]

Ukrainian rivers inland waterways in terms of guaranteed depths are not in full conformity with navigation safety conditions and requirements. Slightly more than half of the waterways (56.1 per cent) have the guaranteed depth.

From 1990 to the end of 2013, the length of river navigable routes of general use decreased: 1.9 times — with navigation signs; 2.6 times — with guaranteed depth; 3.27 times — with lighting and reflective signs.

In recent years the waterway quality has gradually begun to improve as a result of dredging works at the site of Dneprodzerzhinsk re-rolling on the Dnipro and at the

site from Nikolayev to Voznesensk on the Southern Bug, where the depth reaches only 1.6 m at the necessary minimum 2.9 m, at the expense of the private investor (Nibulon, LLC JV).

Figure 4.29. TCS of Ukraine river communication routes waterway depth diagram [150]

Exclusively through own initiatives and actually performing the state functions Nibulon and other private companies develop waterways and build a fleet to organize export transportations along the rivers Dnipro and the Southern Bug.

As a result, regular water communication with Belarus in the upper reaches of the Dnipro and the Pripyat, water communications along the Desna River are virtually ceased, which is due to the mentioned rivers in this area shallowing.

Due to the gateways unsatisfactory technical condition, as well as their annual funding gap, there is a real threat of a technogenic catastrophe [5]. The actual operational reservoirs lifetime ranges from 27 years (the Dniester) to 67 years (the Dnipro). In terms of the reservoirs useful area utilization level only the Kremenchug and Dniester reservoirs are used, respectively, at 65.9 and 66.7 per cent. And the rest are used only at one third (the Kahovka reservoir — 37.4 per cent, the Kiev reservoir — 32.2 per cent, the Dnipro reservoir — 30 per cent) and less — (the Dniprodzerzhynsk reservoir —12.5 per cent and the Kaniv reservoir —11.5 per cent)[150]. Water facilities development on the Dnipro River immediate reconstruction is required.

Unfortunately, the main negative factors, as noted, are the critical level of financial condition and practically worn-out rolling-stock and material-technical base.

Inland waterways, serving infrastructure and river fleet deterioration is caused by fixed capital disinvestment. The first sharp industry enterprises capital investments reduction occurred in the period of 1998-2000. [46]. If in 1998 investments in fixed capital (in comparable prices) amounted to UAH 14 million, in 2000 their value decreased 2.3 times and amounted to UAH 8 million. The second capital investments more than 2 times reduction happened during the period of 2010 — 1012. So, in 2010, UAH 152.3 million of capital investments (in actual prices) was invested in the industry development.

And in 2012, capital investments amounted to UAH 74.5 million. So, the annual, up to 30 per cent, reduction could not but affect the deterioration of the river transport general condition and traffic density.

River fleet technical condition is constantly deteriorating. A significant proportion of ships are approaching a critical service life. Technically and morally obsolete ships number (with an average lifetime of 21 to 25 years), amounts to 81.9 per cent. In the transport fleet structure the largest proportion of obsolete ships falls on: passenger (97.1 per cent), cargo liquid (89.5 per cent) and dry-cargo (84.4 per cent) ships. In the special-purpose fleet structure the largest proportion of obsolete ships falls on: Raiding and shunting, towing and towing and circuit ships — 90.7 per cent; technical ships — 79.6 per cent and auxiliary and support ships — 77.7 per cent.

Transport ships of river-sea type mostly belong to the well-known shipping companies: Shipping Company Ukrrichflot (JSSC), Ukrainian Danube Shipping Company (PJSC UDP) (with special status of national carrier), KDM Shipping Public Ltd (Cyprus), which is a shipping operator LLC Capital Shipping Company (Kiev) holding company, running freight and passenger transportations in domestic and international communication, which is the main type of their activities, as well as Nibulon LTD JV (agro-industrial group), running transportation by company's own ships in order to perform production and economic activities for agricultural purposes (coastal and international

transportations). In 2012, the company exported more than 10 per cent of Ukrainian grain having performed transportation in the amount of 3.5 million tones [150].

One of the financial receipts reserves from communication infrastructure of TCS of Ukraine water transport functioning is lockage and bridges moving apart charging.

Potentially, the Dnipro shipping companies can serve 10 to 12 million tons of cargo and more traffic volume every year. These are bulk cargo transportations in the amount of 9 million tons (construction, grain, coal, ore), unitized cargo — 1 million tons (metal, timber, fertilizers), containers — up to 100 thousand tons.

However, if we consider the fact that in 1990 river transportations volume accounted to 66 million tons, and in 2012 it was slightly more than 4 million tons, it can be considered that the Dnipro River has largely lost its potential.

For comparison: freight traffic on the rivers Oder Vistula and Rhine is about 450 million tons, and on the Danube — 80 million tones [46].

Based on analytical data about factors and development of all structural elements of transport-communication system systematization significant reserves in domestic TCS presence can be confidently argued, and their activation will minimize external dependencies and lead to positive changes in its self-reliant development. For these purposes active support of the state is of particular relevance and importance.

Figure 4.30. Calculation of TCS of Ukraine water transport infrastructure financial capacity by lockage and bridges moving apart charging [150]

It is necessary to form and implement a complex mechanism to promote transport-communication system of Ukraine self-reliant development.

4.3. A COMPLEX MECHANISM OF STATE INCENTIVES FOR TCS SELF-RELIANT DEVELOPMENT

In Economic Glossary the term "mechanism" is interpreted as "a sequence of states, processes that determine some kind of action or phenomenon," and also

as "a system, a device that determines some kind of activity order" [206].

In this definition, on the one hand, *the functional content of a mechanism is presented*, since any mechanism is a system, and hence, the correlation and interdependence of events and movements, and on the other hand, its *structural content*, as the mechanism is a device that enables movement, relationship and interdependence of phenomena and processes.

Mechanism of state stimulation of TCS self-reliant development is one of its subsystems, a kind of *system to ensure transport-communication system self-reliance.*

The mechanism *has a goal* that is to organize something. Achieving the goal is mechanism's implementation. Therefore, *the essence of the mechanism* is the goal plus achieving the goal (amount of necessary patterns and qualities).

The mechanism of the system is a combination of *sub-mechanisms*, which include both individual pieces of the mechanism and qualitatively special mechanisms in general mechanism that implement their own specific purposes. The internal mechanisms of the system are complemented by the mechanisms of its interaction with the external environment. The mechanism of a specific system goes beyond the scope of this system. Thus, *the mechanism is wider than the system itself*.

As noted in the preceding paragraphs of the chapter transport-communication system, unfortunately, is operating in a far-from-equilibrium conditions, besides

constantly faces the destructive impact of both internal and external factors of varying scale and nature. In this regard, there is a need for the state intervention in construction and implementation of such socio-economic system development model that would ensure economic self-reliance and national security.

Practical forms of state influence by regulatory actions mechanism help subsystems and the system as a whole adapt mutually. It is not just about adapting to external and internal externalities but to mutual functioning in a single transport and economic space adaptation. The overall effect of the Ukrainian TCS functioning directly correlates with the state active participation in addressing priority issues.

Structured and configured in accordance with influence of interests, purposes, means and goals the system represents a holistic block with a regulatory legal form. Such a system reliably establishes typical multilevel functioning models that allow TCS entities interact in the mode of optimal economic (territorial) cooperation.

Economic theory and practices of the countries with market economies have formed a complex and diverse mechanism for state economic policy implementation. It covers the whole system of forms, methods and ways of influencing domestic and foreign manufacturers with a view to creating competitive national complexes and industries. It consists of financial, monetary, customs, price, currency, antimonopoly, institutional, foreign economic policy, etc. This mechanism affects the

implementation of economic policies, both directly and indirectly, by adjusting the market mechanism action.

The role of transport-communication system in the context of state incentives for self-reliant development is determined by the economy as a whole stabilizing strategic importance, which is characterized by its significance in self-reliant and secure existence of the society, in specific weight in GDP, exports structures and volumes of budget revenues to the income of our state.

The strategic tasks of the socio-economic policy of the state are addressed by appropriate structures and bodies of state management and control through institutional and socio-economic support, protectionism and system monitoring. For normal competitive environment exclusively for all system entities it is necessary to develop an appropriate mechanism of state incentives for transport-communication system of Ukraine self-reliant development. This mechanism as a set of methods, instruments and forms of environmental and socio-economic harmonization of TCS economic entities activities, due to the budget, tax, regulatory, pricing, finance, innovation, investment and information systems of the self-reliant development state support is one of the most important and strategically significant components of the policy of further development of Ukraine. Incentive mechanism structural elements should function as a motivational basis key determinant for conducting activities in the field of communications and transportation, which is determined by the economic laws

of the system. It should be based on the conceptual provisions, based on evolutionary changes and adaptation, as well as organizational and methodological aspects, which reveal a counter-development of both TCS entities and state regulatory bodies.

The concept of state incentives for TCS of Ukraine self-reliant development mechanism is proposed below, which is based on strategic management and planning as guidelines for achieving economic self-reliance and national security essence. The following principles and provisions form the basis of this mechanism conceptual component:

1. Periods of global and national socio-economic system or its segments crisis development determine the supremacy of the state in order to encourage the development of key, strategically important activities by providing them with maximum preferences;

2. State incentives for transport-communication system self-reliant development needs the organization, legal and information-analytical management functions strengthening.

The following principles of an effective mechanism for the development by the state stimulation should be classified as basic: consistency and integrity; subsidiarity; flexibility; dynamics; innovation; information; transparency and openness; predictability; verifiability.

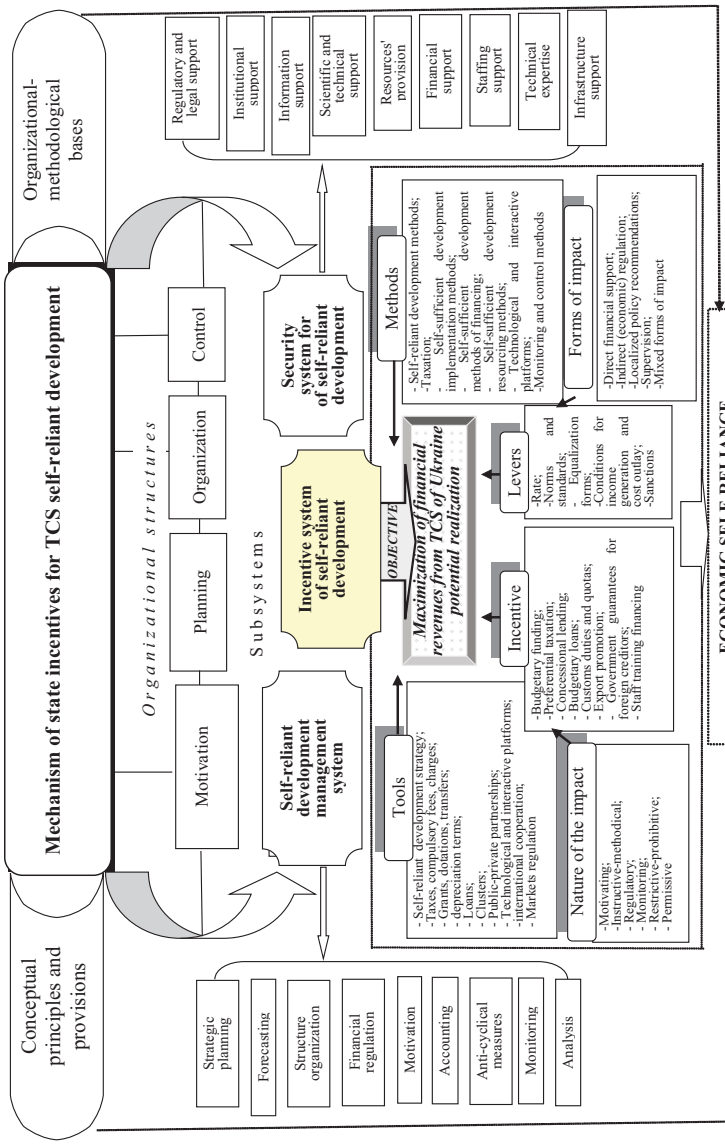


Figure. 4.31. The structure of an integrated mechanism to promote TCS of Ukraine self-reliant development

This mechanism should affect all areas of transport-communication system functioning: financial resources, personnel, logistics, information, as well as innovative-investment resources, etc. In addition to objective economic laws, the mechanism should correspond to certain regularities, such as: constant growth of consumers, as well as limited resources regularity

We emphasize that these regularities determine, first of all, the proposed mechanism social and environmental components importance. Thus, increase of needs reflects social factor as self-reliant development dominant, and the environmental component determines the possibilities for ensuring the needs of the society growth at the expense of limited resources, and also outlines the conditions under which the society exists. Fig. 4.31 presents the structure of state incentives for TCS self-reliant development.

This mechanism implementation should occur through the successive implementation of the following phases (fig. 4.32).

Formed and presented mechanism of state incentives for transport-communication system of Ukraine self-reliant development includes the system of incentives, which determine economic entities motives for competitive activities: system of objectives formation, forms and methods of direct and indirect state incentives, impact tools, contributing to the society's needs for transport into the final product i.e. TCS quality services, maximally satisfying both domestic and foreign consumers, transformation.

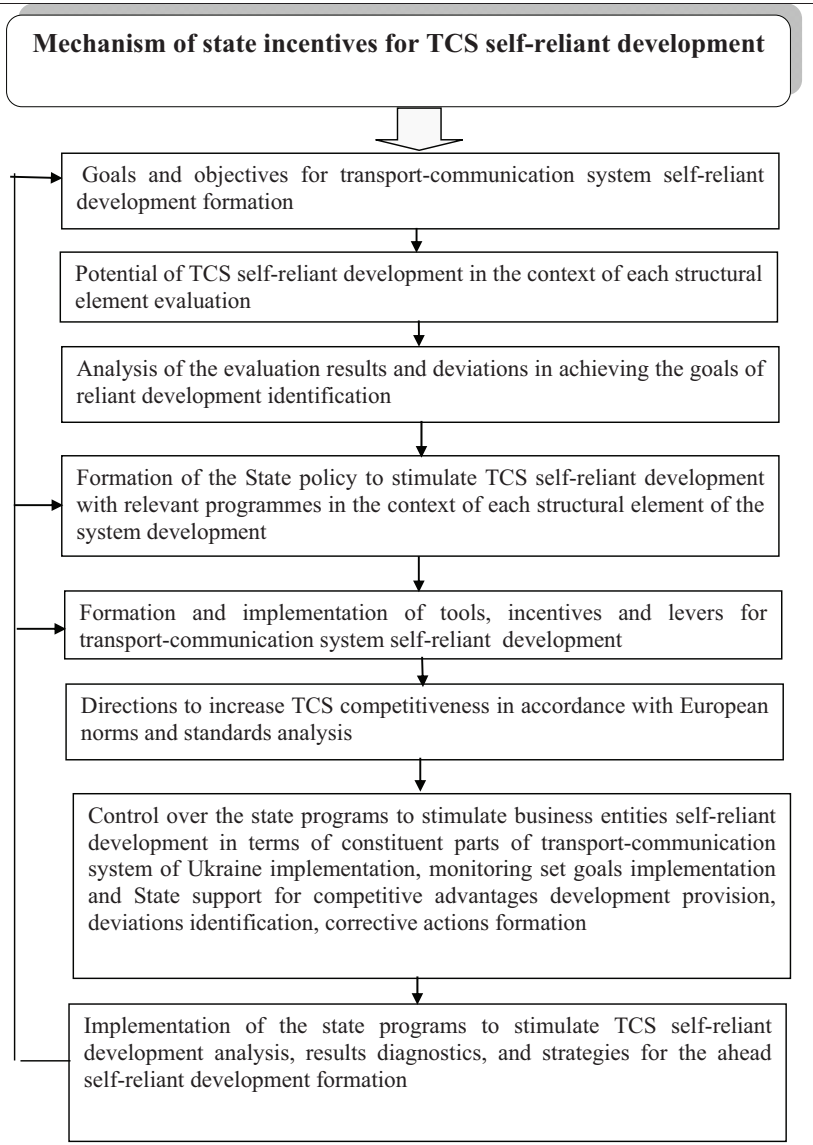


Figure 4.32. Stages of integrated mechanism to promote TCS of Ukraine self-reliant development implementation

** Source: compiled by the author*

This mechanism is a logical description of the state management system for ensuring TCS self-reliant development in the form of certain principles, priorities, methods and levers of influence on factors and conditions that stimulate self-reliance level by all transport-communication system elements achievement.

On this basis, a strategic model of TCS of Ukraine self-reliant development, which is presented in section 5.1 of this work, must possess adaptability and resistance i.e., ability to function in turbulence dynamics, be based on the laws of evolutionary development, include basic principles, methods, levers and instruments based on which TCS entities can be competitive on both domestic and foreign markets.

Thus based on the above, it can be concluded that in modern conditions mechanism of TCS self-reliant development stimulation is a more effective factor in economic self-reliance achieving than the traditional levers of administrative management methods. And, finally, the state has perhaps the biggest package of opportunities and methods to stimulate national socio-economic system self-reliant and safe development.

CHAPTER 5
TRANSPORT SECURITY IN TRANSPORT COMMUNICATION SYSTEM SELF-RELIANT DEVELOPMENT ENFORCEMENT

5.1. TRANSPORT SECURITY AS A FACTOR OF TRANSPORT AND COMMUNICATION SYSTEM OF UKRAINE SELF-RELIANT DEVELOPMENT

The lack of a holistic vision of national security of Ukraine itself is one of the significant threats, as the State cannot effectively protect its interests, because the latter are not exactly verified, if you have to respond to the public interest threats which are not relevant, using inappropriate threats to these tools. It should be noted that value circumstances have increased, especially after the political crisis and military actions on the territory of Ukraine in 2014-2015 [1, 2].

The definition of the state national interests and its foreign-policy efforts activation primarily occur at two levels: global and sub-regional. At the global level the opportunities became very limited after Ukraine had got rid of nuclear weapons and had significantly reduced its military potential, not offsetting these losses by economic achievements. In this regard, it has become the target of influence and pressure from global power structures such

as: the United States, the European Community, as well as Russia. Note that the decline in the quality of Ukraine as a full-fledged, self-contained subject of geopolitical and geo-economic relationship reduces its ability to resist, and vice versa. In addition, the following should be noted: the combination of a different nature internal crisis phenomenon essentially weakens its economic and political self-reliance, and therefore "undermines" the status of national independence against outside influences. Today, unfortunately, Ukraine cannot position itself as a leading state in the sub region, hence its external relations should be primarily aimed at ensuring its own economic interests, which essentially means foreign policy objectives subjection to our state optimum adaptation to the processes of globalization with a view of neutralizing their fatal fluctuations and maximizing their positive impact on the national economy development, as well as economic and military security providing.

All this fully relates to the events of the past two years, namely, Russia unleashed military aggression and its economic war against our country. It should be noted that our country is not a member of international systems of collective defense, and it must rely on its own forces, and ensure national security and defense. We are talking about domestic socio-economic system self-reliance as an opportunity for resilience (resistance) to external and internal threats of different nature.

In a number of publications of the authors of this study focus on the main premise, which is *self-reliance is a*

criterion function of national security. Its intention is that the state will be able to ensure national security, especially in the event that it will mainly rely on its own strength and will be economically self-reliant. Further to this, the authors' assertion of the exceptional role of Ukraine transport-communication system in economic self-reliance and therefore national security ensuring is quite logical and understandable. Transport security serves as an integral structural element of national security [6-10].

Figure 1. Displays logical link between transport-communicative system of Ukraine self-reliance and its national security.

As you can see, the TCS self-reliance is based on effective functional segments: effective TCS entities, effective transport servicing process, efficient transport services market and these services consumers. Therefore, it is necessary to clarify the authors' vision of the concept of efficiency in the process of TCS self-reliance and safe development.

Since today concepts-categorical apparatus definition of "transport security" is virtually non-existent, there is no methodical maintenance of filling it, hierarchical and semantic analysis has not been made, there is a need to offer the authors' position to clarify the distinction between the terms "transport security", "transport safety" and "transportation security".

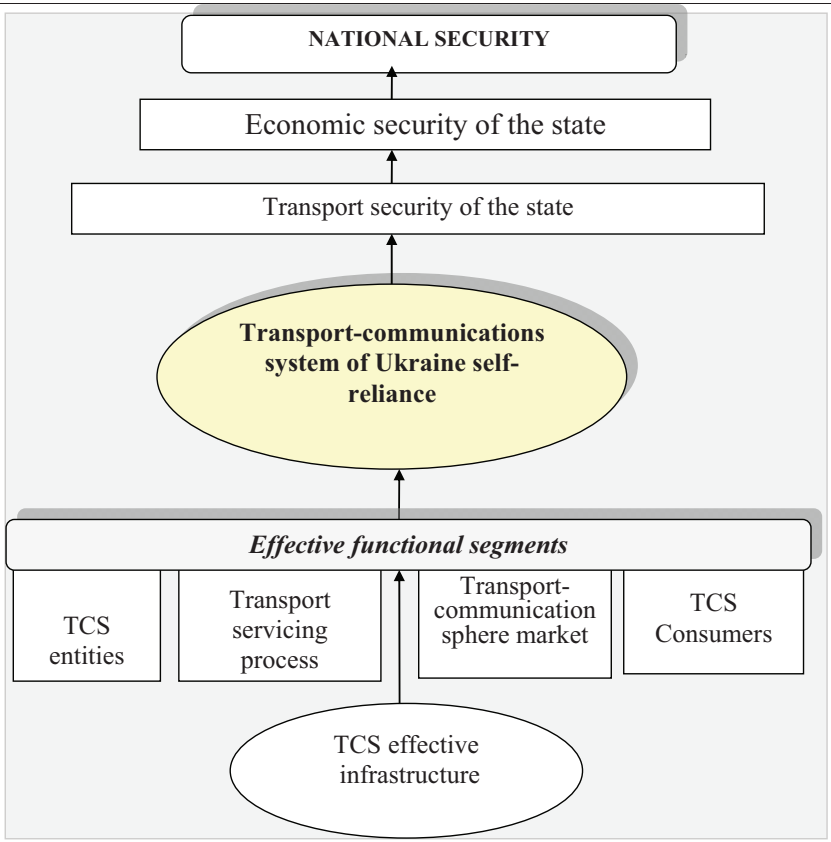


Fig. 5.1. Transport-communications system self-reliance in national security system

** Source: developed by the authors*

So, transport communication system of the country and its regions self-reliance is essentially an economic-managerial category, and its status is determined by the level of economic development of the territory, transport capacity, as well as the efficiency of its use. Transport security is increasingly determined by management component, i.e. the level of organization of the

transportation process, it's internal and external qualitative, technical and technological and other parameters and mutually agreed mechanism of its regulation and regulatory support of this process.

At the same time, "transport security" is a political-economic category. It may be applied in cases of possible threats to economic independence, territorial integrity, political independence and sovereignty.

"Transport security" category has a generalizing meaning and we even can claim it includes a conglomerate of meanings and interpretations depending on the context of use. This substantiates the need for comprehensive interdisciplinary research that concern as well legal regulation of transportation security, and public administration in the context of political and economic interests of the state management, and technical and technological aspects of transport-communication system safe operation.

According to I. Kokorev [3, p.16], sectorial, non-systemic and episodic approach to the issues of transport security should be avoided. In terms of integration of different transport modes into a unified transport system (transport-communication system-authors), as only this can ensure the survival in the modern tough-pragmatic environment, weighted treats grounding and conceptual apparatus of transport security objective understanding may become useful in the formulation of strategies for integration, unification and structuring of the bodies responsible for transport systems management.

In S. Aristov [4] scientific work transport security acts as a comprehensive concept, which includes relatively independent components: organizational and managerial, technical and technological and anti-terrorism. The author believes that ensuring transport security is now issued in a new independent branch of social relations which is regulated by specific set and in which there are special (specially designed -authors) entities with specific special legal status. The scientist considers that the main effects of transport security systems implementation will include obtaining economic benefits, solving foreign policy objectives, strengthening the country's defense capability. In this the views of S. Aristov coincide with the views of the authors of this study [6].

In the context of the problems raised, the point of view of V. Saleev [5], as to transport security as an economic category, is interesting and consistent with our views. The scientist justifies transport security formation in the context of three functional blocks:

1) informational, which is responsible for analyzing information as to possible terrorist acts;

2) preventive – development and introduction of the security regime that meets threats level;

3) response.

The leitmotif of the views of the authors of this thesis research is based on the fact that the national security system office in view of the existence in geoinformational environment continuing potency of destabilization of varying intensity should be based on a synergistic system

unity: and the national security system, and the system of risks and threats, which could not be seen separately from the system itself. I.e. we underline the absolute importance and significance of effective mechanism for ensuring transport security built-in system reactivity and resistance forming, i.e. the system of response to threats and dangers of different types and levels of scale, as well as confront the destructive influence and TCS self-preservation.

Summing up theoretical views of domestic and foreign scientists we can offer authors' interpretation that reveals and fits into the self-reliant development context: transportation security is a man and a citizen, society and the state (TCS service consumers), objects and subjects of transport-communication system vital interests security, which provides self-contained development, timely identification, prevention and neutralization of real and potential threats to the national interests.

Another important aspect of the study of this problem is the "transport safety" concept. It should be noted that the authors' scientific exploration revealed that there is still no unambiguous interpretation of this concept. However, in our opinion, in many cases there is a confusion and substitution of "transport security" and "transport safety" concepts.

In terms of causality, which provides for the establishment of the relationship between the causes and consequences of events and phenomena, the "transport safety" concept correlates and consistent with the concept

of "safe transportation". It can be divided into three components: safe transportation of goods and passengers by ensuring reliability of vehicles, as well as infrastructure and communications, performing all the technological processes related to the work of transport; protection of transportation process at TCS enterprises from provocations and terrorism; environmental protection in connection with the TCS entities operation.

Thus, as has been noted, transport safety is a wide concept which concerns not only to the safety of traffic, but also to the security of all technological processes in the TCS. Consequently, transport safety is directly linked to informational, economic, technical and technological and environmental safety. It aims to protect: population, passengers, owners, recipients and transporters of goods as persons who directly consume or produce the TCS functioning product, suffer or benefit from the TCS functioning, as well as owners of vehicles and persons that charter them.

Transport safety issues in recent years have become more acute since transport is actually has turned into one of the most risky spheres of life, in which people unfortunately are regularly injured and killed.

So, in the scale of development indicators in the field of road transport over the past 30 years on the roads of Ukraine there were more than 1.2 million traffic accidents which have killed about 200 thousand and traumatized more than 1.3 million people . Today's accidents kill annually around 7 thousand and injure 37-40 thousand

people; the accidents occur every 12 minutes; almost every 1.5 hours a person dies. Per calendar day approximately 20 people die and more than 130 people are injured; more than 90 per cent of fatalities are people of working age; almost 13 per cent of people killed in road accidents in Europe are residents of Ukraine. Crimes against traffic safety account for 97 per cent of all crimes against traffic safety and operation of transport and the number of victims far exceeds their number in all modes of transport as a whole [10].

The number of fatalities on 1000 cars in Ukraine exceeds the corresponding figure of Poland in 2.5 times, France in5-6 times; Sweden in 10-11 times; road transport in cities is the source of one-third of all emissions of harmful substances [15].

The overall picture of the road accidents dynamics and their consequences for 2000-2014 is presented in table 5.1.

The data presented in the table gives the opportunity to draw the following conclusions:

-the total number of accidents during the period from 2010 to 2014 has decreased by 25.81 per cent;

-the total number of road accidents victims during 2014 amounted to 36.4 thousand people, the lowest rate in the analyzed period;

- 133,200 traffic accidents that occurred in the settlements were recorded in 2014. While the number is less than the figures from 2010 to 2013, but it also exceeds the value set in 2000 and 2005 at 5.2 and 4 times, respectively.

Table 5.1

Traffic accidents on the roads and streets of Ukraine characteristics, 2000-2014

	Years						
	2000	2005	2010	2011	2012	2013	2014
Road traffic accidents, total, thousand.	…	…	204.2	186.2	196.4	191.0	151.5
including: - with victims	33.3	46.5	31.9	31.3	30.7	30.7	25.8
from them: -fatal	4.7	6.4	4.2	4.3	4.5	4.3	…
The number of victims, thousand people	41.8	63.2	43.9	43.1	42.6	42.4	36.4
from them: - fatal;	5.2	7.2	4.9	4.9	5.1	4.8	4.4
-injured	36.6	56.0	39.0	38.2	37.5	37.5	32.0
Road accidents that occurred in the settlements, thousand	25.3	33.1	148.7	137.7	147.1	142.4	133.2
from them: - fatal, thousand pers.;	3.0	3.6	2.2	2.2	2.1	2.3	…
-injured, thousand pers.	27.3	38.3	26.7	25.9	25.3	25.7	...

** Source: State Statistics Service of Ukraine*

The number of fatalities on the roads is comparable with the number of victims in Donbas region. As we have informed, according to the UN, at the beginning of the year, 4808 people died in conflict in the Donbas region. This number includes deceased Ukrainian military, 298 victims of Malaysian aircraft plane crash, civilians and militants. 2014 was the worst for the number of car crashes victims, over the past eight years.

As you can see, the figures in the table show that for the period from 2006 to 2014, 5 crashes with the total number of 536 fatalities occurred over Ukrainian sky. According to the experts as a result of terrorist operations over the past 2014 3 large-scale catastrophes, which killed 361 persons or 67.35% of the total for the entire sampling

period were recorded in Ukraine. The number of major accidents involving aircraft with the capacity of more than 14 passengers over the last 8 years was 3 catastrophes (2006 and 2014).

Table 5.2

Causes and consequences of aircraft accidents in Ukraine characteristic 2006-2014

Year	Place of accident	Plane	Country of a plane owner	The cause of the accident	The number of victims
2006	Ukraine	TU-154 M	Russia	Loss of control, fell into the downward spiral	170
2013	Ukraine	Antonov -24	Ukraine	Split apart when landing	5
2014	Ukraine	MI-8	Ukraine	Shot down near Slavyansk by terrorists. The helicopter was carrying military for rotation	14
2014	Ukraine	Ilyushin Il-76	Ukraine	Military transport aircraft with Ukrainian military was shot down by terrorists with MANPADS above Lugansk airport	49
2014	Ukraine	Boeing-777	Malaysia	Shot down by terrorists' rocket "ground-to-air" at an altitude of 10 thousand km in the Donetsk region with SAM "Buk - M1".	298
				TOTAL IN UKRAINE	**536**

** Source: compiled by the authors based on data from http://forinsurer.com/public/14/07/07/3824/*

It is believed that the aviation ranks first for security. So, according to the Ministry of transport of the United States, the risk of dying during a flight on an airliner is 1 to 52.6 million. To compare, the risk of death in a road

accident is 1 to 7.6 million. That is, driving a car is 7 times more dangerous than flying.

With regard to the second on the magnitude mode of TCS rail transport development, the disaster of deemed accidents with severe consequences, which led to the collision of passengers or freight trains on the lines and stations, resulting in one or more dead and six or more persons injured and/or damaged rolling stock of railway transport to the extent evicting it from inventory in volume from three units [11]. As you can see, the notion of train crash is inextricably linked with devastating consequences for rail infrastructure, environment, objects of human settlements, as well as economic and health losses.

Analysis of reasons of sanitary and irretrievable losses of most major train disasters that have taken place in Ukraine for the period from 1986 to 2014 is presented in table 3.

Analysis of table 5.3 suggests that over the last decade catastrophes on railway transport in Ukraine occurred quite regularly. Most of them 5 of 7 (71 per cent) occurred at railway crossings (Dnipropetrovsk region 1997, 2010, Odessa region 2004, 2005; Sumy 2014). As a result of these catastrophes 101 (70.1 per cent) people died and 43 (14.6 per cent) were injured.

The largest number of victims (51.5 per cent) 152 persons was fixed on station-to-station block Ozhidov – Red Lviv railroad crash. As a consequence of the convergence of the rails tanks with yellow phosphorus

were damaged, which, flamed, led to mass poisoning of people.

Table 5.3

Sanitary and irretrievable losses in railway accidents in 1986-2014 in Ukraine reasons characteristic

No	The scene of the accident	Date	The cause of the accident	Consequences	
				The number of injured, pers.	The number of fatalities, pers.
1.	St. Kostogryzovka, Odesskaya railway	6.11.1986.	Two passenger trains collision	100	43
2.	Station-to-station block Samarovka-Pavlograd, Pridneprovskaya railway	7.11.1997.	Train with truck collision	2	16
3.	Crossing over Tashbunar, Odesskaya railway	16.05.2004.	Freight train with regular bus collision	20	15
4.	Crossing near Novoveselovka, Odesskaya railway	02.06.2005.	Freight train with regular bus collision	9	13
5.	Station-to-station block Ozhidov-Red, Lviv railway	16.07.2007.	Freight train toe rails	152	-
6.	Marganets, Pridneprovskaya railway	12.10.2010.	Passenger train with fixed-run taxi collision	7	45
7.	g. Sumy, Southern railway	04.02.2014.	Suburban train with fixed-run taxi collision	5	12
			TOTAL IN UKRAINE	**295**	**144**

** Source: compiled by the authors based on data from [11]*

The crash at Kostogryzovka station of Odessa railway as a result of two passenger trains collision 100 people (33.9 per cent) were affected, 43 of the passengers killed (29.9 per cent).

Table 5.4

Sanitary and irretrievable losses in disasters of railway transport of Ukraine for 1986-2014 comparative characteristics

	Proportion of affected persons,%	Proportion of dead persons,%
Accidents at railway crossings	14.6	70.1
Catastrophes due to rolling-stock trains collisions	33.9	29.9
Accidents due to the train composition convergence toe rails	51.5	-
Accidents due to terrorist attacks	0	0
Accidents due to substances explosions	0	0
TOTAL,%	**100**	**100**

Analytical evaluation of performance data analysis of accidents is to be concluded at water transport of Ukraine, which took place in the Black sea during 2010-2014 (table 5.5).

As you can see, small boats are the most dangerous on the water. This category includes boats with a hull up to 24 meters and sailing boats with chassis from 2.5 up to 24 meters with a gross tonnage of less than 80 units (except for boats carrying more than 12 passengers, or boats carrying dangerous goods, tugs, pushers, icebreakers, ferries, ships, auxiliary and technical fleet). This includes as well water motorcycles (scooters).

Over the past four years, 100 crashes that have killed 89 people and injured 43 people have occurred involving small boats. Most accidents were recorded in 2010 (31 fatalities) and 2013 (25 fatalities). For comparison, in maritime transport in the Azov and Black seas for specified period 159 crashes, killing 6 people were fixed. Due to the low economic and other activity on the river transport the smallest number of accidents for the period was fixed: 23 with 2 fatalities.

Table 5. 5

Accidents and their effects on water transport of Ukraine for 2010-2014 characteristics

	2010			2011			2012			2013			2014		
	Number of accidents	Number of fatalities, pers.	Number of injured, pers.	Number of accidents	Number of fatalities, pers.	Number of injured, pers.	Number of accidents	Number of fatalities, pers.	Number of injured, pers.	Number of accidents	Number of fatalities, pers.	Number of injured, pers.	Number of accidents	Number of fatalities, pers.	Number of injured, pers.
On maritime transport	66	0	0	51	4	0	24	2	2	14	0	0	4	0	0
On river transport	4	0	0	2	0	0	6	0	0	7	0	0	4	2	0
On small boats	31	26	13	19	7	16	20	20	9	20	25	2	10	11	3
TOTAL	**101**	**26**	**13**	**72**	**11**	**16**	**50**	**22**	**11**	**41**	**25**	**2**	**18**	**13**	**3**

** Source: compiled by the authors based on data from Ministry of Infrastructure http://mtu.gov.ua/*

It should be noted that this table does not contain information on water transport accidents of Ukraine, which have led to ecological disasters. For example, the list of the five largest and high-profile accidents in the Black Sea [12] includes ecological disasters near Odessa. In early March, 2013 at the coast of Odessa region (near the mouth of the Starostambul at a distance of 5 km from the Black Sea zero kilometer) Moldovan ship Nikolay Bauman sank. The cause of the accident was a leak, which could not be eliminated. As a result, the oil spilled on an area of over 840000 square meters in the Sea, which threatened the region's environmental disaster. The ship was carrying gypsum cargo and equipment from Turkey to the port of Kherson. In the engine room the ship was carrying 3.3 tons of petrol, oil and lubricants and 3 tons of gypsum. There were no injuries –11 crew members (10 Ukrainians and one Russian) were saved.

On the State Environmental Inspectorate of Ukraine evaluation the amount of damage to the ecology of the Black sea amounted to $ 1.9 million The claim has been exposed to the ship-owner – Moldavian company Daubing Shipping LTD, as well as to the ship's operator – SAF management company.

The above accidents and catastrophes analysis of all modes of TCS transport in Ukraine allows us to conclude that in spite of the complex species composition, *security system of any type of TCS transport should ensure the three main types of security*:

1) *safety* – safety of goods, vehicles and provide security for passengers and carriers i.e. safety during transportation;

2) p*rotection* – transport economic space safety from external risks exposures and threats due to emergency, natural disasters, acts of terrorism, etc.;

3) *defense* – protection of the society from negative factors of TCS functioning such as from loss of life and health of the population as passive participants of transport process as a result of TCS anthropogenic and techno genic influence.

As a result, transport security in TCS parametric characteristics vary greatly in terms of each mode of transport (table 5.6).

Thus, we can determine the *subject of transport security as a study and analysis of TCS protective properties and mechanisms to confront the threats and dangers of socio-economic system functioning.*

Meeting the challenges of ensuring TCS transport security is only possible with the establishment of a coherent system which includes the totality of legislative acts and created on their basis structures and mechanisms of cooperation for the protection of the interests of all its entities.

In such a case, the explanations of the concept of "transport safety" can be submitted both in broad and narrow forms.

In general terms, *transport safety is the absence of unacceptable risks associated with safety of vehicles,*

cargoes and passengers, technical and economic performance and society security.

Table 5.6

Security settings of transport-communication system of Ukraine main modes

Types of transport	*Safety* Safety of vehicles, cargoes and passengers	*Protection* Security of technical and economic performance from influence of external dangers and threats	*Defence* Protecting society from TCS anthropogenic and technogenic influence
TCS of Ukraine	**relatively high**	**average**	**average**
including: -road transport	relatively high	low	low
-railway transport	relatively high	high	average
-maritime and river transport	relatively high	average	relatively high
-air transport	high	relatively high	high
-pipeline transport	relatively high	average	relatively high

* *Source: compiled by the authors*

In narrow understanding *transport safety is a complex process of TCS uninterrupted activities, which is required for effective and safe operation of its links, as well as the prevention, elimination and homogenization arising during its risks and threats development.*

Characterization of the mechanism as a combination of constituent elements in a state of dynamic interaction,

which is carried out in certain forms and allows the collection of elements to allocate in a relatively independent system seems quite reasonable.

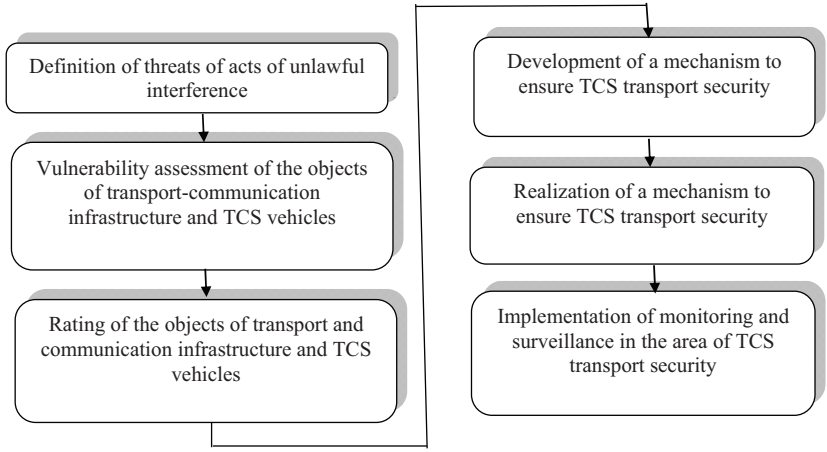


Fig. 5.2. Transportation security enforcement mechanism algorithm to ensure TCS security through identification and elimination of dangers and threats

** Source: compiled by the authors*

So, summarizing all of the above we can conclude as follows. *Objectively determined and subjectively realized totality of power, management and coordination of conditions and measures used, methods of action on definition and organization (involvement) of necessary and sufficient forces and resources, integration of various elements of transport-communication system for transport security, prevention, liquidation and leveling of the dangers and threats of self-reliant development should be understood under the mechanism for transport safety ensuring.*

In the most general form of the mechanism for ensuring transport safety the algorithm (fig. 5.2) looks like this: institutional entities of TCS transportation security system of Ukraine based on national interests, determine this mechanism objectives, necessary ways, means, forms and methods of work of the functional entities and organize their interaction, control and correction.

Thus, all the foregoing in this study proves that self-reliance is a national security function. The authors have justified and proven structural difference between "transportation security" and "transport safety" concepts as well as defined transport security system specific structure. In addition, the vision of TCS self-reliance mechanism to ensure transport security has been proposed [277].

5.2. INFORMATION SECURITY AS THE BASIS FOR NATIONAL TRANSPORT SECURITY: ITS ESSENCE AND ORGANIZATIONAL SUPPORT

The Ukrainian state has been in the course of information society developing for almost twenty-five years. And, as known, a number of different problems arise during any construction. Currently we will highlight one of the most relevant, which underpins an individual state development. It is a problem of information security as part of Ukraine's transport security ensuring.

Information security problem is of ancient origin and has become particularly significant in our time when the use of information and telecommunication technologies is

already happening in practically all spheres of society. Information security issues consideration is given great attention by both domestic and foreign researchers. Among foreign scientists G. Kissinndzher, K. Kokorev, S. Brzezinski, L. Braun, C. Flavin, H. French, T.Zakopaemaya have made a significant contribution to these issues consideration. Among domestic researchers we would like to mention works of such authors as A. Sosnin, V. Grubov, V. Domaryov, V. Lipkan, N. Krylova, V. Kosevtcova, I. Binko, V. Muntiyan, G. Pocheptcova, A. Litvinenko and many others [246].

In today's world, information is the most valuable global resource. In his work, K.A. Kokunov notes: "Information, forming a single global information space, creating global society network, on the one hand, opens for the citizens of the countries covered access to all material and spiritual goods, multiplies their intellectual resources, and hence all other resources, contributing to sustainable development, well-being and a person and society security. On the other hand, information technology is not an absolute benefit: they provide opportunities for mass consciousness control and manipulation in domestic politics and new effective means of inter-state rivalries, and, respectively, new threats to national security" [93, p.3].

Society economic potential is mainly determined by information resources level and information infrastructure development level. Information is constantly becoming more complex, qualitatively

changing, and its sources and consumers number is increasing. At the same time modern information society vulnerability against unreliable (and sometimes hazardous and harmful) information, its late receipt, industrial espionage, computer crime, etc. is increasing. The Ukrainian Constitution therefore relates information security to the essential function of the state.

An integral part of national security is transport-communication system in the country and its regions stable functioning. The current state of Ukrainian society is characterized by its role increase. As a backbone factor, this sphere has an active influence on economic, foreign, military, environmental, energy and other components of the national security of Ukraine. Information security provision directly affects both transport security and safety and general national security. It should be noted that, in accordance with the level of scientific and technological progress increasing, this dependence is increasing.

In view of society's informatization processes dynamic nature, we consider information and communication technologies in all spheres of socio-economic system diffusion, including national security areas, addressing system-wide nature, related to the lack of scientific basis and practical testing policies and methodologies of TCS state information security system, to be important. By nature transport-communication system information security is a set of legal and regulatory, scientific,

technical, economic, and institutional challenges for the state information sovereignty.

In addition to all the issues mentioned, it is worth adding that difference in approach to "information security" definition by different regulations, as well as by various scientific schools, is not conducive to information security in general and transport-communications system information security in particular phenomenon common view. In this regard, in order to better understand the problem, it is necessary to distinguish between information security, security of information and information protection concepts.

One of the national security system main components is information security, which is an important link of all major components of public policy into a coherent whole. At that it is clear that the role of information security and its place in the system of national security of the country is becoming increasingly significant.

This is due to the following reasons:

-national interests, threats and their protection in all areas of national security, including transport, ensuring are expressed implemented and exercised through information and communications sector;

-a human person and his rights, information and information systems and the rights thereto is not only information security main objects, but also all security objects in all sectors, including transport-communication system of the country and its regions basic elements;

-addressing the challenges national security is linked to and based on information approach as the main research method use;

-national security issue is of highly informative character.

The above-mentioned circumstances, along with objectives of self-reliant state as information society building, increasing role of information, information resources and technology in the twenty-first century, have deduced information security issues to national security and self-reliant development forefront.

Based on domestic and foreign scientists scientific works review we try to present our own vision and understanding of information security as a transport security component.

The term "information security" itself, which is used to indicate security of an individual, society and state as a whole from negative information effects, inherent to the post-Soviet countries scientific schools. Among Western scientific schools understanding of the word (information security) has been disseminated as a protection against unauthorized access to, use and/or modification, as well as disclosure and/or disposal. Note that in domestic scholars' works the term "security of information" is of such importance. Humanitarian aspects, i.e. information space from negative external effects protection, contains "cybersecurity" concept. These differences in definitions are explained by information society in the post-Soviet

countries and Western Europe and North America countries development level.

A study of scientists' works on this issue highlights several approaches to this concept defining: factorial, value-conscious (axiological) and methodological.

V.A. Lipkan [119-122], the Ukrainian specialist in the field of national security, within the methodological approach framework proposes "national security" definition to be divided into three groups, namely: legal and regulatory (based on legal and regulatory instruments which contain certain types of security definition analysis), doctrinal (based on definitions in works of scientists and researchers in this area analysis), encyclopedic (definitions contained in dictionaries, encyclopedias, handbooks, etc. analysis). Extrapolating this approach to the definition of "national security" to "information security" and "transport-communication system information security" we will consider these three groups of definitions.

1. Legal and regulatory group. Analysis of national legislation in the area of information security, informatization and information society building provides a range of definitions related to information concepts. Thus, for example, in the law of Ukraine "On National Security of Ukraine" and the Doctrine on information security of Ukraine, the "information security" notion does not find its operationalization. The only identification that reveals the essence of the definition is the identification contained in the Law of Ukraine "On the Basic Principles

of Information Society Development in Ukraine for 2007-2015": "information security" is a person, society and the state vital interests protection which prevents harm through: incompleteness, delays and unreliability of information used; negative information influence; negative effects of information technologies use; integrity, confidentiality and availability of information unauthorized distribution, use and violation.

A rather similar approach can also be found in the Informational Security Doctrine of the Russian Federation, which defines information security as a condition of national interests in the information sphere protection, defined by balanced interests of individuals, society and the state combination.

The US code of Information Security defines information and information systems from unauthorized access, use, and disclosure, resulting in destruction, alteration or destruction of the system protection.

The fact that the above definition of "information security" in the laws of different countries vary considerably draws attention. This is largely due to different approaches to the certain processes and phenomena designation. Thus, legislation acts of neighboring countries rely on the concept humanitarian aspect, while the United States Federal Law emphasizes technical aspect which, in the regulatory framework of the post-soviet space countries, is contained in the "security of information" term.

2. Doctrinal group. Scientific papers of domestic and Russian researchers' analysis have demonstrated a considerable attention to information security phenomenon. To avoid definitions repetitiveness that can be included in the doctrinal group, a comparative method and method of content analysis as well as criteria of prevalence and popularity in academic circles circulation have been used to select definitions.

Ukrainian researchers N.P. Nizhnik, G.P. Sytnik, V.T. Belous define information security as corresponding security institutions that guarantee data for strategic decision-making constant availability and information resources in the country protection legal status [201]. Russian scientists V.I. Yarochkin and T. A. Shevtsova demonstrate basically close approach: information security is legal, organizational and technical activities in formation and use of information technology, infrastructure and information resources, importance of information security to ensure actors involved in information activities rights.

The broader view of information security is provided by such domestic researchers as O.G. Danilyan, A.P. Dzoban, M.I. Panov, who define information security as an object security against information threats or negative effects related to information and data about a state-owned object non-disclosure. The authors consider information security system to be an instrument for information aggression countering.

By combining humanitarian and technical approaches, national scientist A.V. Litvinenko offers information security to be understood as the three components unity: protection of information ensuring, national information space protection, as well as adequate level of information sufficiency ensuring. It must be emphasized that in this definition the researcher considers information security as a process possessing certain functional characteristics as well as object-oriented and substantive focus.

National scientist B.A. Kormych notes that information security is statutory rules, under which information processes in a state providing constitutional conditions for a human being, society and the state as a whole existence and development, protection. This definition is quite controversial, since reflects only the legal component of the notion, completely bypassing information impact on a person and society as a whole issue.

A new approach to the specified definition understanding demonstrates V.I. Gurkovskaya, according to which national information security is public relations related to an individual and a citizen, society and the state vital interests against real threats in information space protection, which is a prerequisite for the state-forming nation spiritual and material values safeguarding and promotion, its existence, self-preservation and progressive development as a sovereign state, which depends on targeted information policy warranties , security, defence and its national interests protection.

Ukrainian scientist M. Galamba's definition principle is based on threats and their enumerations concept: information security is a state of information protection in which special information operations, acts of external information aggression and tacit use (copying) of information (by means of special technical means), information terrorism and computer-related crimes do not cause significant harm to national interests [246].

3. Encyclopedic group. This group is represented by the first multi-volume encyclopedia in Ukraine, the second volume of which (issued in 1999) presents information security definition. In fact, the Ukrainian Soviet Encyclopedia and other Soviet encyclopedias do not contain interesting definitions of "information security" phenomenon.

In the sources above the definition of "information security" as one of the national security types, an important function of the state is presented. Information security means: state information policy legislative formation; freedom of information and the right of access to information held in the national information space ensuring; support in national information resources development, taking into account advances in science and technology and spiritual and cultural life characteristics; secure information technology establishment and introduction; state secrets protection, as well as restricted access to information, which is object to property right or object only to the state possession, use, or disposal;

Subjecting a comprehensive integrated assessment of the entire range of approaches, it is possible to make some generalizations, namely, that there are three main approaches to this concept definition: humanitarian, technical and mixed. In our view, the most productive is the latter, as the current trends in the world's self-reliance show that it is not possible to limit understanding of the "information security" definition by one aspect.

In the study of information security essence, it is important to understand that it is primarily social rather than purely technical phenomenon. In this regard, the views of a number of scientists on information security should be acknowledged as a combination of technical activities aimed at protecting information, including so-called firewalls, access control systems, anti-virus programmes and other methods, as well as software and technical means. For example, one of the works states that "the protection of information is one of the priority areas of national security policy", but equally states that "legal protection priority objects in the field of information security are human rights and interests of society in the field of information, actually information and information systems, advocating." In this case, the author identifies data protection and information security concepts, at that the interests of the state are excluded from information security protection, which is not consistent with national security, where information security is an integral part [246].

Others, speaking about information security, realize the term narrowly, as a set of hardware and software to ensure data integrity, availability and confidentiality in computer networks [4]. Still others understand the security of information processed in the information-computing system under information security [93]. Certainly, information security, involves special technical means and methods to protect information from unauthorized access, theft, destruction, etc., especially in transport-communication system use, but should not become these concepts identification. Otherwise, the very notion of information security is unnecessarily narrowed, and consequently the information security issue is limited to the use of technical means and methods. Thus, information security is not only protection of information, but also institutional, legal, economic and other measures aimed at achieving society and the state sustainable and self-reliant development.

As noted above, it is the general notion of "security", widely used in Russian language, that is "an individual, society and the state against internal and external threats vital interests protection", and can therefore be divided into two components: - content of information (meaning) security that is inducement of negative effects, specially laid mechanisms of negative impact on human psyche or negative impact on another block of information absence (e.g. information contained in computer program, called virus), information security from external effects (attempts to copy, distribute, modify or destroy the

meaning). The second part of the information security concept will be called information protection.

Thus, *a line of three research categories are being set up: information security, security of information and information protection. At that, each following category is an integral part of the previous one.*

To better understand the problem, we need to define another concept: security threat. *"Security threat" to an individual, society or the state category can be broadly defined as something that ultimately can significantly limit or harm the existing self-reliance level (ability based on independent decisions to achieve goals, on the basis of own fundamental values and functions) of the person, society or the State.* Such definition makes it clear that force, and in particular military force, traditionally regarded as the security policy main instrument, can be used only in a limited and narrowly defined number of cases. And then a different form of activity in different public spheres importance criterion is their ability to ensure that society achieves its specific values and objectives. Certainly, the reasoning given would also be true for other types of security, including transport.

Thus, there are two different perspectives on information security issue: narrower (traditional) that provides only information capacity physical damage prevention (impact on information systems and networks) by using any technical means, and broader, based on the above formulated concept of security threats that does not

focus solely on protection against technical or other destructive effects.

Based on the above, it is possible to offer the following "information security" definition.

Information security is an individual, society and the state protection against information that is harmful or illegal, and hinders the self-development of an individual, society and the state. Information security is also something that ensures information infrastructure self-reliant development and security, including computers and information and telecommunications infrastructure, as well as information they store.

Information security is already acquiring the role of main structure-forming component on which the system of country's national security and transport security in particular is built. Indeed, in information society, channels, networks and systems of information and communication are becoming so to say, both nervous and cardiovascular systems at the same time.

The fact that, to date, a single authority of information security management and national information sovereignty, including TCS of Ukraine, has not been formed should be separately emphasized. A fragmented number of issues in the field of transport-communication system information security are being solved:

- by the Ministry of Infrastructure through a specially created State Service on Transport Security of Ukraine (Ukrtransbezpeka), which is the central body of the Executive power. Its activities are directed and

coordinated by the Cabinet of Ministers of Ukraine through the Minister of Infrastructure, and implement the State policy in the sphere of security in road public transport, city electric, rail, sea and river transport (excluding fisheries fleet vessels maritime security) [153].

- by the Security Service of Ukraine and its anti-terrorism centre. On 20 March 2003, the Verkhovna Rada adopted the Act "On Combating Terrorism" to protect individuals, state and society against terrorism, to identify and eliminate causes and conditions that give rise to it, to define legal and institutional framework for combating this dangerous phenomenon, powers and duties of executives, associations of citizens and organizations, officials and individual citizens in this area, and the manner in which they coordinate their activities, guarantees for citizens legal and social protection in connection with the fight against terrorism [156].

- by the Ministry of Defense of Ukraine and the Information Technology Office established in its structure. The office is designed to implement the Ministry of Defense unified strategy in accordance with the State Policy on information security and informatization principles; organize and coordinate modern information technology in the Ministry's activities implementation; coordinate institutional arrangements for a common information space development and space-based information technology introduction.

- by the National Security and Defense Council of Ukraine. According to the law of Ukraine "On National

Security and Defense Council of Ukraine" the functions of this body are: proposals to the President of Ukraine regarding principles of domestic and foreign policy implementation in national security and defense sphere submission; executive authorities activities in national security and defence area in peacetime coordination and monitoring; executive authorities activities in the area of national security and defence under martial or emergency conditions and in the event of crisis situations threatening the national security of Ukraine coordination and monitoring [156].

In the context of the recent years events related to the Russian Federation cowardly aggression and information war, national information security importance has acquired a new perception. In the context of our study, terrorist acts prevention based on information interception and decryption is particularly important. In particular, as a result of the 3 air transport disasters in 2014, caused by the enemy terrorist attacks, a number of subversive acts perpetrated in the combat zone in the areas of transport-communication system infrastructure, the country's leadership has adopted normative-legislative acts aimed at detecting and preventing such threats.

Thus, the Decree of the President of Ukraine of 1 May 2014 No. 449/2 014 enacted decision of the National Security and Defence Council of Ukraine of 28 April 2014 on measures to improve state policy in the field of

information security of Ukraine formation and implementation [156].

The Decree stipulates that one of the main tasks is to develop a draft strategy for the information space of Ukraine development, which should, inter alia, define objectives, tasks, structure and functioning of the national system for the state information security during the aggression. In addition, the question of information security strategy for Ukraine developing is on the agenda.

At the public demand, on 3 July 2014, the Parliament held a hearing on: “Information Society Development in Ukraine Legal Support" and adopted the recommendations.

In particular, it was noted that:

- Since the independence of Ukraine the information technology industry has evolved virtually without the support of the state whose role has been largely limited to the collection of statistical information, which often did not reflect the actual state of affairs;

- in the context of Ukraine's European integration an issue of studying information society in European Union Member States experience, as well as EU legislation in information legislation of Ukraine implementation is updated;

-in the context of information aggression against Ukraine, effective information policy and information security system issue development is of utmost relevance for Ukraine;

- in the list of priorities for strategic development of Ukraine protection of rights, freedoms and security of the citizens in information sphere, rejection of total information control ideas and innovative industries development should occupy the special place.

To neutralize existing threats to the national security of Ukraine taking into account the recommendations of parliamentary hearings the President of Ukraine on 24 September 2014 enacted the NSDC decision of 28 August 2014 "On Urgent Measures to Protect Ukraine and Strengthen its Defence" by his Decree No. 744/2014 [156].

In particular, the following objectives were set:

-in a month's time, the Cabinet of Ministers together with the Security Service shall work out the issue of a national center for cyber defence and countering cyber threats, as well as a national center for operational and technical management of Ukraine's telecommunications networks to meet the needs of the state's defencive capability in a particular period establishing;

-the Security Service of Ukraine together with the Ministry of Internal Affairs, the Ministry of Defence of Ukraine, the Ministry of Justice, the State Committee for Financial Monitoring shall take immediate measures to identify and suppress channels of terrorist activities political, information and other support.

By the President of Ukraine Decree No 287/2015 of 26 May 2015 the national security strategy of Ukraine was adopted. The main objectives stated therein are:

- threats to state sovereignty minimization;

- human and civil rights and freedoms affirmation.

The strategy outlines the following threats:

1. For information security:
 – information warfare;
 – lack of a coherent communication policy of the state.
2. For cybersecurity and information resources safety:
 – critical infrastructure facilities, state information resources from cyberattacks vulnerability;
 – system of state secrets and types of information protection physical and moral obsoleteness.
3. For critical infrastructure security:
 – fixed assets objects critical depreciation and their physical protection insufficient level;
 – protection against attacks and sabotage insufficient level;
 – critical infrastructure and life support systems ineffective management.

In addition, it identifies security priorities:

1. For information security:
 – asymmetric actions against information aggression;
 – public opinion manipulation and information distortion counteraction;
 – state's information policy coordination;
 – subversive activities of Russia counteraction;
 – training in the field of information security improvement.
2. For cybersecurity and information resources safety:
 – information infrastructure of the state development;

– CERT network establishment and development;
– cyberspace monitoring, cyber threats neutralization;
– security of critical infrastructure facilities and state information resources from cyberattacks ensuring;
– Russian software abandonment;
– state secrets protection, information protection, e-Government, etc. systems reform.

3. For critical infrastructure security:
– critical infrastructure protection improvement;
– critical infrastructure and life support systems protection strengthen;
– cooperation among actors involved in critical infrastructure protection establishment and public-private partnerships in the field of emergency prevention development;
– information exchange, accidents prevention, adequate response and their impact minimization.

This is perhaps the first policy document that outlines national information security of Ukraine in the system of hazards and threats detecting, preventing and counteracting. Information system is seen as the basis for national security mechanism. Fully all the above is also related to national and transportation security as a type of national security ensuring.

In our opinion, information security issue as multi-tiered, consisting of a large number of transport-communication system diverse elements should be a subject to a separate scientific research. We will

concentrate our attention on the general issues of TCS of Ukraine infrastructure entities information security organization, relevant and exclusive for all transport system means.

Information security for TCS infrastructure provision in the last few years has been at the forefront in all processes of vital activity in transport sector of the country economic complex.

Given the limited resources and objective impossibility to provide absolute protection and security for all infrastructural systems many countries implement critical infrastructure concept to focus on the systems, networks and individual sites, destruction or disruption of which would have serious negative consequences for national security. As a rule, energy and transport networks, oil and gas pipelines, ports, high-speed and government communications channels, life-support systems (water and heating) mega-cities, waste management, emergency services to the population and emergency response services, high-tech enterprises and enterprises of the military industrial complex, as well as central authorities are included to critical infrastructure.

Despite the considerable number of regulatory certain categories of vital facilities and, accordingly, their lists; Ukrainian legislation still has not defined "critical infrastructure" term, although it has been applied. Thus, in the updated National Security Strategy [217] among the ways to strengthen energy security "fuel and energy complex critical infrastructure effective protection from

ecological and technogenic influences and malicious action" (paragraph 4.3.4.) is described and one of the ways of information security ensuring is defined as "safeguarding information and telecommunications systems operating in the interests of state administration security, which provide defence and security needs of the state, credit and banking as well as other sectors of the economy and critical infrastructure management systems" (paragraph 4.3.8). An attempt to introduce "critical object of national information infrastructure" term was implemented in the Ukrainian Act of 16 January 2014, No. 721-VII, which vitiated in early February 2014, in the draft Act "On Amendments to Certain Ukrainian Laws on Cybernetic Security of Ukraine Protection Introduction" (registered under No. 11125 on 31 August 2012, withdrawn on 12 December 2012) amendments to Law of Ukraine "On Fundamentals of National Security of Ukraine" were intended, and, in particular, "critical information infrastructure facilities" term introduction [156].

It should be noted that valid and definitive term "critical infrastructure" in the legislation existence does not automatically mean a list of such facilities formation. This is evidenced by the experience of CI facilities definition in the USA, where even in the presence of significant amount of material and organizational resources to discharge such a task, the responsible agency faced the problem of methodology developing, not to mention the need to handle a large number of data on the

facilities (with more than 33,000 facilities-candidates in CI, 3,000 was attributed that belong to 18 life-support sectors) [67].

In the EU, an attempt to identify CI was implemented in 2005 by preparing "Green Book", under the terms of which 11sectors were included in CI [73]. Subsequently, the European Commission's Directive No. 114 of 2008 recognized only two priority sectors that are energy (electric networks and facilities that generate and transmit electric power; oil and petrochemical industry, oil pipelines and storage; gas production industry, gas pipelines, liquefied natural gas terminals) and transportation (road transport rail transport; aviation; river fleet; ocean and marine ports) [67].

Exchange of information on potential threats and their implementation impact, as well as critical infrastructure vulnerability plays a key role in threats to critical infrastructure analysis. Aware of the need to establish a network for this purpose, the European Commission adopted a decision on European Critical Infrastructure Warning Information Network (CIWIN) establishment.

The CIWIN main objective is to create means for coordination and information on critical infrastructure at the European level exchange. CIWIN is characterized by high requirements for information security, as the network processes information that is sensitive to critical infrastructure facilities security. The cost of supporting CIWIN software and hardware functioning is more than EUR 600,000 annually.

Another example of such approach implementation is Trusted Information Sharing Network (TISN), which was established by Australian Government in April, 2003. TISN functions as a forum in which the critical infrastructure owners and operators may exchange information on threats, vulnerabilities and risk mitigation techniques. TISN consists of seven sectoral groups and two expert advisory groups comprising representatives of the government, critical infrastructure owners and operators and local authorities.

An extremely important issue is the ability of a state to allocate sufficient material resources to critical infrastructure protection system maintenance and modernization.

To date, vital installations and systems in Ukraine safety cost planning is not based on the extent of possible accidents at these sites consequences and threats to these facilities analysis. In particular, funding for disaster prevention, response and mitigation activities is planned in the State Target Programme. The reserve fund of the Cabinet of Ministers of Ukraine is also used to finance emergencies costs. Unfortunately, the cost of critical infrastructure security systems developing can be fully on the shoulders of these infrastructure users owing to the state financial resources scarcity.

Legislative framework of Ukraine and foreign countries comprehensive analysis made it possible to identify *the information object, to which action to ensure information and transport security in this study*

framework is directed, as four interrelated components combination: TCS transportation facility (TF_{TCS}), TCS carrier vehicle (CV_{TCS}), cargo and/or passengers.

In order to achieve this goal, it is essential to establish concept and model for information security provision and information processed in TF_{TCS} and CV_{TCS} functioning protection:

For correct security identification as a system-protected state it is necessary to identify possible system vulnerabilities and threats directed at its destabilization. Based on vulnerability assessment, legislation of foreign countries and Ukraine analysis, as well as emergency situations analysis TF_{TCS} following basic security threats can be identified:

– threat of capture;

– danger of explosion;

– threat of explosive devices accommodation or attempted placement;

– threat of dangerous substances defeat;

– threat of TF_{TCS} critical element capturing;

– threat of TF_{TCS} critical element explosion;

– risk of placing or attempting to place explosive devices on TF_{TCS} critical element;

– threat of blocking;

– threat of theft;

– threat of disclosure.

Based on TF_{TCS} Infrastructure Facility Vulnerability Assessment algorithm (Figure 4.4.) it is further necessary to define more detailed characteristics and structure of an

object constituent elements security concepts informatization, which is intended to provide information and transport security within this study framework.

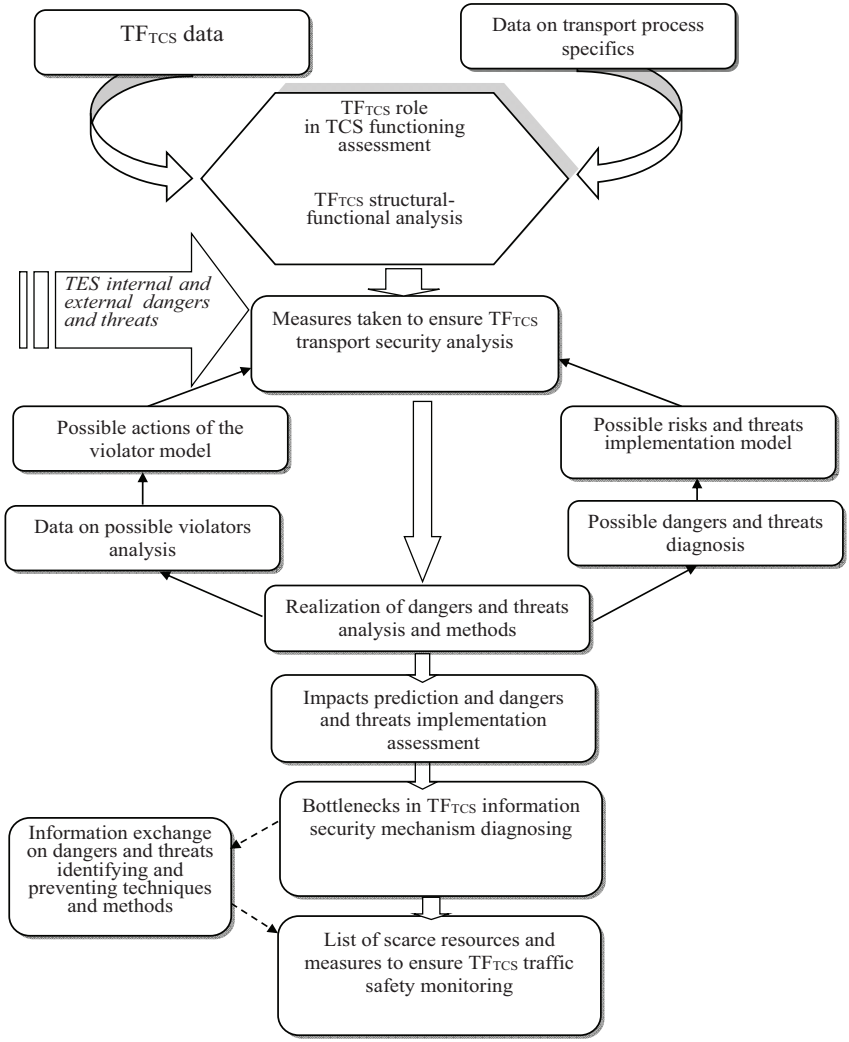


Figure 5.3. TCS Infrastructure Facility Vulnerability Assessment algorithm

** Source: developed by the author*

For example, TF_{TCS} functioning safety is very much dependent on the infrastructure facility nature and its interaction with external environment – transport-economic space.

TF_{TCS} security determined primarily by the object itself territory and adjacent territories, potentially dangerous to implement illegal actions, protection. TCS infrastructure object security in a broad sense is a system of TF_{TCS}, vehicles, passengers and employees comprehensive security measures (including information, author).

In general, TF_{TCS} security depends on three main factors:

-TCS transport unit safety ;

-vehicles safe operation;

-TCS communication channels safety.

TF_{TCS} security other side is information timeliness for management decision-making improvement and consequences of realized dangers and threats, illegal actions, vehicles/machineries, personnel and other sites errors elimination correctness.

Effective TF_{TCS} security is possible with the following activities implementation:

– employees training and attestation on transport and industrial safety courses;

– threats and magnitude of their implementation consequences timely and correct identification;

– possible dangers and threats diagnostics by employees;

– possible risks and threats implementation model studying;

– intruder model drafting;

– TF_{TCS} information security, which includes legal, organizational and program-technical components, development;

– techniques and methods of dangers and threats detection and prevention information exchange, as well as advanced world experience studying;

– sufficient funds allocation and the developed system implementation;

– TF_{TCS} information resources security timely updating;

– conducting regular checks of personnel and equipment for external situations readiness.

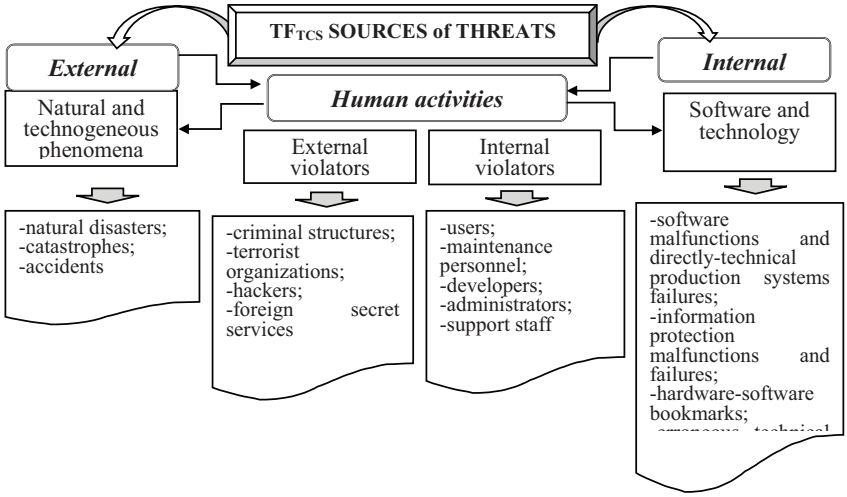


Figure 5.4. TCS infrastructure entities functioning threats classification

** Source: developed by the author*

Figure 5.4 provides specific threats for TF_{TCS} functioning general classification. We should note that, in fact, we have addressed basic types of threats, but the increasing complexity and system development risks and threats, without which it is impossible to examine the responsiveness and consequences of their implementation prevention should also be taken into account.

The specified classification could serve as a basis for a methodology for relevance of one or another threat assessing formulation, and, in the detection of the most relevant threats, measures may be taken to choose methods and means to prevent or neutralize them. In relevant threats identifying, the expert-analytical method identifies protective objects exposed to the threat, specific sources of these threats and vulnerabilities that contribute to the threat.

Threat-taking capabilities classification, that is, attacks, possible threat actions by certain implementation methods combination, exploiting vulnerabilities that result in attack targets.

The purpose of an attack may not coincide with the purpose of threats realization and may be aimed at obtaining an intermediate result required to achieve the further implementation of the threat. In the event that an attack is not matched to the purpose of the threat, the attack itself is considered to be a preparation stage for the actions aimed at the threat realization, that is, "preparing to commit" the wrongful act execution. The result of an

attack is effects that the threat poses and/or contributes to its implementation.

The approach to TF_{TCS} information security status analysis and assessment is based on weighing coefficients for threats and vulnerabilities computation, these coefficients with predetermined criterion and consistent reduction (exclusion) of the complete list of possible sources of threats and vulnerabilities to the minimum for the specific object comparison. These ratios calculating methodological base is ISO-17799:0000 [67].

During the analysis, it is essential to verify that TF_{TCS} most potential sources of threat and vulnerability are identified and mapped to each other, and all identified sources of threats and vulnerabilities are matched to neutralizing and eliminating methods.

Based on the results of the analysis sources of threats and vulnerabilities relationship matrix shall be prepared, which identifies possible consequences of threat implementation (attacks) and calculates the significance (severity) of these attacks as a product of threat factors and threat sources defined earlier.

The results of assessment and analysis can be used in selecting appropriate best practices for threats parry as well as in information security of any other facility in Ukraine's critical infrastructure real state auditing.

5.3. RESISTANCE MECHANISM IN THE TRANSPORT SECURITY SYSTEM ENSURING

Multidirectional geopolitical influence on Ukraine in the context of inefficiency of its security guarantees, unleashed military aggression against it, critical external dependence of national economy require the invention of ways to identify our country as an equal independent partner on the world stage, thus describing the strategy for further development. However, our country is not a member of international systems of collective defense, and it must rely on its own forces, and ensure national security and defense. In this sense, the transport capacity is gaining particular importance, the level of which is determined not only by the efficiency of physically existing resources, but by general aggregate spatio-temporal opportunities of domestic transport system. To date, the transport-communication system is hardly the only sector of national economy, which is capable to become the catalyst for socio-economic growth without significant investment, a tool to achieve self-reliant and safe level of Ukraine's development.

The history of many countries is an example of transport "putting back on its feet" devastated economy, providing a targeted and intensive development of its basic industries. By building car plants, the United States overcame the crisis of the great depression. Thanks to the development of transport, based on new technologies and construction of roads, Germany and Japan restored after World War II. Ukraine has every reason to rely on the

unique geographical location and available transport capacity. Based on these circumstances, there is an urgent need to address the management and economic problems of geostrategic transport possibilities of Ukraine as Transportation and Communication Bridge between the European Union and East Asia, the country's economic and political influence in the processes of integration into the new transcontinental and regional flows and socio-economic activity network realization.

Public request on the need to establish a coherent conceptual model of achieving economic self-reliance and national security by intensifying "growth points" recourse, which can be domestic transport-communication system, actualizes in-depth research.

National security is ensured through a single state policy in all spheres of life, a system of economic measures, political and organizational measures adequate to the threats and dangers of the vital interests of an individual, society and the state. In view of the fact that the national security system (NSS) is a multi-component, logically, there is a need for a special subsystem allocation, the purpose of which would be the system functioning and development ensuring, i.e., in ensuring the viability of its backbone elements, in particular national interests of an individual, society and the state. Such a system is the system of ensuring national security.

We believe that the exclusive concentration of scientific attention on the national security system itself will be superficial without deep study of NSS

destabilization. Destabilization and dysfunction of the national security system reflects the other side of the operation and sustainable development of the State. Therefore, examining processes of socio-economic system threats-resistance is relevant and meaningful in this context.

The leitmotif of the views of the author of this publication is based on the fact that the national security system office in view of the existence in geoinformational environment continuing potency of destabilization of varying intensity should be based on a synergistic system unity: and the national security system, and the system of risks and threats, which could not be seen separately from the system itself. I.e. we underline the absolute importance and significance of effective mechanism for transport security built-in system reactivity ensuring and resistance forming, i.e. the system of response to the threats and dangers of different types and levels of scale, as well as confront the destructive influence and TCS self-preservation.

Summing up theoretical views of domestic and foreign scientists we can offer authentic interpretation that reveals and fits into the self-reliant development context: transportation security is the vital interests of a man and a citizen, society and the state (TCS service consumers), objects and subjects of transport-communication system security, which provides a self-reliant development, timely identification, prevention and neutralization of real and potential threats to the national interests.

The author's scientific research on the interpretation of the essence of resistance system and mechanism in the context of the development of complex systems study has proved that the study of this phenomenon mainly took place in biology and medicine, particularly in immunology. A Soviet scientist, pathophysiologist, M.M. Sirotinin occupies the decisive role in this direction of research studies. His unfinished monograph "Resistance and Reactivity Evolution" (1966), published only after his death, is of important theoretical significance [199, 200]. For a wealth of factual material and credibility of generalizations in the field of the reactivity evolution of different kinds his work can hardly be overestimated. The main tasks of this problem, the scientist identified as follows: "Explore the reactivity, to be able to manage it, to successfully combat diseases, is one of the main tasks of theoretical and practical medicine" [199, s. 5]. The monograph presents the results of the scientist and his disciples' research concerning the different forms and types of resistance and responsiveness in comparative evolutionary direction. It should be noted that the research in this author's plane has not lost relevance today; it is a source of ideas for scientists of modern times.

According to our vision, the phenomenon of resistance is of direct relevance to complex open systems development, in particular in socio-economic system. Scientific exploration of the author found the reference to that term in the works of L.G. Melnik [132]. So, in his work "The Scientific Basis of Self-Organization of Economic

Systems" the scientist identified the following indicators of the system security:

- endurance (ability to retain functional capacity);
- tolerance (ability to perceive different environmental options);
- resistance (ability to resist environmental factors);
- stability (ability to maintain properties unchanged);
- resistance (ability to maintain viability);
- vulnerability (inability to confront various factors);
- elasticity (ability to restore functional features).

At the same time, an in-depth research of this phenomenon in the context of socio-economic systems development, have not yet been carried out.

The term "resistance" is derived from the Latin language and means steadiness, resistance, and ability to resist anything. Concurring with the point of view of M.M. Sirotinin, we believe that precisely because of the high level of reactivity (the ability to quickly respond to the impact of external and internal factors) and resistance (steadiness), the system is capable of ensuring its development safety.

To deepen theoretical and methodological bases of socio-economic system resistance we offer to explore its genesis within the national security system.

Rezistenciogenezis allows us to get closer to the understanding of how in the context of rapid globalization processes, which are simultaneously threats and potency for the further socio-economic system development, in the face of immense geo-information space to achieve a

reasonable balance in providing self-reliant and secure level of development.

According to our vision, rezistenciogenezis is a process of resistance developing scenarios in the interaction of past, present and future states of socio-economic system. In other words, it is resistance experience evolutionary metamorphosis gained by socio-economic systems for its self-defense and survival.

To the extent that, the more the formation of the past is left behind and the total volume of acquired knowledge on safe development ensuring increases, a complex new area of knowledge on national security that is naciobezpekoznavstvo becomes increasingly important.

The term "naciobezpekoznavstvo" has been proposed by V. Lipkan, he proved the need to introduce it as the general theory of the national security term. Actually, the term derives from the combination of the Latin word natho-tribe, the people and from the Ukrainian words safety and znavstvo-science, theory about security. Naciobezpekoznavstvo is the new integrated scientific direction, combining a number of sciences and private theories, which explores the specific theoretical and practical problems of national security in accordance with the individual spheres of life. We are confident in the apparent organic unity and knowledge of resistance socio-economic system embeddedness in general naciobezpekoznavstvo theory.

It should be noted that the current state of the national security system is characterized by practical incapacity

and failure to adequately confront dangers and threats. In particular, we are talking about the NSDCU low functioning efficiency and the discrepancy in all functions of momentary geopolitical realities.

In our vision, the main problems of desingression system of national management system not only in our country, but in many others are:

- inconsistencies in the current system adequately respond and resist to implementing the newest forms of dangers and threats for geo-information society;

- lack of national security studies for the development of the destabilizing factors and manage threats and risks inclusion in the system.

Specified mismatch becomes more perceptible in the political and economic crisis, deficiency of influential state image and lack of adequate methodologies for ensuring safe development realities, which is fatal for Ukraine. Today a conceptual integration with the aim of objective synthesis of the theoretical basis for the establishment of an effective system of national security, ensuring the national interests, foremost of which is economic self-sufficiency, is absolutely essential.

The transparent idea of the author of this publication is that the national security system office in view of the existence in geoinformational environment continuing potency of destabilization of varying intensity should be based on a synergistic system unity: and the national security system, and the system of risks and threats, which could not be seen separately from the system itself.

And, consequently, relevance and importance of rezistenciogenezis research is obvious, owing to a number of factors on theoretical and practical levels.

Theoretically, the following factors can be identified:

- lack of a coherent system of knowledge on national security, which would describe the mechanism of the resistance of the socio-economic system;

- lack of common approaches to the formation of integrated problem creating and problem solving systems and mechanisms in the field of national security;

- lack of management resistance knowledge in the system of national security;

- lack of a common vision and approach to the specialists in the field of macro managers sistemologists in national security training.

On a practical level, it is necessary to focus on the following factors:

- escalation of threats and dangers that have become global in nature and require the invention of adequate mechanisms for confrontation (resistance);

- approaches changing to security management in the context of threats resistance in geo-information space; atypical mutation and hybrid character, an increase in the number and magnitude of such dangers and threats implementations should be considered;

- availability of real threats to national security, particularly to its constitutional order, territorial integrity and state sovereignty that should accelerate the establishment of appropriate research centers, services,

communication and management formulate their rapid response mechanisms for realization of algorithms of destabilization;

- low security policy culture at all hierarchical levels, which makes inspirations to external forces intentions to destabilize national security;

- lack of informational, financial, technical and institutional resources for the establishment of an effective resistance system within the overall system of national security.

Getting started with rezistenciogenezis research we must first get a convincing answer to the question: What comes first in the resistance - a process or a system? Posing this question here is not scholastical, but conceptual in nature, recognizing the fundamental basis for the development of a theoretical concept, namely the logic and sequence of its composition and content.

This is of particular importance because the dilemma is still an unresolved -under the rule of traditional allegations of systematization of the world the fact, as to the first system is not clearly proven. In search of the answer the scientists came to the conclusion that the manifestations of the system start, identified and defined procedurally as the first protosistem formation, in which, in turn, all subsequent processes of its formation, functioning and development can then be performed.

Within this framework, the author's position, the essence of which is that the notion of resistance is generally regarded as directly linked, including

investigation of cause and effect, process and system, should be noted. This is the correlation of the two main forms of resistance that reveals its basis for resistance as a process is primary, and resistance as a system is secondary because it is the result of a process of adaptation (rehabilitation), compensation and protection.

Such logically built conclusion stipulates all further approach to the procedure and system analysis of rezistenciogenezis to build a major theoretical constructs from the standpoint of the process on the system primacy.

Procedure rezistenciogenezis analysis involves clarifying the circumstances of the resistance, its formation and development. All this leads to and updates the search for an answer to what the intrinsic nature of the process of resistance is.

Theoretically, the resistance as a process can be objective and subjective and, therefore, yields to different results. Moreover, the development of civilization, increase in the number of hazards and threats, evolution of their form and nature generates evolutionary changes of the resistance process. First of all, it is reflected in increasing human influence on dangers and threats system from microbial to outer level. It follows that resistance forms and develops dual objectively subjective nature of occurrence, formation and development process to ensure national security.

Security in the socio-economic system is achieved through the conscious and organized human activity. In fact, security activities consist of the following stages:

Prevention of risks; risks containment and neutralization; termination; localization of combat; fix; threats destruction (elimination). From the standpoint of national security as a condition of protection review, it is logical that this condition must be created, evaluated and anticipated. Thus, the essence of national security support is the focused actions of the subjects in identifying, preventing and combating various dangers and threats to socio-economic system. It is these proceedings, which are at the heart of the national security system, which the author described as a rezistestentnost mechanism.

So resistance is the backbone subsystem of national security system, which performs the role of neutralizing threats of desingression and rock fluctuations in the socio-economic system.

In line with this, resistant system SZNB is a system of theoretic-methodological, regulatory, organizational and managerial information analysis, resource (financial, personnel, logistic, transport, military and other) elements and measures aimed at ensuring confrontation and protection of socio-economic system with a view to self-reliant and safe development.

A general description of the occurrence, formation and development of processes and systems for resistance, substantive and consistent observation of rezistenciogenezis is presented in an integrated model in Figure 1. This configuration model opens and positions the content of a resistance evolutionary cycle in the process and the system terms.

Structural-process model of rezistenciogenezis combines both vertical, horizontal and diagonal ties and functionally-distributed dependencies formed in an integrated, holistic and deployed basis.

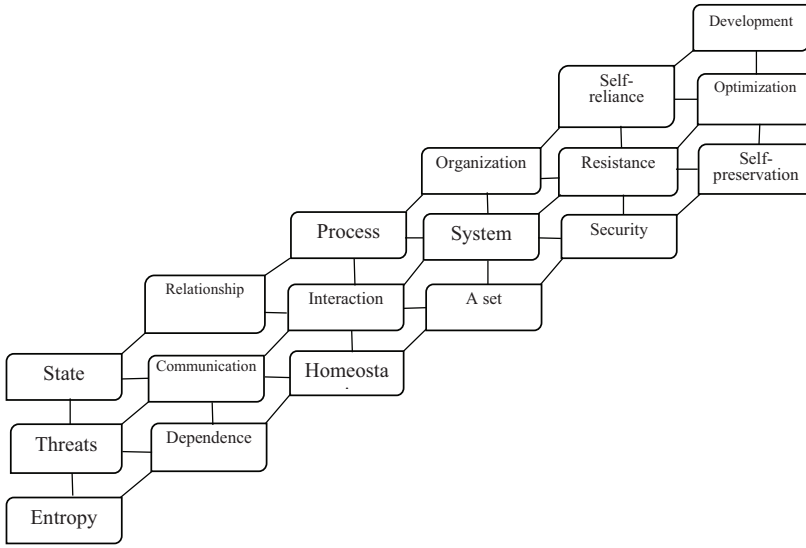


Figure. 5.5. Configuration of rezistenciogenezis integrated structural-process model

** Source: compiled by the author*

Described above allows to select two main approaches to the understanding of the resistance.

The first approach stems from an objective understanding of resistance as an expression of an objective nature desire of the system for self-preservation under a variety of negative impacts. It is in this context that the resistance is understood as a property (attribute) of the system. Appropriately resistance can be considered

as a form of the system self-preservation, which allows it to maintain its integrity.

The result of the identification of resistance with self-preservation is the entropy explanation of resistance and homeostatic explanation of resistance.

Entropy explanation of the resistance is based on the understanding of entropy as a measure of internal disarray in the system. Resistance as a resistivity to the destruction of the system should be seen as a definite dependence of the resistance from orientation, dynamics and processes of entropy scale.

Homeostatic explanation of resistance is based on an understanding of homeostasis as a set of reactions to eliminate or limit the actions of various internal and external factors, violating a relative dynamic stability of the composition and properties of internal environment of the system. Resistance (survival) of the system is understood here as a steady state, resulting from the adaptation (perhaps further mutations) and harmonization. As a rule, the survival of complex open systems is determined by the internal and external environmental balance establishment. In biology, for example, establishing such a balance is achieved through proactive adaptation.

Scientific position of the author is to approve that the resistance due to the effect of systems aspiration for self-preservation to survive and to achieve this, it uses its full potential (resource) is a cross-cutting function of system development. In other words the resistance as a function

of self-preservation is a cross-cutting for all phases of the system life cycle for all structural components at all stages of its reproduction.

The second approach is based on the subjective nature of the phenomenon of resistance. Subjective understanding of resistance is the basis of specific and valuable definitions of resistance.

Comprehension of the resistance nature in its entirety is determined by the withdrawal of unilateralism in the unity of form and content, the unity of the subject and nature of certainty, forming a holistic view of the resistance phenomenon.

The resistance phenomenon can get its conceptual completeness in reflecting it as a specific form of realization of natural existence in human existence that determines a reflective value of human self-determination to the need for self-preservation as genetic properties. This interpretation reflects the duality of natural phenomenon resulting from the resistance being the unity of universality of nature and characteristics of forms of self-preservation manifestations in human activity.

Resistance can be explicated as a protective mechanism for the system. In order to realize its value, you must understand how it manages to keep the system from destruction. Dialectical relationship between self-reliance – resistance - safeties of the system is obvious.

So, the socio-economic system self-reliance is treated as the target function of national security. In favour of self-reliance, it is necessary that from 2/3 to the maximum

possible 1 (or 100 per cent) of functions were implemented in the structure of the system. Therefore, the limits of self-sustaining development or "corridor of self-reliance" are from 2/3 to 1, it can be argued that the socio-economic system will be self-reliant, if 2/3 of its needs would be met through domestic sources (potential).

It is logical that the self-reliance level impacts the level of resistance in direct ratio to the system - by increasing the self-reliance level the level of resistance is relatively increased and and vice versa.

It should be noted that resistance is the attribute property of the socio-economic system, which follows from its openness. Openness is sensitive to both external and internal impulses and, accordingly, provides feedback. Indicators of intensification of reactivity in the system are the violations of the options order as a result of the actions of the governing parameters -a priori threats (prefactum) which have a chance of negative influences and a posteriori threats (postfactum), which have already led to losses and harm due to causing adverse effects. Changing of these parameters leads to the aggravation of the system. Rebalancing of the existing order occurs in this mode. Security management should be based essentially on the reactivity mechanism. In a chain reaction reactivity mechanism “starts" the resistance mechanism, the main modules are: adaptation (reintegration), compensation, and protection (fig. 5.6).

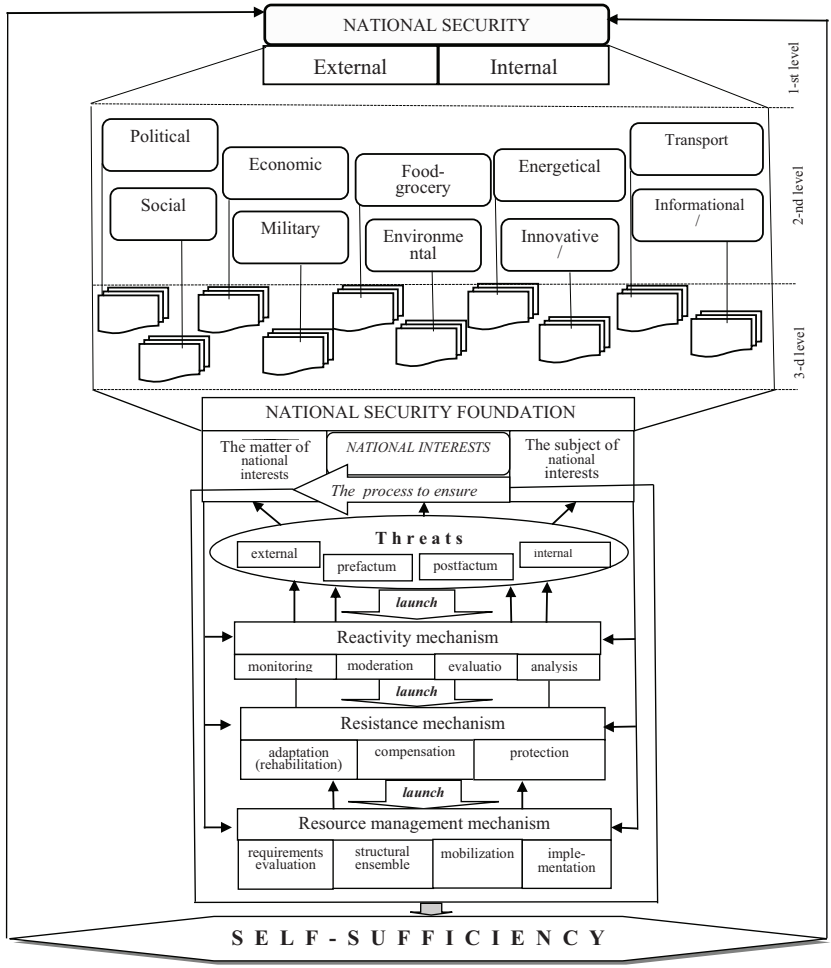


Figure. 5.6. The resistance mechanism in the system of self-sufficient and safe development of the socio-economic system ensuring

** Source: compiled by the author*

It is the resource availability makes it possible for resistant resistance to security threats and its quantitative-qualitative adequacy reflects the socio-

economic system self-reliance ("immunity"). Indeed, the lack of self-reliance or almost total external resource dependency of the system will characterize immunological tolerance - a condition opposite of immunity. This will mean the loss or weakening of the system's ability to respond to threats, there is a lack of immune response. Such a system is open to external aggression.

The result or the product of the resistance is structural and/or functional updates. The resistance mechanism aims to generate the most adapted to the environment of the system structure. This task will involve a balance between internal capabilities of the system and external requirements. In cases where the ravages of posteriori threats currently reflects the process of adaptation to the system disturbances. That is, rehabilitation is a complex of measures aimed at restoring the lost stable state, which contributes to the adaptation of the system to the new conditions, thus demonstrating its resistant plasticity.

We believe that resistant plasticity is the ability of the socio-economic system to structural and functional transformation, with a view to strengthening the protective properties. It is implemented through:

- formation of new combinations of effectors and strategies for the implementation of the tasks;

- sprouting (from sprout-sprout, grow) - forming a multitude of ways and management relationships of equilibrium; the process of recovering lost channels of interaction of structural elements of the system by the emergence of new, more viable and adapted to new conditions;

- unmasking of security threats - the ability to proactively respond to approaching risk by grouping (regrouping), activating of the special operation mode that will quickly navigate in the situation and establish communication with all the structural elements of the system.

The term "plasticity" is derived from the Greek word plasticos, meaning "sculptural". The scientific study of plasticity in mostly engaged in medicine when exploring the nervous tissue capabilities to change structurally functional organization influenced by exogenous and endogenous factors. So, the human body as a single complex functional system is characterized by a relatively dynamic internal stability and the sustainability of major physiological functions. Compensatory processes, as the leading factor of organism's adaptation after injuries that are typical for various organs and tissues, but are most pronounced in the nervous system and are regarded as the plasticity of the nervous system (neuroplasticity).

Analysis of the scientific publications on this subject proves similarity leakage resistance mechanisms in biological and socio-economic systems.

We can approve that almost all of the structural elements of socio-economic systems have some level of resistant plasticity. We believe that the highest potential of resistant structural plasticity belong to the system segments with the highest functionality and multifaceted relationships that contributes to relatively rapid restoration of stable functioning state in cases of

relationship channels damage (destruction) both within the external and internal environment.

Thus, plasticity is a versatile process aimed at system self-preservation in constantly changing internal and external environmental conditions.

In the basis of interaction effects of exogenous and endogenous factors on the socio-economic system development are its high sensitivity (responsiveness) and the ability to change its morphological and functional characteristics as a result of such influence. In this sense resistant plasticity is formed as a result of adaptive responses and presents a range of options changes structural and functional organization of the system by electoral mobilization, collaboration and integration elements resistant structures (structural ensembles, control centers).

Plastic adjustment intended to adapt the socio-economic system to the new functional criteria in response to the factors of destabilization, thus providing the optimization of its operation. It turns out that resistant plasticity is a form of adaptation.

From the point of view of resistant plasticity as system adaptation (rehabilitation) to destructive influences of the environment in order to optimize its functioning the concept acquires a more specific sense. In this sense, resistant plasticity of the socio-economic system is the ability for flexible changes in effective targeting links between structural elements of the system in the regulation of processes of adaptation to the changing threats of the environment to optimize the performance.

Comprehensive analysis of research reports on issues of national security proves two types of security:

1) safety approval as the development and strengthening of the system and support of its nature;

2) security as the fight against specific risks, resulting in a supported system.

As a result, two strategies can be implemented to ensure security:

- approval strategy, security strengthening, based on the system self-reliance;

-protection strategy (negation of avoiding threats and dangers), in which the basis for security is to identify hazards and to counteract them, and system safety approval is the result of preventing the threats and dangers.

Security in the socio-economic system is achieved through the conscious and organized human activity. In fact, security activities consist of some sequential stages: prevention of risks; risks containment and neutralization; termination; localization of combat; clearance; threats destruction (elimination). From the perspective of National security as State security research, this condition must be created, estimated, anticipated.

Thus, the essence of national security support is the focused actions of the subjects in identifying, various dangers and threats to socio-economic system preventing and combating.

It is logical to offer a working hypothesis which involves separation of units in security mechanism to identify and prevent threats, which is resistance and unit

resilience to the system hazards, which manifests itself as the hazards elimination. The first administrative unit is continuing the implementation of arbitration or moderation of information about possible threats to safe development-system reactivity. The second unit is to oppose destructive influence of destabilizing factors-resistance.

The correctness of the assumptions is suggested to be studied on transport-communication system (TCS). So, we believe that, of all the structural segments of the socio-economic system one of the highest levels of reactivity is TCS through the ability to respond quickly to negative stimuli through the well-established system of communications and relationships. Reaction to the significant influence of destructive factors triggers socio-economic system resistance in which the TCS serves as a tool for sustainability and security threats.

Instrumental quality of TCS in the self-preservation of the entire system from the destructive influence of factors of destabilization provides territorial configuration of the supporting network infrastructure, transport system, system of public administration for national security means of transport. The resistance mechanism is driven by management activities of relevant entities.

Resistance management is a deliberate moderation and coordination of resources to eliminate or modify the target of destabilizing factors. Efficiency in the resistance management depends on the rate of absorption of not absolute, but structural and functional resource ensemble in the right place and in a certain amount. Resource

ensemble composition depends on the nature and scope of the threats to security.

Socio-economic system resistance mechanism involves appropriate resource to the system "pain points" deployment and implementation to absorb destructive security threats impact and enhance its self-sufficiency-"immunity".

From what has been said it follows that the security condition as such arises due to the resistance of the system, i.e. a system which provided with "immunity" is able to resist and counteract the aggressive effects and destruction.

Moreover, it is logical to assume the multiplicative nature of resistance activity.

That is, thanks to the high level of resistance, for example, in the transport sector, an increase in resistance of the other paired branches and chain reaction of the entire socio-economic system is ensured. In turn, national security is based on a resistant components platform. The peculiar process of "effect of circles on the water" arises. Moreover, the more and wider becomes the process, the less intense the effect of the system perturbations.

Resistance multiplier in relation to security represents the relationship between the increase in the (reduced) system resistance and change in the security status of the socio-economic system. In an ideal form of self-reliant socio-economic system, that is, that from 2/3 to 1 of all requirements are carried out by domestic resource potential is characterized by high resistance and high capacity to withstand the ravages of external and internal

destabilizing factors, and it shows that all the security conditions and secure development. High level resistance is based on the management, driven by such institutional structure of the system, such relationships between its components that will ensure its invulnerability to eliminate targets actions of destructive factors.

Thus, the resistance in the development of socio-economic system appears as:

1) "genetic property" of the system to survive (to save itself from destruction);

2) socio-economic system development cross-cutting function;

3) socio-economic systems self-reliance indicator;

4) structural elements of the system organization and interaction, ensuring its viability and resistance to the devastating effects form;

5) a mechanism to ensure national security.

Studies have shown, the category of resistance is a multicomponent, multicomposet concept, and therefore it should be considered as the sum of individual components, combination of which forms its overall level.

In summary, it must be recognized that the category "resistance" in the context of socio-economic development is a more complex and diverse phenomenon and has not yet posted the importance of academics and practitioners.

CHAPTER 6
TRANSPORT – COMMUNICATION SYSTEM SELF-RELIANT DEVELOPMENT STRATEGIC MODELING

6.1. MODEL OF TRANSPORT-COMMUNICATION SYSTEM SELF-RELIANT DEVELOPMENT FORMATION

For the purpose of TCS self-reliant development strategic modeling we consider the use of Foresight research methodological tools to be expedient.

Their application main motives are:

– the need to intensify available reserves of transport-communication system self-reliant development utilization;

– changes in its further development strategy motivation;

– the need to create alternative directions for TCS future development;

– the need for more detailed and accurate forecasting of transport sector self-reliant development prospects in collaboration with the entire process of goods and passengers' transportation participants.

It should be noted that the Foresight notion is an innovation for Ukraine, which is evidenced by a limited number of Foresight works in mass media. Today,

Foresight is used in a number of developed countries as an integrated tool to influence formation of the future, allowing taking into account any possible changes in all spheres of socio-economic system.

The author's position is based on the exploratory (or search) approach of Foresight expediency, namely when starting from now the solution of what will happen in the future in the event of the existing trends continuation is being searched. The exploratory Foresight basis is focus on opportunities and trends in the development of situations based on the forecast information development establishment [82].

Foresight Toolkit includes a variety of methods: traditional analysis methods, forecasting and decision-making, as well as creative techniques that are developed in the course of foresight works.

The groups of basic methods (Table 6.1), which are used today in Foresights conducting, reflect its different functions: analytical (current situation analysis), predictive (lines of development processes anticipating, with the aim of crises and losses preventing) and creative (new ideas for the future development).

Note that Foresight is neither their stage nor form or planning; it is a completely different phenomenon [5]. However, if we talk about the similarity, it should be noted that it includes various methods of forecasts developing, which are aimed at initiative forecasts development. With Foresight technological areas of possible effective breakthroughs can be identified.

Table 6.1

Foresight basic methods

Literature Review	Обзор источников
Other methods	Другие методы
Scenarios	Сценирование
Brainstorming	Мозговые штурмы
Expert Panels	Экспертные панели
Futures Workshops	Разработка будущего
Delphi	Метод Дельфи
Key Technologies	Выделение ключевых технологий
SWOT Analysis	СВОТ-анализ
Environmental Scanning	Сканирование источников
Trend Extrapolation	Экстраполяция трендов
Technology Roadmapping	Картирование технологий
Stakeholder Mapping	Картирование стейкхолдеров
Citizens Panels	Общественные панели
Modelling and simulation	Моделирование и симуляции
Backcasting	Обратное сценирование
Essays	Испытания
Gaming	Игры
Cross-Impact Analysis	Анализ взаимных воздействий
Megatrend Analysis	Анализ глобальных трендов
Multi-criteria Analysis	Мультикритериальный анализ
Bibliometical analysis	Библиографический анализ

We fully support the opinion of T.I. Ladykova, I.A. Vasilyeva and E.N. Zawisza [3] and believe that "...Foresight, unlike traditional forecasting, deals with the future to present design: we introduce an image of the future, describe it, and then go back and design a plan of how to achieve this image". In the case of the present study perspective regarding the segments of the socio-economic system (TCS is among them), as well as the system as a whole, self-reliant development achievement, it is

advisable to design a strategy for sustained action to obtain the desired result i.e., self-sufficiency.

Foresight's success as systematic attempts to "look ahead" organization leads to public administration higher culture and eventually more reasonable, scientific-technical and innovation policy formation. Thus the Foresight's projects effect is multifaceted and multilayered [82].

From the totality of Foresight's methods we use the following: literature review, environmental scanning, bibliometical analysis, expert panels, cross-impact analysis, multi-criteria analysis, futures workshops and modelling. These methods combination was selected by statistical and expert information availability criterion, as well as the Foresight research objectives implementation tangibility. Below are the results of the forecasting model of transport-communication system of Ukraine economic self-reliance Foresight study.

As already mentioned in the works of the author [240] domestic TCS, in comparison with other structural components of the country's economic complex, has unique specific properties and features which can serve as the main vector of self-reliant and safe level of the socio-economic system development strategy. In the face of political and economic instability, as well as its own financial resources to restore development while safeguarding national security deficit, transit and external economic cooperation in transport sphere will receive foreign exchange earnings through the existing capacity utilization.

The economic result of transport-communication system functioning is affected both positively and negatively by a great number of factors. Our objective is to study the dominant factors in gross income (GI) from transport-communication system of Ukraine functioning receipt with a view to develop its self-reliance predictive model.

To achieve this objective it is necessary to select the most significant factors to determine each of them influence degree on the gross income from TCS functioning amount. In the work we have used the Expert Panels method, based on data from a statistical information array that is of transport enterprises on the prospects for their business development expectations survey [242]. This allowed causal analysis of gross income factors in transport-communication system.

Thus, TCS functioning gross income is equal to the sum of aggregate GDP_{TCS} in market prices and net income from foreign economic activity operations.

$$GI_{TCS} = GDP_{TCS} \pm BI_{TCS}, \qquad (6.1)$$

where BI_{TCS} is balance of income from economic activity in transportation sphere, received from abroad and abroad (the difference between TCS services export and import).

Based on financial information statistical data [46] we have identified and analyzed a combination of factors regarding the cause-effect relationships of each of them identification and of the effective indicator i.e., the gross income from transport-communication system

functioning. As a result, a group of factors of the first and second order is selected (fig. 6.1).

The first-order factors directly affect the size of GI $_{tcs}$ money supply i.e. are dominant, while the second-order factors influence an outcome indicator indirectly or inconsequentially i.e. are indirect or latent. In general case, the presence of cause-effect relationships means that the presence of changes alters the probabilistic characteristics of consequences i.e., in our case GI $_{TCS}$.

It should be noted that in practice, one casual, correlative or descriptive method is rarely used in constructing a model. The most commonly various combinations of the three methods suggested above are used. It is the complex approach that allows us to estimate the model from different angles and identify its different characteristics. In our study, we will adhere to the same principle.

Consequently, the developed econometric model should include the first-order factors, that is, those that directly and most significantly affect transport-communication system gross income: cargo transportation, million tons; cargo turnover, billion t / km; passenger turnover, billion Paz. km; communication lines length, thousand km; number of transport system enterprises, thousand units; transit traffic volume , thousand tons; export volume, million USD; import volume, million USD;. Budget expenditures on transport sector, million UAH; domestic investment in transport sector, million UAH; foreign direct investment, million USD.

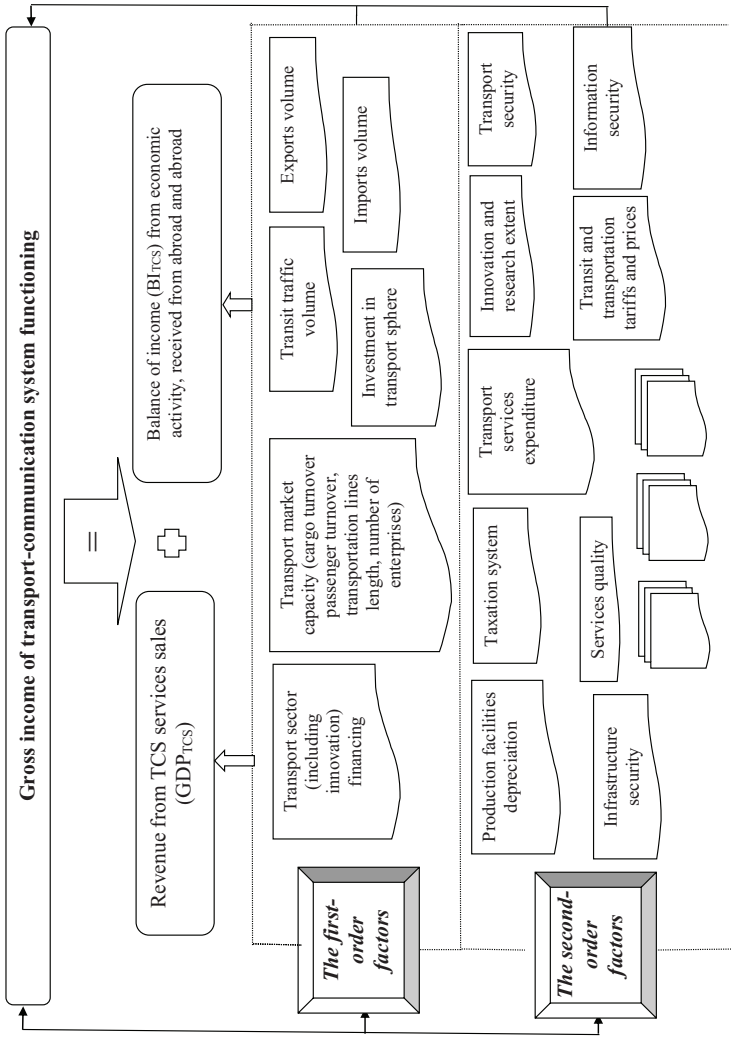
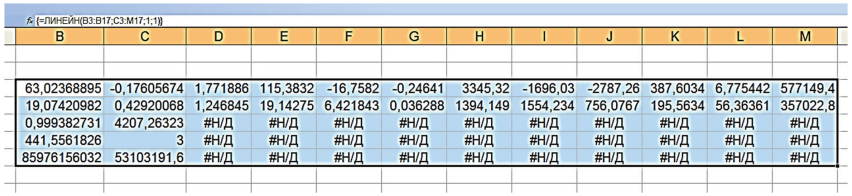


Figure 6.1. Combination of factors and gross income cause-and-effect relationship in transport-communication system of Ukraine casual diagnosis

So, suppose that there is a linear relationship between the selected first-order factors and gross income volume.

We denote the resultant GI $_{TCS}$ indicator through Y, and the above factors through X_j, j = 1, 11. An array of bench marks is collected in Appendix A.

For further calculations we use the built-in function LINEST Excel. The results of the calculations are shown in Fig. 6.2.



fx {=ЛИНЕЙН(B3:B17;C3:M17;1;1)}

B	C	D	E	F	G	H	I	J	K	L	M
63,02368895	-0,17605674	1,771886	115,3832	-16,7582	-0,24641	3345,32	-1696,03	-2787,26	387,6034	6,775442	577149,4
19,07420982	0,42920068	1,246845	19,14275	6,421843	0,036288	1394,149	1554,234	756,0767	195,5634	56,36361	357022,8
0,999382731	4207,26323	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д
441,5561826	3	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д
85976156032	53103191,6	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д

Figure 6.2. The results of multi-factor model calculation

Thus, econometric model of monetary gross income volume of transport-communication system functioning from the eleven first-order factors listed above dependence is analyzed $t \in [2000,2014]$:

$$Y(t) = a_0 + a_1 x_1(t) + \ldots + a_{11} x_{11}(t) = \varepsilon(t),\ t \in [2000,2014], (6.2)$$

where $a_0, \ldots, a_{11}$ – parameters that need to be evaluated;

$\varepsilon(t)$ -random variable.

The estimated regression equation has the following form:

$$\hat{Y}(t) = 6{,}76x_1 + 387{,}6x_2 - 2787{,}26x_3 - 1696{,}03x_4 +$$
$$+ 3345{,}32x_5 - 0{,}25x_6 - 16{,}76x_7 + 115{,}38x_8 +$$
$$+ 1{,}77x_9 - 0{,}18x_{10} + 63{,}02x_{11} + 577149{,}4$$

Determination coefficient R2 = 0.99 testifies the fact of a very close interrelationship between the factors mentioned and transport system functioning positive performance (GI_{tcs}).

Model validity validation on F-selection has shown that the model is valid and adequate ($F_{calc} = 441.556 > F_{tabl} = 10.1$).

Parameters of regression dependences analysis shows that the greatest influence on the amount of GI_{TCS} have cargo turnover, passenger turnover, communication lines length and number of enterprises in the transport system.

To test the correlation coefficient R significance, we calculate the Student *t*-criterion:

$$t_{\alpha} = \frac{R\sqrt{n-m}}{\sqrt{1-R^2}} = \frac{0{,}99\sqrt{(15-11)}}{\sqrt{1-0{,}99^2}} = 14{,}036$$

Using the statistical tables at a significance level α = 0.05 and degrees of freedom 4 we select $t_{tabl} = 2.132$.

Since $t > t_{tabl}$, we can draw a conclusion on the correlation coefficient significance.

To evaluate the significance of multiple regression models parameter estimates, we calculate *t*-criterion for each estimate.

To get the *t* fitted values, it is necessary to divide the figures of the first row of results by the corresponding values of the second (Figure 6.2) and evaluate the results by the module: $t_j = \frac{|\hat{a}_j|}{\sigma_{\hat{a}_j}}$. (Fig. 6.3).

=B23/B24

B	C	D	E	F	G	H	I	J	K	L	M
63,02368895	-0,17605674	1,771886	115,3832	-16,7582	-0,24641	3345,32	-1696,03	-2787,26	387,6034	6,775442	577149,4
19,07420982	0,42920068	1,246845	19,14275	6,421843	0,036288	1394,149	1554,234	756,0767	195,5634	56,36361	357022,8
0,999382731	4207,26323	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д
441,5561826	3	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д
85976156032	53103191,6	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д	#Н/Д
3,304131052	-0,41019678	1,421096	6,027515	-2,60956	-6,79037	2,399543	-1,09123	-3,68648	1,981983	0,12021	1,616562

Figure 6.3. *t*-criteria calculation

It turns out that t_0=1.617, t_1=0.12, t_2=1.982, t_3=3.687, t_4=1.09, t_5=2.399, t_6=6.79, t_7=2.61, t_8 = 6.028, t_9 =1.421, t_{10} = 0.41, t_{11} = 3.304.

At the significance level α = 0.05 and degrees of freedom $n - m = 4$ we select $t_{\text{tabl}} = 2.132$.

Not all evaluation parameters were statistically significant, indicating linear relationship between factors of explanatory variables possibility.

According to the *t*-statistics analysis the amount of gross income money supply from transport-communication system functioning is affected by the following factors:

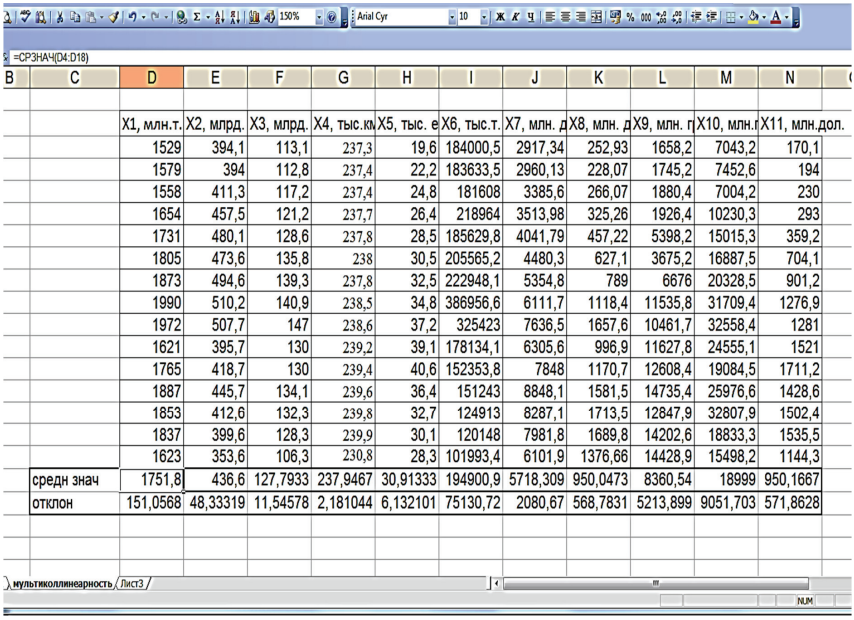
- passenger turnover,
- number of transport system enterprises,
- transit traffic volume,
- export volume,
- import volume,
- investment in transport system.

As we see from this list of factors, budget financing does not significantly affect effective indicator, which means that TCS strives for self-reliance not at the expense of state's financial resources, but mainly at the expense of

financial business entities resources, which ultimately has a positive effect on self-reliance achievement.

Given that the model is multifactorial and not all estimates have shown significance, we will check the multicollinearity factors using the Ferrara-Glober algorithm. This algorithm use provides for the seven steps implementation.

The first step is initial variables normalization. Calculations are performed using Excel built-in functions. Course of calculations is presented in figures 6.4-6.8.



=СРЗНАЧ(D4:D18)

		X1, млн.т.	X2, млрд.	X3, млрд.	X4, тыс.кв	X5, тыс. е	X6, тыс.т.	X7, млн. д	X8, млн. д	X9, млн. п	X10, млн.г	X11, млн.дол.
		1529	394,1	113,1	237,3	19,6	184000,5	2917,34	252,93	1658,2	7043,2	170,1
		1579	394	112,8	237,4	22,2	183633,5	2960,13	228,07	1745,2	7452,6	194
		1558	411,3	117,2	237,4	24,8	181608	3385,6	266,07	1880,4	7004,2	230
		1654	457,5	121,2	237,7	26,4	218964	3513,98	325,26	1926,4	10230,3	293
		1731	480,1	128,6	237,8	28,5	185629,8	4041,79	457,22	5398,2	15015,3	359,2
		1805	473,6	135,8	238	30,5	205565,2	4480,3	627,1	3675,2	16887,5	704,1
		1873	494,6	139,3	237,8	32,5	222948,1	5354,8	789	6676	20328,5	901,2
		1990	510,2	140,9	238,5	34,8	386956,6	6111,7	1118,4	11535,8	31709,4	1276,9
		1972	507,7	147	238,6	37,2	325423	7636,5	1657,6	10461,7	32558,4	1281
		1621	395,7	130	239,2	39,1	178134,1	6305,6	996,9	11627,8	24555,1	1521
		1765	418,7	130	239,4	40,6	152353,8	7848	1170,7	12608,4	19084,5	1711,2
		1887	445,7	134,1	239,6	36,4	151243	8848,1	1581,5	14735,4	25976,6	1428,6
		1853	412,6	132,3	239,8	32,7	124913	8287,1	1713,5	12847,9	32807,9	1502,4
		1837	399,6	128,3	239,9	30,1	120148	7981,8	1689,8	14202,6	18833,3	1535,5
		1623	353,6	106,3	230,8	28,3	101993,4	6101,9	1376,66	14428,9	15498,2	1144,3
	средн знач	1751,8	436,6	127,7933	237,9467	30,91333	194900,9	5718,309	950,0473	8360,54	18999	950,1667
	отклон	151,0568	48,33319	11,54578	2,181044	6,132101	75130,72	2080,67	568,7831	5213,899	9051,703	571,8628

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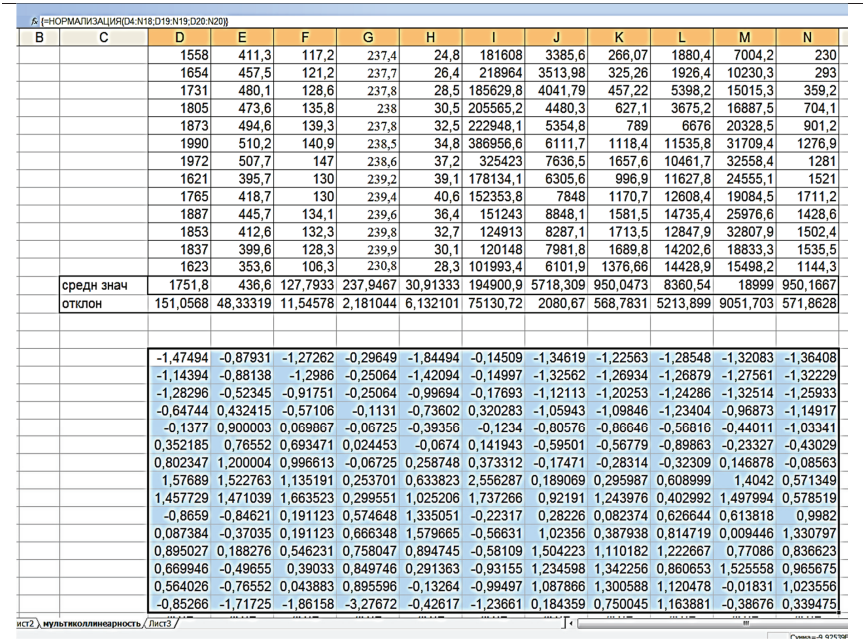
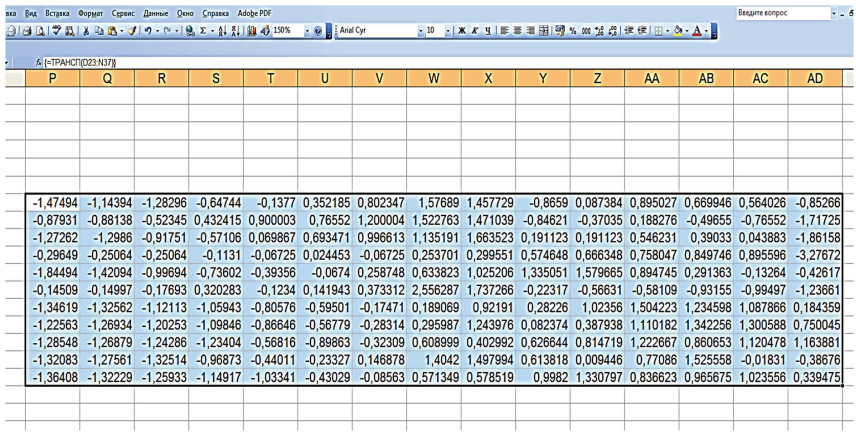
Figure 6.4. Initial values input and mean values and factor variables standard deviations calculation



	B	C	D	E	F	G	H	I	J	K	L	M	N
			1558	411,3	117,2	237,4	24,8	181608	3385,6	266,07	1880,4	7004,2	230
			1654	457,5	121,2	237,7	26,4	218964	3513,98	325,26	1926,4	10230,3	293
			1731	480,1	128,6	237,8	28,5	185629,8	4041,79	457,22	5398,2	15015,3	359,2
			1805	473,6	135,8	238	30,5	205565,2	4480,3	627,1	3675,2	16887,5	704,1
			1873	494,6	139,3	237,8	32,5	222948,1	5354,8	789	6676	20328,5	901,2
			1990	510,2	140,9	238,5	34,8	386956,6	6111,7	1118,4	11535,8	31709,4	1276,9
			1972	507,7	147	238,6	37,2	325423	7636,5	1657,6	10461,7	32558,4	1281
			1621	395,7	130	239,2	39,1	178134,1	6305,6	996,9	11627,8	24555,1	1521
			1765	418,7	130	239,4	40,6	152353,8	7848	1170,7	12608,4	19084,5	1711,2
			1887	445,7	134,1	239,6	36,4	151243	8848,1	1581,5	14735,4	25976,6	1428,6
			1853	412,6	132,3	239,8	32,7	124913	8287,1	1713,5	12847,9	32807,9	1502,4
			1837	399,6	128,3	239,9	30,1	120148	7981,8	1689,8	14202,6	18833,3	1535,5
			1623	353,6	106,3	230,8	28,3	101993,4	6101,9	1376,66	14428,9	15498,2	1144,3
		средн знач	1751,8	436,6	127,7933	237,9467	30,91333	194900,9	5718,309	950,0473	8360,54	18999	950,1667
		отклон	151,0568	48,33319	11,54578	2,181044	6,132101	75130,72	2080,67	568,7831	5213,899	9051,703	571,8628
			-1,47494	-0,87931	-1,27262	-0,29649	-1,84494	-0,14509	-1,34619	-1,22563	-1,28548	-1,32083	-1,36408
			-1,14394	-0,88138	-1,2986	-0,25064	-1,42094	-0,14997	-1,32562	-1,26934	-1,26879	-1,27561	-1,32229
			-1,28296	-0,52345	-0,91751	-0,25064	-0,99694	-0,17693	-1,12113	-1,20253	-1,24286	-1,32514	-1,25933
			-0,64744	0,432415	-0,57106	-0,1131	-0,73602	0,320283	-1,05943	-1,09846	-1,23404	-0,96873	-1,14917
			-0,1377	0,900003	0,069867	-0,06725	-0,39356	-0,1234	-0,80576	-0,86646	-0,56816	-0,44011	-1,03341
			0,352185	0,76552	0,693471	0,024453	-0,0674	0,141943	-0,59501	-0,56779	-0,89863	-0,23327	-0,43029
			0,802347	1,200004	0,996613	-0,06725	0,258748	0,373312	-0,17471	-0,28314	-0,32309	0,146878	-0,08563
			1,57689	1,522763	1,135191	0,253701	0,633823	2,556287	0,189069	0,295987	0,608999	1,4042	0,571349
			1,457729	1,471039	1,663523	0,299551	1,025206	1,737266	0,92191	1,243976	0,402992	1,497994	0,578519
			-0,8659	-0,84621	0,191123	0,574648	1,335051	-0,22317	0,28226	0,082374	0,626644	0,613818	0,9982
			0,087384	-0,37035	0,191123	0,666348	1,579665	-0,56631	1,02356	0,387938	0,814719	0,009446	1,330797
			0,895027	0,188276	0,546231	0,758047	0,894745	-0,58109	1,504223	1,110182	1,222667	0,77086	0,836623
			0,669946	-0,49655	0,39033	0,849746	0,291363	-0,93155	1,234598	1,342256	0,860653	1,525558	0,965675
			0,564026	-0,76552	0,043883	0,895596	-0,13264	-0,99497	1,087866	1,300588	1,120478	-0,01831	1,023556
			-0,85266	-1,71725	-1,86158	-3,27672	-0,42617	-1,23661	0,184359	0,750045	1,163881	-0,38676	0,339475

Figure 6.5. Variables vectors normalization



	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
	-1,47494	-1,14394	-1,28296	-0,64744	-0,1377	0,352185	0,802347	1,57689	1,457729	-0,8659	0,087384	0,895027	0,669946	0,564026	-0,85266
	-0,87931	-0,88138	-0,52345	0,432415	0,900003	0,76552	1,200004	1,522763	1,471039	-0,84621	-0,37035	0,188276	-0,49655	-0,76552	-1,71725
	-1,27262	-1,2986	-0,91751	-0,57106	0,069867	0,693471	0,996613	1,135191	1,663523	0,191123	0,191123	0,546231	0,39033	0,043883	-1,86158
	-0,29649	-0,25064	-0,25064	-0,1131	-0,06725	0,024453	-0,06725	0,253701	0,299551	0,574648	0,666348	0,758047	0,849746	0,895596	-3,27672
	-1,84494	-1,42094	-0,99694	-0,73602	-0,39356	-0,0674	0,258748	0,633823	1,025206	1,335051	1,579665	0,894745	0,291363	-0,13264	-0,42617
	-0,14509	-0,14997	-0,17693	0,320283	-0,1234	0,141943	0,373312	2,556287	1,737266	-0,22317	-0,56631	-0,58109	-0,93155	-0,99497	-1,23661
	-1,34619	-1,32562	-1,12113	-1,05943	-0,80576	-0,59501	-0,17471	0,189069	0,92191	0,28226	1,02356	1,504223	1,234598	1,087866	0,184359
	-1,22563	-1,26934	-1,20253	-1,09846	-0,86646	-0,56779	-0,28314	0,295987	1,243976	0,082374	0,387938	1,110182	1,342256	1,300588	0,750045
	-1,28548	-1,26879	-1,24286	-1,23404	-0,56816	-0,89863	-0,32309	0,608999	0,402992	0,626644	0,814719	1,222667	0,860653	1,120478	1,163881
	-1,32083	-1,27561	-1,32514	-0,96873	-0,44011	-0,23327	0,146878	1,4042	1,497994	0,613818	0,009446	0,77086	1,525558	-0,01831	-0,38676
	-1,36408	-1,32229	-1,25933	-1,14917	-1,03341	-0,43029	-0,08563	0,571349	0,578519	0,9982	1,330797	0,836623	0,965675	1,023556	0,339475

Figure 6.6. Normalized variables transposed matrix

The second step is a correlation matrix development. Information about paired dependencies is in symmetric

matrix of paired correlation coefficients between explanatory variables:

		матрица кореляций								
1	0,70854	0,883737	0,430495	0,650058	0,487709	0,678884	0,673967	0,545022	0,837832	0,606152
0,70854	1	0,807289	0,371247	0,328473	0,787259	0,045533	0,008777	-0,11334	0,431914	-0,01
0,883737	0,807289	1	0,632215	0,720271	0,574215	0,530797	0,463478	0,333376	0,785795	0,507986
0,430495	0,371247	0,632215	1	0,409635	0,190542	0,350824	0,186674	0,08674	0,390188	0,305996
0,650058	0,328473	0,720271	0,409635	1	0,188101	0,794156	0,675442	0,72466	0,790862	0,860711
0,487709	0,787259	0,574215	0,190542	0,188101	1	-0,12067	-0,09197	-0,17052	0,361442	-0,07495
0,678884	0,045533	0,530797	0,350824	0,794156	-0,12067	1	0,959526	0,928202	0,802143	0,9453
0,673967	0,008777	0,463478	0,186674	0,675442	-0,09197	0,959526	1	0,93016	0,806484	0,899218
0,545022	-0,11334	0,333376	0,08674	0,72466	-0,17052	0,928202	0,93016	1	0,729073	0,935914
0,837832	0,431914	0,785795	0,390188	0,790862	0,361442	0,802143	0,806484	0,729073	1	0,791097
0,606152	-0,01	0,507986	0,305996	0,860711	-0,07495	0,9453	0,899218	0,935914	0,791097	1

Figure 6.7. Correlation matrix

If among paired correlation coefficients of explanatory variables there are those which level is approaching or equal to the multiple correlation coefficient, this means the multicollinearity existence possibility. So the paired correlation coefficients are as follows:

$$r_{12} = 0{,}71;\ r_{13} = 0{,}88;\ r_{14} = 0{,}43;\ r_{15} = 0{,}65;\ r_{16} = 0{,}49;$$

$$r_{17} = 0{,}68;\ r_{18} = 0{,}67;\ r_{19} = 0{,}55;\ r_{1\,10} = 0{,}84;\ r_{1\,11} = 0{,}61;$$

$$r_{23} = 0{,}81;\ r_{24} = 0{,}37;\ r_{25} = 0{,}33;\ r_{26} = 0{,}79;\ r_{27} = 0{,}05;$$

$$r_{28} = 0{,}01;\ r_{29} = -0{,}11;\ r_{2\,10} = 0{,}43;\ r_{2\,11} = -0{,}01;\ r_{34} = 0{,}63;$$

$$r_{35} = 0{,}72;\ r_{36} = 0{,}57;\ r_{37} = 0{,}53;\ r_{38} = 0{,}46;\ r_{39} = 0{,}33;$$

$$r_{3\,10} = 0{,}79;\ r_{3\,11} = 0{,}51;\ r_{45} = 0{,}41;\ r_{46} = 0{,}19;\ r_{47} = 0{,}35;$$

$$r_{48} = 0{,}19;\ r_{49} = 0{,}09;\ r_{4\,10} = 0{,}39;\ r_{4\,11} = 0{,}31;\ r_{56} = 0{,}19;$$

$$r_{57} = 0{,}79;\ r_{58} = 0{,}68;\ r_{59} = 0{,}72;\ r_{5\,10} = 0{,}79;\ r_{5\,11} = 0{,}86;$$

$$r_{67} = -0{,}12;\ r_{68} = -0{,}09;\ r_{69} = -0{,}17;\ r_{6\,10} = 0{,}36;\ r_{6\,11} = -0{,}07;$$

$$r_{78} = 0{,}96;\ r_{79} = 0{,}93;\ r_{7\,10} = 0{,}8;\ r_{7\,11} = 0{,}95;\quad r_{89} = 0{,}93;$$

$$r_{8\,10} = 0{,}81;\ r_{8\,11} = 0{,}9;\ r_{9\,10} = 0{,}73;\ r_{9\,11} = 0{,}94;\ r_{10\,11} = 0{,}79.$$

There is a linear relationship between the independent variables vectors, since the calculated coefficients are greater than 0.7 in absolute value.

We identify the correlation matrix determinant $\det(R) = 0{,}0074$. The more determinant tends to 0, the more confident you can argue that there is multicollinearity between explanatory variables.

The third step is criterion χ^2 according to the formula definition:

$$\chi^2 = -\left[n - 1 - \frac{1}{6}\cdot(2\cdot m + 5)\right]\ln|r| \quad (6.3)$$

The value of this criterion is compared with the tabular, at $\frac{m}{2}(m-1)$ degrees of freedom and significance level α.

If the χ^2 actual is more than the χ^2 tabular this means that there is multicollinearity in the explanatory variables array.

$$\chi^2 = -\left[n - 1 - \frac{1}{6}\cdot(2\cdot m + 5)\right]\ln|r| =$$

$$= -\left[15 - 1 - \frac{1}{6}(2\cdot 11 + 5)\right]\cdot(-23{,}325) = 221{,}5875.$$

χ^2 tabular value at a degree of freedom 55 and significance level α = 0.005 is 86.52. Phenomenon of multicollinearity is observed in the data array.

Step four is inverse matrix definition:

$$C = r^{-1} = \left(X^{*T} \cdot X^{*}\right)^{-1} \tag{6.4}$$

{=МОБР(U41:AE51)}

AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
57,33332	-46,6011	-9,50983	7,448122	44,94521	-0,79144	-41,2856	16,39499	3,430145	-3,70324	-47,4074
-46,6011	70,66344	-32,0243	2,781558	-31,654	-8,23489	6,006274	10,82609	-17,769	7,721011	66,10807
-9,50983	-32,0243	60,27075	-15,2153	-21,3153	8,736598	43,13297	-40,7518	22,40666	-7,85352	-20,4023
7,448122	2,781558	-15,2153	9,088459	14,40206	-2,64501	-29,3535	23,06893	1,833137	-1,19311	-5,90095
44,94521	-31,654	-21,3153	14,40206	57,80504	-2,83004	-65,1704	48,09059	3,664008	-6,1191	-51,3316
-0,79144	-8,23489	8,736598	-2,64501	-2,83004	5,878727	14,06789	-8,69332	2,614764	-3,0116	-5,9008
-41,2856	6,006274	43,13297	-29,3535	-65,1704	14,06789	141,2064	-100,382	-8,44417	7,932477	27,7145
16,39499	10,82609	-40,7518	23,06893	48,09059	-8,69332	-100,382	93,7628	-5,82329	-9,53858	-14,6567
3,430145	-17,769	22,40666	1,833137	3,664008	2,614764	-8,44417	-5,82329	33,42554	-6,41359	-30,1488
-3,70324	7,721011	-7,85352	-1,19311	-6,1191	-3,0116	7,932477	-9,53858	-6,41359	11,93741	9,355207
-47,4074	66,10807	-20,4023	-5,90095	-51,3316	-5,9008	27,7145	-14,6567	-30,1488	9,355207	94,10344

Figure 6.8. Inverse matrix development

The fifth step of the algorithm provides for F-values calculating according to the following formula:

$$F_k = \left(C_{kk} - 1\right)\frac{n-m}{m-1} \tag{6.5}$$

where C_{kk} is the diagonal matrix C elements.

The actual values are compared with tabular criteria at the degrees of freedom $n - m$ and $m - 1$ and significance level α.

If F calculated is more than F tabular, then, accordingly, some independent variable is multicollinear with others.

The calculated values are as follows:

$$F_1 = 22{,}53;\quad F_2 = 27{,}87;\quad F_3 = 23{,}71;\quad F_4 = 3{,}24;\quad F_5 = 22{,}72;\quad F_6 = 1{,}95;$$

$$F_7 = 56{,}08;\quad F_8 = 37{,}11;\quad F_9 = 12{,}97;\quad F_{10} = 4{,}37;\quad F_{11} = 37{,}24.$$

F tabular – criterion at the significance level α = 0.01 and degrees of freedom $n - m = 4$ and $m - 1 = 10$ is 5.99.

In this case $F_1, F_2, F_3, F_5, F_7, F_8, F_9, F_{11} > F_{\text{табл}}$, and the corresponding variables are multicollinear with others.

At the sixth step we calculate serial correlation coefficients according to the formula:

$$r_{kj} = \frac{-C_{kj}}{\sqrt{C_{kk} \cdot C_{jj}}} \qquad (5.6)$$

where C_{kj}, C_{kk}, C are matrix C elements.

The results of the calculations are presented in table 6.2.

Table 6.2

Serial correlation coefficients of variables pairs relationship

Marking	Value	Marking	Value	Marking	Value	Marking	Value	Marking	Value
r12=	0.732	r24=	-0.11	r37=	-0.468	r4,11=	0.202	r6,11=	0.251
r13=	0.162	r25=	0.495	r38=	0.542	r56 =	0.154	r78=	0.872
r14=	-0.326	r26 =	0.404	r39 =	-0.499	r57=	0.721	r79 =	0.123
r15=	0.781	r27 =	-0.06	r3,10=	0.293	r58 =	-0.653	r7,10=	-0.193
r16=	0.043	r28=	-0.133	r3,11=	0.271	r59=	-0.083	r7,11=	-0.24
r17=	0.459	r29 =	0.866	r45=	-0.628	r5,10=	0.233	r89 =	0.104
r18=	-0.224	r2,10=	-0.266	r46 =	0.362	r5,11=	0.696	r8,10=	0.285
r19 =	-0.078	r2,11=	-0.811	r47 =	0.819	r67=	-0.488	r8,11=	0.156
r1,10=	0.142	r34=	0.65	r48=	-0.79	r68=	0.37	r9,10=	0.321
r1,11=	0.645	r35=	0.361	r49=	-0.105	r69 =	-0.488	r9,11=	0.538
r23=	0.491	r36=	-0.464	r4,10=	0.115	r6,10=	0.36	r10,11=	-0.279

There is a linear relationship between the variables vectors absolute values of which exceed 0.5.

The seventh step is *t*-criterion according to the following formula calculation:

$$t_{kj} = \frac{r_{kj}\sqrt{n-m}}{\sqrt{1-r_{kj}^2}} \qquad (6.7)$$

The actual *t*-criterion values are compared with tabular criteria at the degrees of freedom $n - m$ and significance level α. If *t* actual is more than the *t* tabular, there is multicollinearity between the independent variables.

Table 6.3

Serial correlation coefficients of variables pairs relationship

Marking	Value	Marking	Value	Marking	Value	Marking	Value	Marking	Value
t_{12}=	2.1488	t_{24}=	-0.2213	t_{37}=	-1.0591	$t_{4,11}$=	0.4125	$t_{6,11}$=	0.5186
t_{13}=	0.3283	t_{25}=	1.1394	t_{38}=	1.2899	t_{56}=	0.3117	t_{78}=	3.5628
t_{14}=	-0.6897	t_{26}=	0.8833	t_{39}=	-1.1516	t_{57}=	2.081	t_{79}=	0.2479
t_{15}=	2.5011	t_{27}=	-0.1202	$t_{3,10}$=	0.6129	t_{58}=	-1.7244	$t_{7,10}$=	-0.3934
t_{16}=	0.0861	t_{28}=	-0.2684	$t_{3,11}$=	0.5631	t_{59}=	-0.1666	$t_{7,11}$=	-0.4945
t_{17}=	1.0333	t_{29}=	1.7866	t_{45}=	-1.614	$t_{5,10}$=	0.4792	t_{89}=	0.2091
t_{18}=	-0.4597	$t_{2,10}$=	-0.5519	t_{46}=	0.7767	$t_{5,11}$=	1.9386	$t_{8,10}$=	0.5947
t_{19}=	-0.1565	$t_{2,11}$=	-2.7724	t_{47}=	2.8547	t_{67}=	-1.1182	$t_{8,11}$=	0.3159
$t_{1,10}$=	0.2869	t_{34}=	1.7107	t_{48}=	-2.577	t_{68}=	0.7965	$t_{9,10}$=	0.6779
$t_{1,11}$=	1.6881	t_{35}=	0.7742	t_{49}=	-0.2112	t_{69}=	-1.1182	$t_{9,11}$=	1.2765
t_{23}=	1.1272	t_{36}=	-1.0476	$t_{4,10}$=	0.2315	$t_{6,10}$=	0.7717	$t_{10,11}$=	-0.5811

Tabular value at a degree of freedom 4 and significance level α=0.1 is 1.533. Twelve pairs of variables showed a linear relationship between them. It is therefore necessary to remove those variables that are more common in these

pairs from consideration. We remove the following explanatory variables vectors from the array: X_1-cargo transportation, million tons, X_3-passenger turnover, billion Paz. km, X_4- communication lines length, thousand km X_5--number of transport system enterprises, thousand units, X_8-import volume, million USD, X_9-budget expenses on transport, million UAH., X_{11}-foreign direct investment, million USD.

We develop a new model for the volume of gross income from transport-communication system of Ukraine functioning forecasting.

The results of the calculation are shown in Figure 6.9.

5,312109437	30,0287058	1,032095	5,154512	-173680
2,217914673	9,00032855	0,20033	2,621626	96532,08
0,997193096	28256,166	#Н/Д	#Н/Д	#Н/Д
24,43765112	10	#Н/Д	#Н/Д	#Н/Д
78045150027	7984109197	#Н/Д	#Н/Д	#Н/Д

Figure 6.9. The results of the LINEST function work

We explore econometric dependence model of the gross income of the TCS money supply from the four mentioned factors, $t \in [2000,2014]$:

$$Y(t) = a_0 + a_1 x_1(t) + a_2 x_2(t) + a_3 x_3(t) + a_4 x_4(t) + \varepsilon(t),$$

$$t \in [2000,2014], \qquad (6.8)$$

where $a_0,\ldots, a_4$ parameters that need to be evaluated;

$\varepsilon(t)$ -random variable.

The estimated regression equation has the form:

$$\hat{Y}(t) = 5{,}154x_1 + 1{,}032x_2 + 30{,}03x_3 + 5{,}312x_4 - 173680.$$

Determination coefficient R2 = 0.99 indicates very significant relationships between the selected factors and transport system functioning outcome.

Model validity validation on F-selection has shown that the model is valid and adequate (F_{calc} =24.437 > F_{tabl} = 3.48).

Regression dependences parameters analysis shows that the greatest influence on transport-communication system GI volume provides export, as the a_3 parameter has amounted to 30.03 and characterizes maximum income amount from TCS functioning by export per unit increasing, that is, when the growth of export per unit net income will increase by 30.03.

GI_{TKS} will increase by 5.154 with the turnover per unit growth, all other things being equal. With a transit per unit increase, transport-communication system income will increase by 1.03. With an investment in TCS per unit increase this system income will increase by 5.312.

To test the correlation coefficient R significance, we calculate the Student *t*-criterion:

$$t_\alpha = \frac{R\sqrt{n-m}}{\sqrt{1-R^2}} = \frac{0{,}99\sqrt{(15-4)}}{\sqrt{1-0{,}99^2}} = 23{,}28$$

Using the statistical tables at significance level α = 0.05 and degrees of freedom 10m we select t_{tabl} = 1.812.

Since $t > t_{tabl}$, we can draw a conclusion on the correlation coefficient significance.

To determine the multiple regression model estimated parameters significance we calculate the *t*-criteria for each of its evaluation (Fig. 6.10).

=C88/C89

B	C	D	E	F	G
	5,312109437	30,0287058	1,032095	5,154512	-173680
	2,217914673	9,00032855	0,20033	2,621626	96532,08
	0,997193096	28256,166	#Н/Д	#Н/Д	#Н/Д
	24,43765112	10	#Н/Д	#Н/Д	#Н/Д
	78045150027	7984109197	#Н/Д	#Н/Д	#Н/Д
	2,395091886	3,33640107	5,151974	1,966151	-1,79919

Figure 6.10 *t*-criteria calculation

The result of the calculation: t_0=1.8, t_1=1.97, t_2=5.152, t_3=3.336, t_4=2.395.

At the significance level α = 0.05 and degrees of freedom $n - m = 11$ we select $t_{tabl} = 2.132$. Three of the four calculations confirm the model reliability. Dynamics of gross income for transport-communication system 2000-2014 functioning graph and linear trend are presented in Figure 6.11.

To build a long-term forecast of gross income from transport-communication system in 2015-2025 functioning, we will first predict the factor variables step-by-step values. To do this, we use the Excel built-in function TREND (Figure 6.12).

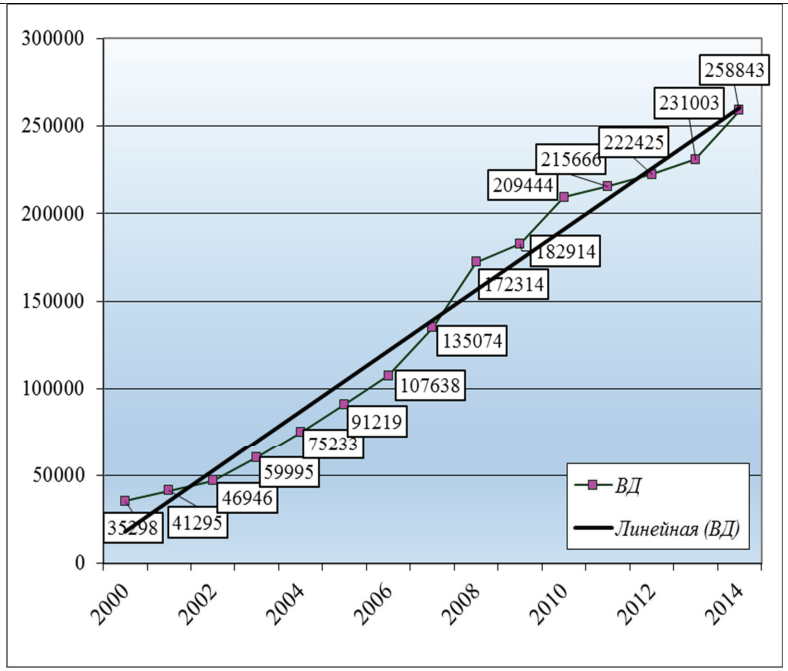


Figure 6.11 TCS gross income for 2000-2014 dynamics.

Presented estimated forecast data indicate that the amount of gross income from transport-communication system functioning has a steady growth tendency in the medium term.

Thus, the above casual and correlation-regression analysis results indicate the TCS gross income dominant growth factors, and hence transport-communication system self-sufficiency; and they are export volume, cargo turnover, investments in transport system and transit traffic volume.

fx {=ТЕНДЕНЦИЯ(D3:D17;B3:B17;B18:B20;1)}

B	C	D	E	F	G
индекс года	ВВП	X2, млрд.	X6, тыс.т.	X7, млн. дол	X10, млн.грн.
1	35298	394,1	184000,5	2917,34	7043,2
2	41295	394	183633,5	2960,13	7452,6
3	46946	411,3	181608	3385,6	7004,2
4	59995	457,5	218964	3513,98	10230,3
5	75233	480,1	185629,8	4041,79	15015,3
6	91219	473,6	205565,2	4480,3	16887,5
7	107638	494,6	222948,1	5354,8	20328,5
8	135074	510,2	386956,6	6111,7	31709,4
9	172314	507,7	325423	7636,5	32558,4
10	182914	395,7	178134,1	6305,6	24555,1
11	209444	418,7	152353,8	7848	19084,5
12	215666	445,7	151243	8848,1	25976,6
13	222425	412,6	124913	8287,1	32807,9
14	231003	399,6	120148	7981,8	18833,3
15	258843	353,6	101993,4	6101,9	15498,2
16	262209,13	418,9571	150285,6	9021,6479	29263,16
17	277607,71	416,7518	144708,7	9434,5652	30546,18
18	293006,3	414,5464	139131,8	9847,4825	31829,2
19	314670,36	383,1338	107429,2	10183,122	30824,24
20	330715,9	376,0268	97454,55	10582,551	31717,91
21	346761,44	368,9197	87479,88	10981,981	32611,58
22	355031,15	353,9564	52353,38	11045,722	30926,94
23	369740,94	345,5614	38142,53	11388,713	31391,61
24	384450,73	337,1665	23931,68	11731,705	31856,28
25	393476,08	346,5927	40535,57	12099,861	34156,45

Figure 6.12 The resulting variable forecast during 2015-2025 time-frame.

The most significant impact on the amount of TCS gross income money supply provides transport services export. Advantageous geographical position of Ukraine traditionally ensures transport services in foreign services trade preponderance. Transportation services in Ukraine

account for more than 65 per cent of services exports. In the structure of transportation services exports the leading role belongs to the pipeline transport, the share of which in the total transportation services exports increased from 39.5 per cent in 2007 to 47 per cent in 2015. All this is confirmed by our research estimates.

The second place in terms of TCS gross income volume influence is occupied by cargo turnover. At the same time, a decline in the role of passenger turnover is observed which is explained by this indicator for certain means of transport decrease due to the increase in the cost of travel while reducing the purchasing power level.

Effect of investing in transport sector with the subsequent growth of gross income has been revealed in this study calculations and it shows that with total investment in TCS per unit increase, TCS income will increase by 5.312. First of all, it is due to the investment with simultaneous budget financing deficit competitiveness level of transport sector production capacities updating, progressive innovative technologies introduction and increase of transport-communication system services may be achieved.

One of the significant factors of influence on TCS gross income is transit traffic volume. Thus, transit represents significant in absolute terms share (up to 40 per cent) in structure of foreign trade cargo flows passing through the borders of Ukraine [46]. In modern conditions the role of organizational-economic mechanism in the field of transit transport has increased. The major role in this mechanism

formation is played by the state which receives foreign exchange earnings from transit potential realization. Consequently, an increase in the number of such transport and logistics organizations, as well as roadside service network enterprises, will lead to the effective indicator increase. It should be noted, that transport-communication system does not significantly depend on budgetary financing that shows a trend towards the sector self-financing (above econometric model).

The next stage of our study is transport-communication system of Ukraine self-reliance prognostic evaluation for a period up to 2025 determination, on the basis of the balance model presented and described in detail in paragraph 3.1.2 . GI_{tcs} Main forecasting indicator for determining the total sum of sources of own means of TCS financing expenditures we have already defined (Fig. 6.12).

For this purpose, we build self-reliance analytical balance in tabular form for the subsequent forecasting (Table 6.4).

For the generalized analysis of self-reliance for the period from 2000 to 2014 data of own and attracted funding sources of transport-communication system functioning total costs as a percentage should be aggregated. For this propose we propose to form a complementary table (Table 6.5).

Table 6.4

Transport-communication system of Ukraine self-reliance balance, million. UAH.

Year	Budget expenditures	Business entities costs	**Total costs of TCS functioning**	GI_{TCS}	Transfers	Lending at the expense of the State budget	Capital investments	**Total revenues from own sources of financing**	Foreign Governments and international organizations transfers	Lending by financial institutions	Foreign direct investment	**Total revenue from attracted funding sources**
2000	1,658.2	119,623.525	**121,281.725**	35,298	12	92.06	7,043.2	**42,445.26**	278.6	77,633.0449	924.8201	**78,836.465**
2001	1,745.2	100,249.275	**101,994.475**	41,295	15	104.5	7,452.6	**48,867.1**	348.04	51,755.791	1,023.544	**53,127.375**
2002	1,880.4	102,928.175	**104,808.575**	46,946	23	113.8	7,004.2	**5,4087**	452.55	49,043.033	1,225.992	**50,721.575**
2003	1,926.4	121,016	**12,2942.4**	59,995	22	187.2	10,230.3	**70,434.5**	504.65	50,440.974	1,562.276	**52,507.9**
2004	5,398.2	142,481.675	**147,879.875**	75,233	18	203.4	15,015.3	**90,469.7**	544.03	54,987.529	1,878.616	**57,410.175**
2005	3,675.2	173,781.125	**177,456.325**	91,219	20	259.3	16,887.5	**108,385.8**	657.45	64,857.37	3,555.705	**69,070.525**
2006	6,676	201,444.25	**208,120.25**	107,638	22	321.2	20,328.5	**128,309.7**	704.33	74,555.16	4,551.06	**79,810.55**
2007	11,535.8	260,772.75	**272,308.55**	135,074	21	343.0228	31,709.4	**167,147.4228**	788.54	97,924.2422	6,448.345	**105,161.1272**
2008	10,461.7	367,953.6	**378,415.3**	172,314	24	471.0005	32,558.4	**205,367.4005**	804.45	163,607.2035	8,636.246	**173,047.8995**
2009	11,627.8	369,546.275	**381,174.075**	182,914	25	1,465.021	24,555.1	**208,959.121**	843.37	159,659.884	11,711.7	**172,214.954**
2010	12,608.4	321,048.525	**380,656.92**	209,444	26	1,538.304	19,084.5	**230,092.804**	856.76	89,127.961	13,579.4	**103,564.121**
2011	14,735.4	415,749.95	**430,485.35**	215,666	22	2,504.342	25,976.6	**244,168.942**	889.73	174,044.168	11,382.51	**186,316.408**
2012	12,847.9	413,739.2	**426,587.1**	222,425	24	2,545.376	32,807.9	**257,802.276**	807.22	155,971.924	12,005.68	**168,784.824**
2013	14,202.6	398,825	**413,027.6**	231,003	25	2,661.503	18,833.3	**252,522.803**	865.65	147,365.897	12,273.25	**160,504.797**
2014	14,428.9	436,609.075	**451,037.975**	258,843	21	2,027.438	15,498.2	**276,389.638**	870.02	160,176.367	13,601.95	**174,648.337**

Table 6.5

TCS self-reliance for 2000-2014 characteristics.

Year	Total costs of TCS functioning, %	Own sources of financial resources		Attracted sources of financial resources, %
		Relative share, total,%	Self-reliance diagnosis (getting into the "self-reliance corridor" from 62 to 100%), +;-	
1	*2*	*3*	*62% ≤ 4 ≤ 100%*	*5*
2000	100	34.99724	-	65.00276
2001	100	47.91152	-	52.08848
2002	100	51.60551	-	48.39449
2003	100	57.29065	-	42.70935
2004	100	61.17783	-	38.82217
2005	100	61.07745	-	38.92255
2006	100	61.65171	-	38.34829
2007	100	61.38163	-	38.61837
2008	100	54.27037	-	45.72963
2009	100	54.81987	-	45.18013
2010	100	60.44624	-	39.55376
2011	100	56.71945	-	43.28055
2012	100	60.43368	-	39.56632
2013	100	61.13945	-	38.86055
2014	100	61.27857	-	38.72143

** compiled by the author*

Analysis of the data suggests that transport-communication system has not reached self-reliant development level in none of the years of the time series i.e. proportion of own sources of costs funding have never reached the min "self-reliance corridor" border of 62 per cent. However, tables 6.4 – 6.5 analytical data show a

tendency of absolute and relative increase in total income from the system internal sources. Thus, if in 2000 the indicator was equal to UAH 42,445.26 million or 34.99 per cent of all revenue sources of financial resources, in 2014, the total amount of TCS own financial costs funding increased by 26.29 per cent and amounted to UAH 276,389.64 million.

Based on transport-communication system analytical balance analysis it can be concluded that transport sector cumulative costs increased 3.71 times and amounted to UAH 451,037.98 million in 2014. And the key role in TCS costs financing is not played by the state, but by economic entities of domestic transport sector financial resources, which indicates the industry's commitment to self-reliance.

At the same time, dynamics of decrease in the share of attracted financial resources revenues is observed. Thus, if in 2000, the amount of total income from external sources accounted for 65.0 per cent or UAH 78,836.47 million, in 2014 their relative share decreased 1.7 times and reached UAH 38.72 million that is certainly a positive trend in TCS financial resources overall structure changes. The lion's share, 91.71 per cent, of all external revenues is brought by financial institutions external lending. This suggests that transportation sphere is characterized by lending and investment attractiveness due to the rapid return on investment, which is reflected in the volume of loans growth and foreign direct investments.

For the long-term self-reliance forecast we use the Excel built-in function TREND (Fig. 6.13).

fx {=ТЕНДЕНЦИЯ(D51:D65;B51:B65;B66:B76;1)}

	B	C	D	E
	индекс	года	собственные	привлеченные
	1	2000	34,99724	65,00276
	2	2001	47,91152	52,08848
	3	2002	51,60551	48,39449
	4	2003	57,29065	42,70935
	5	2004	61,17783	38,82217
	6	2005	61,07745	38,92255
	7	2006	61,65171	38,34829
	8	2007	61,38163	38,61837
	9	2008	54,27037	45,72963
	10	2009	54,81987	45,18013
	11	2010	60,44624	39,55376
	12	2011	56,71945	43,28055
	13	2012	60,43368	39,56632
	14	2013	61,13945	38,86055
	15	2014	61,27857	38,72143
	16	2015	64,50203048	35,49796952
	17	2016	65,51310787	34,48689213
	18	2017	66,52418526	33,47581474
	19	2018	67,53526265	32,46473735
	20	2019	68,54634005	31,45365995
	21	2020	69,55741744	30,44258256
	22	2021	70,56849483	29,43150517
	23	2022	71,57957223	28,42042777
	24	2023	72,59064962	27,40935038
	25	2024	73,60172701	26,39827299
	26	2025	74,6128044	25,3871956

Figure. 6.13 TCS of Ukraine self-reliance for 2015-2026 forecast.

It should be noted that the maximum limitation of forecasting time series, in this case 12 years, allows us to present results with minimum forecasting error.

As you can see from the forecasting data presented, transport-communication system of Ukraine enters the "self-reliance corridor" in 2016 i.e. the total income from own financial resources crosses the lower "self-reliance corridor" boundary of 64.5 per cent. While maintaining the trends of significant parameters, the effective indicator positive dynamics is observed. So, in the declared parameters in 2026 presence, TCS self-reliance will be below the average level i.e. below the "self-reliance corridor" median (81 per cent) and will amount to 74.61 per cent.

Graphical interpretation of transport-communication system of Ukraine self-reliance forecast calculated data is presented in Figure 6.14.

Analyzing the graph of transport-communication system economic self-reliance forecasting the following conclusions should be made

-transport-communication system of Ukraine has all chances to reach a self-reliance development level given the trends of basic parameters immutability in 2016;

-growth of own sources of financial resources dynamics indicates a trend of self-reliance level escalating after 2016 onwards and until the end of the forecast period;

-decrease in external sources of financial resources dependence is observed, and this means that external dependence of domestic transport-communication system in covering its own functioning costs has being reducing since 2011and up to the end of the forecast period.

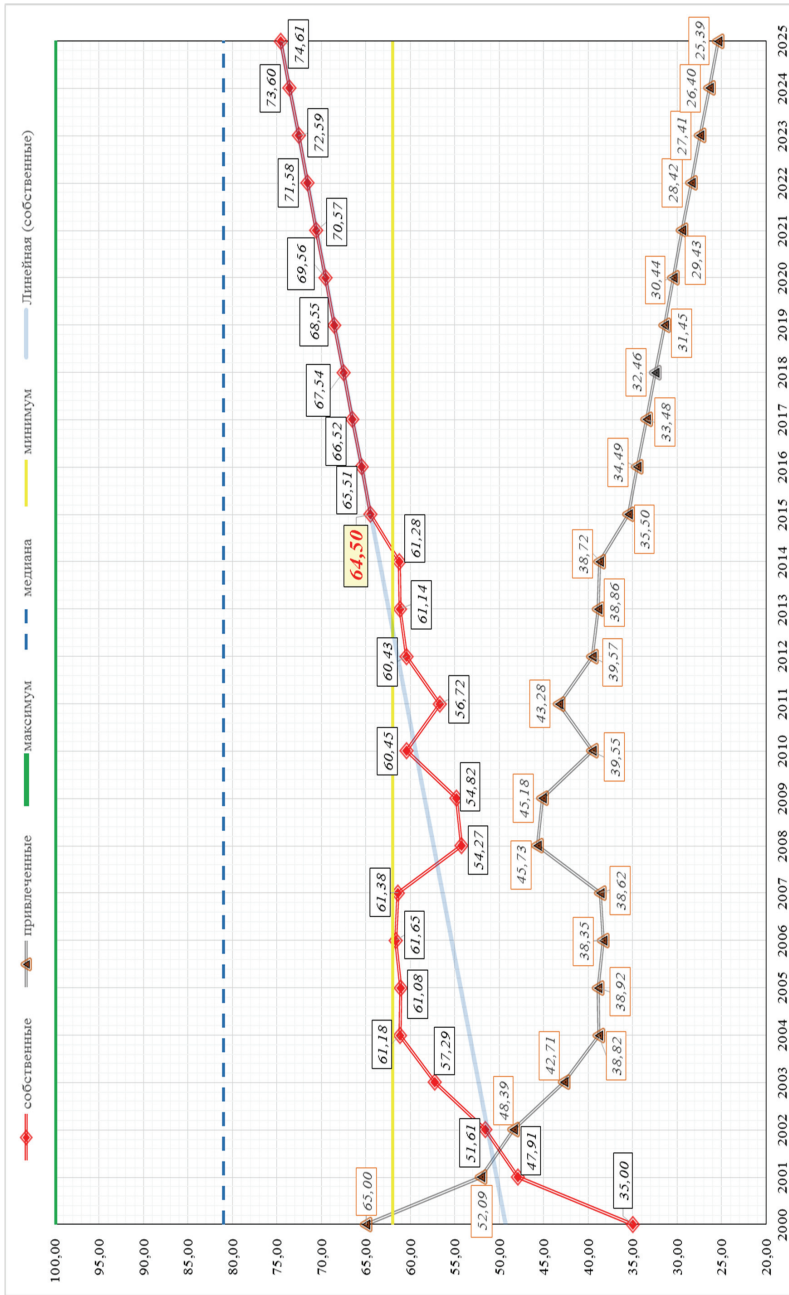


Figure. 6. 14 TCS of Ukraine self-reliance forecast up to 2025

Thus, the above presented estimates of Foresight research allow us to summarize the following:

-using a combination of basic Foresight techniques such as literature review, environmental scanning, bibliometical analysis, expert panels, cross-impact analysis, multi-criteria analysis, futures workshops and modelling has contributed to the goal achievement, i.e. transport-communication system of Ukraine self-reliance predictive model development;

-amount of own sources of financial resources is of dominant influences on the TCS effective outcome indicator, where the size of the obtained GI_{TCS} in the reporting period plays the main role;

-as revealed from the aggregate of 11 first-order factors size of the obtained GI_{TCS} is most significantly affected by export volume, cargo turnover, investment in transport sector and transit traffic volume. Thus, with export per unit growth net income will increase by 30.03; with investments in TCS per unit increase net income will increase by 5.312; GI_{TCS} will increase by 5.154 with cargo turnover per unit growth, all other things being equal; with transit per unit increase, net income of transport-communication system will increase by 1.03.

-estimated GI_{TCS} forecast until 2025, shows its steady growth and this is the basis for TCS self-reliance forecast balance model development;

-self-reliance balance demonstrates that transport-communication system of Ukraine reaches the lower

border of the "self-reliance corridor" only in 2016 and has a positive forecast tendency up to 2025;

-However, the share of external (attracted) sources of financial resources to cover the costs of TCS functioning steadily decreases, suggesting a reduction of external funding dependence.

6.2. CONCEPTUAL BASES OF TCS SELF-RELIANT DEVELOPMENT STRATEGY FORMATION

Based on statistical material synthesis presented in Chapter 3 and forecast research of transport-communication system of Ukraine functioning economic self-reliance, it has been found that at stability and immutability of the trends of key significant development factors TCS will reach the lowest level of "self-reliance corridor" boundary in 2016. To implement economic self-reliance calculated forecast for a long-term period up to 2025, strategic orientations must be substantiated, which can serve as housing for national transport-communication system development strategy. We remind that according to the forecast results shown in section 6.1 the most significant factors for economic self-reliance achieving are identified: exports, investment, and cargo turnover and transit traffic.

With the aim of achieving and increasing self-reliance level, we consider formation and implementation of Ukrainian TCS development strategy to be economically justified, that is the strategy for the four dominant

components of 4T development: transport-communication infrastructure (TCI), trade, technology and transit.

Figure 6.15 presents the overall structure of objectives, priorities and goals for TCS self-reliant development strategy.

It should be emphasized that all four objectives, namely transport-communication infrastructure, technology, trade and transit are closely related and bound in the proposed "4T" strategy. Thus, transit traffic volume, for example, cannot be increased without transport infrastructure and communication channels of appropriate quality. Or, for example, transport-communication channels improvement is impossible without advanced technologies introduction that will provide TCS services in accordance with European standards. The amount of foreign exchange earnings is closely correlated with TCI quality, competitive transport-communication system services quality and transit activity of Ukraine.

Undoubtedly, formation and mechanism as well as tools for an appropriate strategy for transport-communication system of Ukraine self-reliant development implementation deserve a separate research topic, but fundamental conceptual ideas are presented below.

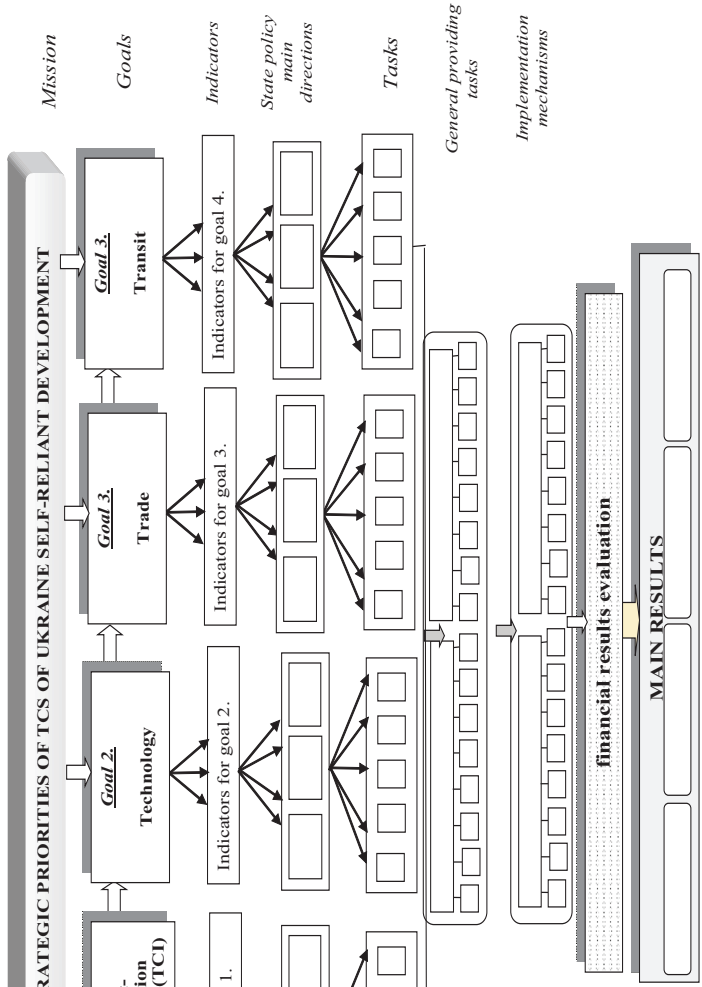


Figure. 6.15. Structure of priorities and objectives of TCS of Ukraine development "4T" strategy

** Source: developed by the author*

Thus, comprehensive measures for transport sector development in the period to overcome crisis phenomena are strategically important and provide for infrastructural and transport projects implementation, including reconstruction of airports, bridges, roads, tunnels, high-speed trains during the daytime launch, of passenger and freight rail routes distribution, re-equipment of ports, chain of international logistics centers development, network of international transport corridors (ITC) further development that would ensure efficient communication between Europe and Asia through the territory of Ukraine.

A significant share of transport-communication system capacity is involved in transit traffic implementation by using favorable geographical position of the country and passage through its territory such routes as: international Cretan transport corridors, transport axes in the directions of East-West and North-South, TRACECA corridors and new intercontinental transport routes, including high-speed ones from Asia to Europe. It should be noted that considering the influence of international transport corridors, it is advisable to create new high-quality centers with logistics services provision at distances up to 200 km in the territories that adjoin the largest border crossing points on the state border on road and rail transport.

Below is TCS of Ukraine road ways communications diagram (Figure 6.16).

Figure 6.16. TCS of Ukraine road network diagram with roads of national and international importance

We remind that in 2014, the total length of roads amounted to 163,028 km; 1,131,313 thousand tons of goods was transported on them.

To date, unfortunately, about 90 per cent of logistical services market in the country is concentrated in Kyiv region, and the total capacity of this market in Ukraine is estimated by experts in the amount of EUR 2.5 billion.

As you can see, provided cargo turnover by regions of our country general scheme (Figure 6.17) clearly indicates that the highest rate for goods carriage is concentrated in areas bordering foreign countries i.e. the boundary regions.

A system of multimodal transportations, to which not only rail transport, but also primarily automobile and

ferry crossings is involved requires pace of development acceleration.

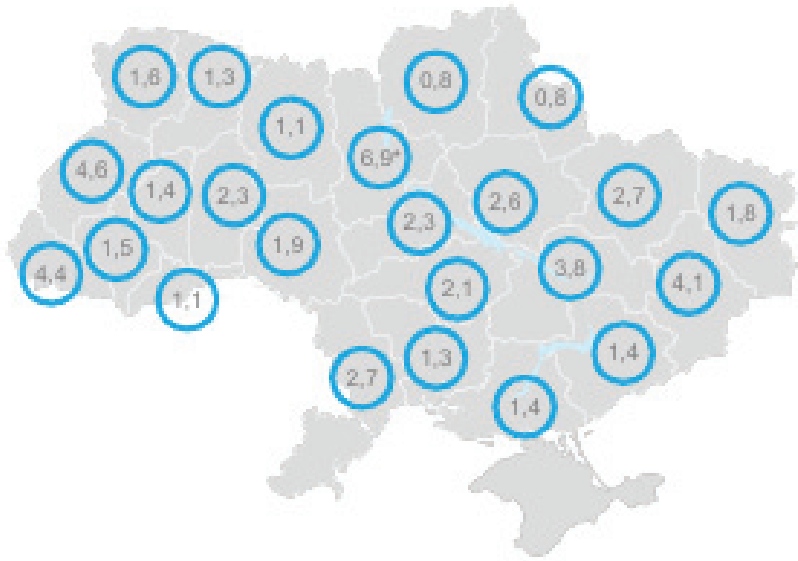


Figure 6.17. Road transport in the regions of Ukraine cargo turnover in 2014 scheme, million tons / km

European investment Bank plans to allocate to Ukraine EUR 900 million in 2015-2016 for transport infrastructure reform. The bank will allocate promised funds only after the Ministry of Infrastructure of Ukraine provides a project for transport infrastructure of Ukraine development. In addition, the European Investment Bank is ready to support projects for public transport and railway development [55]. The European Union will provide Ukraine with additional EUR 20 million to reform infrastructure sector [62]. This once again confirms

formation of integrated strategy for transport-communication system development importance.

As noted in paragraph 4.2 of this study, piggyback shipments are one of the ways to fill foreign exchange revenues into the revenue part of the state budget of Ukraine and they are strategically important for national self-reliant development. Ukraine is pushed to revive piggyback traffic by two relevant market factors i.e. Europe's interest in finding accelerated ways to enter the Asian markets and the desire of "Ukrzaliznytsya" to fill a decreasing cargo transit base. The third factor, administrative, is also for the piggyback concept benefit — control of overloading on roads and significant fines in the future by the government of Ukraine implementation — of fees for road use introduction.

Today's return to the idea of piggyback launch took place in brand new for the Ukrainian transport-communication system conditions that lead to talk about serious market promotion both inside and outside the country. Thus, to date, Ukraine has lost key transit volumes associated with Russian transportations; in addition, domestic and export cargo base has been decreasing, all this makes the Ukrainian transporters not just look for a new download, but completely change the ideology to stimulate customers, attracting small and fractional lots. European carriers, having lost Russian freight traffic axis, reinforce search for alternatives at the expense of the Central Asia and Middle East markets, and here geopolitical potential of Ukraine (and

"Ukrzaliznytsya" in particular) is the best option for foreign partners. Finally, reforms processes have been launched in Ukrainian transport sector to help, among other things, establish horizontal intra-industry communications, vital for innovative types of cargo communications development.

Vivid and indicative is the fact that foreign potential partners of Ukraine i.e. the European logistics business has acted as the main engine of piggyback traffic today recovery. According to experts, if we look at the EU-Ukraine transportation statistics, the main cargo traffic goes by sea, while the rail service is unloaded. To this the fact that the exchange of goods by rail is limited geographically i.e. it is mainly performed with our country neighbours such as Romania, Poland and Czech Republic should be added. An unused but potentially important resource is a huge white spot that encompasses the Benelux countries, Germany, France and Italy that is precisely those markets through which our state could receive the most high-margin transit. It should be noted that "Ukrzaliznytsya" potential in transport communications with the EU is very large, given that volumes transported by road transport today is about 3 million tons of Ukrainian exports and at least 5 million tons of the oncoming cargo annually. Together with TCS of Ukraine road transport entities "Ukrzaliznitsa" should organize these volumes by railway platforms transportations. Today delivery of goods from China to Europe, taking 30-45 days, is the problem. It is not

suitable for high value goods. Ukraine's position here is very advantageous, and if the country can provide conditions for transit, then all sides of such relations will benefit. If Ukraine does not take advantage of this transit traffic through its territory development prospect, then a possible option would be our country bypass via Turkey or other options — via Constanta, via Poti and finally, via the Northern route.

Piggyback traffic on the "Ukrzaliznytsya" network launch took place in early 2000, when the two international piggyback routes were launched — first the Viking (Ukraine-Belarus-Lithuania) and then the Yaroslav (Ukraine-Poland). Both routes started as piggyback routes in 2003, and at the same time received the first downloads, by the end of the year more than 1.5 thousand road trains were transported on the territory of Ukraine (the Viking — 0.25 thousand units, the Yaroslav — more than 1.3 thousand). However, sustainable growth of piggyback routes download has never took place, but it existed, that prompted Ukraine to start another piggyback route train Kyiv Express (Ukraine—Hungary — Austria) in 2006. In 2009, the Ministry of Transport of Ukraine and "Ukrzaliznytsya" announced the idea of the recovery (in fact, creation) piggyback traffic network at the expense of a number of container trains of international communication such as the Viking, the Yaroslav and the Chardash (Ukraine-Hungary). This project, in fact, never left the experimental stage, because already available problems which impeded at the start were not resolved,

among them are tariff, control and cargo passes as well as lack of clear marketing policy and effective international partnership. In addition, total compression of cargo base in crisis resulted in further reduced interest in this business direction [150].

In addition to the Viking, European partners offer Ukraine the following new international piggyback routes, promising for "Ukrzaliznytsya" in terms of transit: Durzh (France) — Duisburg (Germany) — Mostyska (Poland) — Black Sea ports (Odessa/Ilyichevsk); Bologna (Spain) — Chop (Hungary/Ukraine) — Black Sea ports. Today, the goods of these destinations go through Croatia, Hungary and Slovakia, but there are a number of problems there, in particular, infrastructure price increase. If Ukraine offers an acceptable solution for transit traffic the goods will go through its territory. European logistics calculation of "Ukrzaliznytsya" reform processes, which, in particular, will help to reduce transit tariffs, and increase the flexibility of "Ukrzaliznytsya" pricing decisions (another one of the identified issues). It seems expedient to reform the tariff calculating base; it is today incredibly large for transit traffic. For example, in France and Germany the tariff varies within EUR 0.14 — 0.4 TEU/km, whereas to get to Russia through Ukraine it costs three times as much. It's not about the corruption component — the methodology itself probably fails. At the time, in the EU reforms that clarified tariff structure have been carried out. Ukraine should also change the legislation to enable "Ukrzaliznytsya" to use the European tariff structure. The

market will receive tangible benefits from this, and the national economy will feel economic impact from legislative innovations.

According to Ukrainian experts, the state with regard to piggyback traffic is still passive: the special law adoption is delayed, and "Ukrzaliznytsya" is in no hurry to form an effective tariff base.

Thus, according to ASMAP of Ukraine, the Viking, the Yaroslav, Ukraine — Hungary — Italy, Ukraine — Slovakia — Austria — Italy and Ukraine — Hungary — Austria piggyback routes are already relevant for the Ukrainian side today. The first two could be launched today, but there are a number of significant problems. Unfortunately, the Viking and the Yaroslav are not yet demanded as piggyback routes due to higher transportation tariffs, lack of regular services, as well as obsolete transportation technology.

However, it should be noted, that "Ukrzaliznytsya" has adopted a number of routes development projects together with European partners: Ukraine—Hungary—Italy/Austria (with Rail Cargo Hungary participation); Ukraine — Slovakia — Italy (in partnership with ZSSK Cargo). The strategic development goal is the joint project initiative of AsMAP of Ukraine, SNCF Logistics and Forwardis on thepiggyback traffic to Western Europe organization using the SDGNSS, SDDMRSS, RO-LA piggyback platforms. Project involving Ukraine and international logistic companies (German KBU GmbH and Turkish EKOL) is concurrently reviewed and

analyzed, that is organization of piggyback transportation to Europe by SGGNRSS platforms. It is also strategically important that the newest projects are focused on removable automobile coachwork transportation, which significantly lowers the price barrier for TCS road transport entities.

Participants of the Ukrainian market of transport-communication system share the opinion of European colleagues: It is important for Ukraine not to be late with the development of modern international cargo traffic, without which the country risks being marginalized to the global logistics system periphery. Ukrainian experts indicate that these perspectives are, in fact, being implemented. In the midterm Ukraine can expect a certain part of transit loss from China to Belarus, the Baltic States, Eastern Europe, as well as parts of Chinese imports to Ukraine. This, above all, will affect container transportations. However, if the Ukrainian customs works efficiently and quickly serves loads, it may be possible to avoid a 2009-2010 scenario, when part of the containers went to the Baltic, from where was transported to the territory of Ukraine by the Viking train [97].

Thus, there is a need to intensify efforts to attract cargo base on Mediterranean-Black Sea destinations, and it is here that intermodal transportations are becoming the most urgent.

It should be noted that the state executive bodies of Ukraine have recently been paying more attention to the implementation of existing and development of transit

potential of the country. These tasks comprise three major framework areas for the national projects implementation (in particular the Danube corridor, the development of LNG-Terminal); their implementation is expected to attract about USD10 billion of private investment.

TCS of Ukraine can perform its proper role in the economy post-crisis development, if after appropriate reforms gradually integrate into European and global transportation network. Reliable international transport communications create necessary conditions for the progressive development of the entire globalized economy. Their progressive innovative transformation in Ukraine will also help to address critical challenges in foreign trade operations and increase international traffic volume that would justify gross income from TCS functioning multiplication. Thus, compliance with European standards, in particular, gradual transition to a comprehensive use of electronic document management and electronic digital signature associated with goods by rail transportations is seen essential. Therefore national transport infrastructure into single transnational network integration is a national priority for actions in the coming years.

Modern network of freight logistics centers in Ukraine improvement and development optimization is promoted, above all, by an extensive system of Sea Commercial Ports (SCP), which are largely universal, whereas in the modern context there is a growing demand for specialized ports

and terminals which can provide effective specialized services.

There are all preconditions for inland waterways of the Dnieper River and other rivers as well as maritime systems including the deep-water fairway (DWF) Danube-Black Sea created by Ukraine in at the bottom of the Danube riverbed development.

It should be noted that rail and water transportation is inexpensive and reliable way to move cargo and passengers, especially at long distances.

In this case, water transport is economically more efficient:

-the least capital-intensive, environmentally friendlier;

-low cost of inland waterway routes development and settling;

-benefits in using larger vessels;

-low cost maintenance;

-easy integration with maritime transport.

The only disadvantage can be considered its low speed.

To date, inland waterway transport provides the lowest cost of cargo transportation in terms of per conventional ton, while the least detrimental effect on the environment (Fig. 6.18).

About 13.2 per cent of each enterprise budget is used on goods transportation. With this 60-70 per cent of the transportation cost is fuel cost. Significant economic benefit from the use of river transport where it is technically possible is obvious.

Figure 6.18. Domestic transportations by TCS of Ukraine various means of transport comparative costs analysis [150]
(transportation at 100 km distance)

The fact that in our country differs from other European countries such as Romania and Germany, which are similar to Ukraine in terms of area and presence of large vessel smooth rivers, in freight transportations structure should also be focused. If these countries proportion of river transportations is significant and amounts to 13-20 per cent, while in our country it is only 1per cent.

The major artery such as the Dnieper River, capacity is far from being fully implemented. Today this issue is one of the most relevant and significant, given the unsatisfactory state of roads in Ukraine.

In 2014 the quantity of goods transported by river, amounted to 3.1 million tons. The quantity of goods that are now delivered by road is equivalent the trips of 45,252,000 trucks, which are transported by the country's roads annually. In the event of cargo turnover in Ukraine increase inland waterways transportations development

will give possibility to avoid increased congestion of roads by approximately 474,000 trucks per year.

Cargo transportations by water save fuel costs reduce emissions of harmful substances; reduce wear and tear of highways and railroad tracks, which in consequence will save money to repair them.

In the short term, cargo transportations by river transport of Ukraine could amount to 20 million tons (Fig. 6.19).

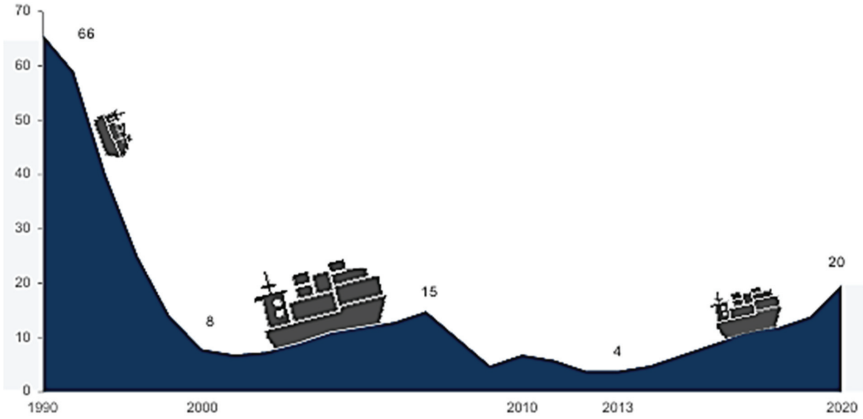


Figure 5.19. Characteristics of cargo transportation by TCS river transport and their forecast up to 2020, million tons [150]

For cargoes flows with relatively low cost density (loose goods, bulk liquids) handling / transshipment costs are rather low. Therefore, transportation budgeting process is an important factor. For such goods, the mean of transport with the lowest variable costs according to the calculated budget is the most attractive.

Figure6.20. Comparative analysis of cargo transportations efficiency *(using 1 l of fuel at 1 km)*

The most efficient in terms of fuel consumption is water transport with the lowest transportation costs of all TCS means of transport. 1 liter of fuel is enough for transporting 127 t/km of cargo by means of water transport, whereas only 97 tons / km by rail, 50 tons / km by road and even less by air can be transported on the same amount of fuel.

The above analysis indicates the need for urgent solution of relevant strategic objectives of water transport development, which must be completed to achieve TCS self-reliant development level.

The following, not less important aspect requiring deeper study is trans-shipment terminals availability.

Thus, if road transport in Ukraine allows delivering cargo to virtually any destination, other TCS means of transport have certain limitations. Trans-shipment terminals availability allows carriers to use more efficient railway and river transport simultaneously with broad roads network access.

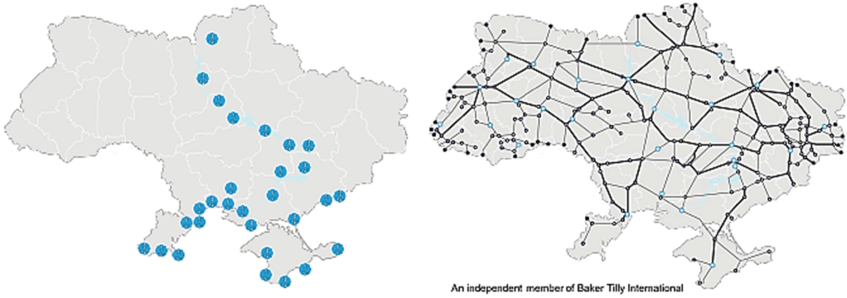


Figure 6.21. Trans-shipment terminals in TCS of Ukraine comparative characteristics: port infrastructure and rail network [150]

However, it should be borne in mind that cargoes transportations by several means of transport have increased the overall logistics costs due to trans-shipment.

On long distances costs associated with transshipment are largely offset by lower transportation costs inherent in rail, river and sea means of transportation. Of all means of transport, as already noted, river transport cannot realize its potential, and one of the significant reasons for this is transshipment facilities shortage.

River infrastructure modernization, river fleet increase and joint projects (such as Vistula – Bug – Dnieper) in the framework of the trans-European TENT – T network implementation will allow Ukraine to use export advantages of its geographical location.

From the point of view that river transport costs are considerably lower than rail and road costs, companies that distribute their products in the countries of Western and Northern Europe can reduce their transportation costs. Those who purchase in these countries will equally save.

Figure 5.22. Waterways as an export potential for TCS river transport of Ukraine development diagram [150]

River transport in Ukraine will be of interest primarily for grain, iron ore and metals exporters, whose facilities are located next to the river ports.

Thus, all the above mentioned indicates that taking into account segmental changes in the world market of goods and services structure is strategically important; sharp fluctuations in commodity markets has resulted in significant structural change in world trade and, in particular, has led to a refocusing of its intercontinental strategic directions. As a result, since the mid 1980s there has been a strong tendency to increase trade between the countries of Western and Central Europe on the one hand, and the Asia-Pacific region, Southeast Asia and the Indian subcontinent on the other. At that the average annual

growth rate accounts for 5-13 per cent. Analysts of the United States, Japan and Western Europe unanimously predict a continuation of this trend with mass merchandise from Asia to Europe simultaneous increase. Therefore, for Ukraine, which is located at the crossroads of trade routes between Europe and Asia, and therefore objectively should play the role of a sort of geopolitical bridge, the main task is its transport and resource capacity use optimization through the supporting network infrastructure further development [6].

Advantageous geographical position of our country on the way of transit flows between Europe and Asia, as well as an extensive railway network with ice-free Black Sea ports and system of roads availability create preconditions for increasing transit traffic of goods and passengers in the North-South and West-East directions and export-import transportations volume increasing in accordance with foreign trade needs. Ukraine's integration into Europe-Asia transport system through the conditions for fast, safe and high-quality transportation of goods and passengers across the country creation will turn potential competitive advantages into real economic achievements, increase transport services volume and their share in the created national gross domestic product.

A number of projects involving the development of Euro-Asian linkages between Europe and Asia bypassing the territory of Ukraine by foreign states initiation requires from the Ukrainian government its own strategy for the transport network development forming, the most

important infrastructure projects construction and transit freight traffic attraction at the earliest possible date [240]. After all, transport sector sales volume (only transit through international transport corridors, axes, networks where railway and automobile are key components creation) are comparable with oil, gas, metals and grains export volumes and can turn into one of national exports main articles in the case of large-scale geo-economic and geo-strategic programs and projects implementation.

In our opinion, for the nearest future transit should be considered as a strategic element of Ukraine's political and economic power. An example of income from transit significance is the fact that about 16 per cent of GDP in Latvia are revenues from transit [37, p. 14].

Today developed pipelines system, railways network, air routes as well as highways in the latitudinal and meridional directions are in the state's strategic transport arsenal. Total transport network of Ukraine includes 46.3 thousand km of major pipelines, 21.655 thousand km of railways and 165.8 thousand km of paved roads, 4.8 thousand km of main oil pipelines, 39.8 thousand km of gas pipelines and 1.0 thousand km ammonia pipelines [46]. At that the railway network length of Ukraine ranks second in Europe; according to English Institute Rendall estimates we have Europe's highest transport transit rating of 3.11 points, taking into account the development of networks located in transport systems, as well as the infrastructure level and condition [23, p. 8].

All means of transport are developed in Ukraine. There are 372 km of railway tracks, 78 km of inland waterways and 2,800 km of paved roads for 10 thousand km^2 of the territory. Most goods and passengers are transported by rail and road means of transport. Public roads network in Ukraine includes 172.4 thousand km of roads, of which 164.1 thousand km are paved (without taking into account municipal, departmental, internal economic). At that almost all roads in Ukraine run through populated areas that do not meet the international transport corridors requirements, because it leads to the road transport speed limit. The European standard high-speed highways (motorways) length is about 300 kilometers, while in France it is more than 8 thousand kilometers.

Over the past 15 years, TCS has been influenced by a number of negative factors such as high levels of wear and tear of productive assets and, primarily, vehicles, means of transport in adequate quantities to meet the economy and population transportation needs lack, transport industry poor financial condition, lack of adequate government funding, poor competitiveness in the international transportation services market, insufficient investment in technical-technological modernization, technical re-equipment and the like. [218].

It must be borne in mind that the current state of rolling stock of TCS capacities requires almost complete updating to maintain competitive and safe level of transportations.

For example, to date railway rolling stock locomotives fleet depreciation is more than 90 per cent, and for freight wagons fleet it is 82 per cent.

Physical depreciation of inland waterway transport facilities is about 80 per cent.

In terms of cost outlay for the rolling stock renewal need, river transport would require the least investment amount (Figure 6.23). Thus, for example, the cost of a mixed-type river-sea vessel with a carrying capacity of 500 tons is estimated to about USD 12 million.

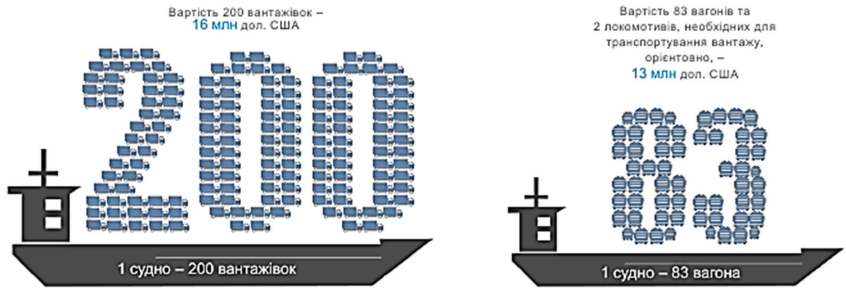


Figure 6.23. Comparative cost characteristic of TCS production capacity (for calculation of conditional 5,000 tons of cargo transportation)

In the context of material and technical reserves exhaustion and lack of financial sources for production facilities modernization and renovation budgetary resources cost structure reorientation in favour of the country territorial integrity maintaining requires a change of state support priorities perspective in determining strategically important sectors of economy, transport industry of which requires special attention. Public policy documents on transport sector further

development analysis reflect the lack of a unified strategic vision of available transport capacity utilization in order to economic self-reliance and national security achievement.

Given the above, a unified strategy for transport-communication system development formation and a number of policy documents aimed at transit cargo flows attracting, working-out and implementation should be promoted at the highest state level, namely:

- Strategies for transit through the territory of Ukraine until 2030 development. The basis of traffic forecasting, which should provide for cargoes on the territory of Ukraine transportation rules simplification, including in accordance with rules and regulations of the common transit procedure in force in the EU, simplification and modernization of customs and border formalities at the EU borders, the number of documents required at border crossings reducing, etc.;

- State Target Program for the Transport Network of Ukraine Development National Priority, which should include infrastructure development according to transit cargo flows perspective directions, national transport routes into the TRANS-European, TEN-T and Euro-Asian transport networks integration;

- State program for multimodal and intermodal transportations development that would provide attraction of transit transportations entities through the territory of Ukraine;

- Public-private partnership concept in transport sector development, which, in particular, should provide mechanisms for engaging private sector in transport infrastructure project planning, financing, construction and objects reconstruction, and should identify ways and directions of budget support as a factor stimulating public-private partnerships in the transport sector improvement;

- Strategies to attract partner countries, international organizations and private capital to TCS of Ukraine infrastructure development [218].

We believe that it makes sense to seriously rethink Ukraine's strategic partnership with China potential and determine their prospects, which may emerge as a result of cooperation intensification. This is primarily due to the terms of a new doctrine of Ukrainian politics in Eurasian and European directions, that is new security perimeter and, accordingly, new development perimeter formation [220].

China is an extremely promising in economic and strategic terms country applying for the role of the second superpower in today's world and the BRIC group member. Ukraine, in turn, is the second CIS country in terms of the territory size and geographically it acts as a kind of way to Europe for China. Thus, priority directions of cooperation between the two countries with transport direct participation development acquire strategic importance. The countries of the European Union are very interested in using the unique transit opportunities of Ukraine, because it is through the territory of Ukraine that the

shortest routes for goods and passengers movement from Scandinavia, Great Britain, the Baltic, and Western Europe countries to the Eastern countries, including China, can be laid. For some transportation the advantage can be up to 2,000 km. And it is not necessary to build new roads. Transport routes in Ukraine network, first of all, road and rail, fits into the European -through Poland, Slovakia, Hungary, Romania, Moldova, Belarus and Russia. It also covers and ice-free seaports of Black-Azov Sea basin, which is particularly valuable for Ukraine-Chinese cooperation in the field of transport.

In particular, such "Cretan" corridors as No. 3 (Berlin-Wroclaw-Katowice-Lviv-Kyiv), No. 5 (Lisbon-Barcelona-Trust-Budapest-Kyiv), No. 9 (Helsinki-St. Petersburg - Vitebsk - Kyiv - Chisinau - Plovdiv - Saloniki) and No. 7 (Danube) pass through the territory of Ukraine. Their intensive use can significantly increase state and regional budgets income; will contribute to road infrastructure development in transport and all involved industries as a whole [153].

Ukrainian and Chinese economies are complementary rather than antagonistic, that indicates a high ratio of commodity groups' exports in Ukraine to these groups' imports in China. China's imports specialization index calculation testifies the country's dependence on imported commodity groups in which Ukraine has competitive advantages.

China is interested in logistics and transport-communication system of Ukraine development that

would speed up and reduce the costs of freight and passenger traffic of China with the European Community countries. Another interest is in broad consumer potential of Ukrainian domestic market.

According to the General Customs Administration of China, in 2014 cargo turnover between Ukraine and China totaled USD 8.594 billion that is 22.7 per cent less than in 2013. At the same time, goods from Ukraine export amounted to USD 3.486 billion (6.5 per cent growth) and import amounted to USD 5.108 billion (34.9 per cent decrease). Bilateral trade surplus in China favor amounted to USD 1.622 billion. Basic positions of Ukrainian exports to China in 2014 continued to be held by mineral products (mainly iron ores, slag and ash, energetic materials, etc.), the share of which amounted to 65.9 per cent of total exports to China, and the total volume amounted to USD 2.297 billion; fats and oils of animal or vegetable origin - 12.9 per cent (USD 450.8 billion); plant products (mainly cereals) - 8.7 per cent (USD 302.0 million) wood and wood products - 7.0 per cent (USD 242.6 billion), mechanical equipment, machinery, equipment and mechanisms - 2.0 per cent (USD 68.5 million), base metals and articles thereof - 1.1 per cent (USD 38.6 million). Other items of Ukrainian exports to the PRC do not exceed 1 per cent in the total export structure.

As of January, 01, 2015 investments in Ukrainian economy from China amounted to USD 24 million (since the beginning of the year, this figure declined by USD

1.6 million). The largest amount (30.5 per cent) of Chinese investment is directed to enterprises in industry sector, including enterprises of woodwork and timber industry - 20 per cent; agriculture - 20 per cent; transport - 15 per cent; wholesale and retail trade - 14 per cent. According to the Ministry of Commerce of China as of January, 01, 2015, the total volume of attracted Chinese investments in Ukrainian economy amounted to USD 55.98 billion [240].

The above proves that Ukraine is strategically interested in active participation and expansion of international cooperation with China perimeter development, especially in the area of foreign trade activities volume as a source of foreign exchange earnings increasing, but its significance as a partner should be considered from economic self-reliance and ability to defend national interests' standpoint. The growing demand for transportation services along the East-West axis and transport-communication systems in neighbouring countries intensive development is a signal for Ukraine on the need to ensure effective international cooperation on our country into the Europe-Asia transport system integration and overcome a significant number of outstanding issues regarding national transport infrastructure development and domestic transport-communication system competitiveness enhancing. To date, the volume of trade between Europe and Asia exceeds USD 1 trillion and with an average 5 per cent per year trade growth it will have doubled and exceeded USD

2 trillion by 2030. The goods are mainly transported from Asia to Europe, but in the next 10 years, the flow of goods should become bidirectional. European producers are interested in penetrating to the markets of China, which gradually turns into the world's largest consumer [240].

Not less strategically important in ensuring national economic security mainstream is cooperation with China as innovative technologies in military-technical sphere exporter.

A.V. Ermolaev at "Ukraine-China: Towards Strategic Partnership" round-table meeting rightly indicates that the most important for us in the development perimeter issue is apparently that modernization of Ukraine in conditions of tough competition, key resource areas and areas associated with technologies distribution impact changes plays the role of an engine, a kind of locomotive that can ensure modernization changes in the country; new growth centres that are major consumers of industrial resources, engineering products and high technologies in the country can play a key role in economic development and self-reliance achievement. Therefore, we have an actual dual problem: firstly, to maximize cooperation resource utilization in order to attract investment for the industrial base modernization and simultaneously to restore Ukraine's potential as an exporter of technology. We have potential not only in the market of high value-added goods, but also in the market of intellectual products, as well as in the technology market. Therefore, for Ukraine cooperation with growth centers is both the

exchange of experiences and capacity-building in scientific cooperation. Especially in fundamental areas, which today are the leaders in new technologies development: aerospace, nanotechnologies, etc. [215].

Thus, today we have a unique chance to deepen cooperation with China and implement the reconfiguration of the further development perimeter in order to ensure national security. To do this, the priorities are: firstly, to utilize cooperation resource in order to attract investment for the industrial base modernization, and, secondly, to utilize transport capacity in order to increase foreign exchange earnings and strengthen self-sufficiency.

Preceding from the above strategic directions for national transport-communication system the following tasks of the first order should be allocated:

- TCS domestic infrastructure development and improvement in order to increase transitivity:

- river transport development in order to reduce transportation cost and cooperation with Western and Northern Europe countries development;

- piggyback as a form of effective integration in the international transportation of goods by road and rail transport development;

- export and TCS transit services volume increase by expanding cooperation perimeter, in particular, cargo transportation intention should be concentrated in the direction of Ukrainian-Chinese relations;

- cooperation with China as one of the largest consumers of Ukrainian transport military equipment and technologies deepening with the purpose of obtaining foreign exchange earnings and ability to update domestic TCS material and technical base;

- single legal framework which is coordinated with European laws and standards creation promoting effective mutual cooperation with foreign partners on the basis of transparent and secure conduct of business foundation;

- unified bodies of coordinated management of the country's transport-communication system capable of harmonizing all parts of TCS in a single process interaction.

Concerning the strategy of TCS self-reliant development, it includes fundamentals conceptual definition and this strategy directions from the perspective of problems of socio-economic development solving and concrete measures on assigned tasks realization working out, and therefore involves a set of actions and activities that should be undertaken by the state authorities, in particular the Ministry of Infrastructure, etc. within the limits of their functions and powers in the sphere of transport-communication system of Ukraine transport activity entities with the purpose of specific tasks and goals solving. Thus, strategy of TCS self-reliant development can be seen as a system of state and regional authorities long-term actions and intentions to manage formation, distribution, redistribution, and utilization of existing and potential resources processes

aimed at their financial self-reliance ensuring based on GI_{TKS} volume increasing, as well as self-reliant and safe development in general that goes from state-level objectives in the TES interests and capabilities and takes into account global externalities barriers.

The subjects of formation the strategy for TCS self-reliant development ensuring are the authorities of both national and regional levels, and the subjects of its implementation are all subjects of transport-communication system, as well as legislative, executive and judicial authorities, public organizations and associations.

Thus, the strategy role and importance in achieving TCS development economic self-reliance is reduced mainly to: determining necessary resources that would allow sufficiently meet transport-communication system needs; establishing directions for all resources efficient utilization; identification and easing external sources of funding dependence. That is, such a strategy provides self-reliance ultimately in three directions: providing ways to increase gross income from TCS functioning volume and thus financial self-reliance achieving, TCS economic self-sufficiency, and then ensuring national self-reliance and national security of Ukraine.

Increased revenues from transport-communication system sold freight services positively affect both its level of financial sufficiency, and TCS economic self-sufficiency. Increasing the level of transportation system self-reliant development guarantees national self-reliance growth.

Financial resources self-reliance and socio-economic system of Ukraine financial stability are prerequisites for national security ensuring (Figure 6.24).

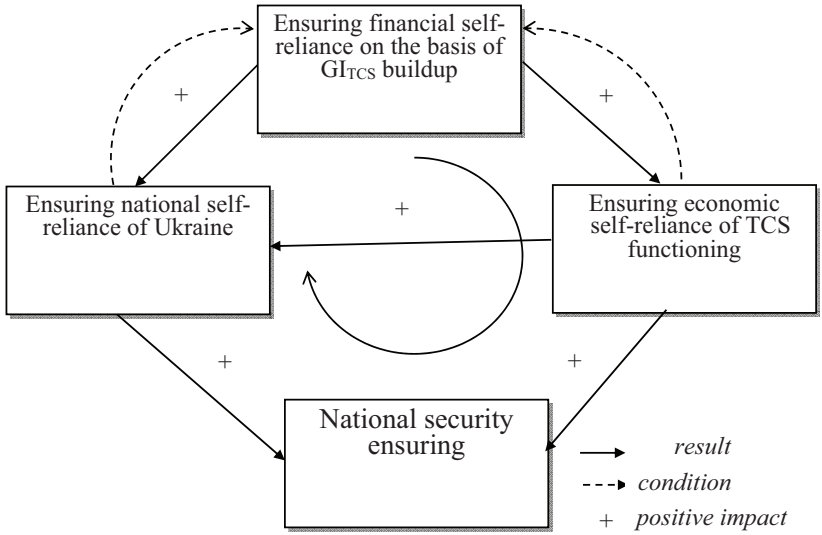


Figure 6.24. Schematic model of self-reliant development and ensuring national security strategic directions interrelation

** Source: developed by the author*

Weighted strategy choice allows concentrating transport-communication system efforts and resources on gross income generated from TCS functioning buildup, and thereby ensuring transport system self-reliant development level and generally national socio-economic system self-reliant and safe development. Note that TCS self-reliance can serve as transfer-factor of self-reliance and national security of Ukraine.

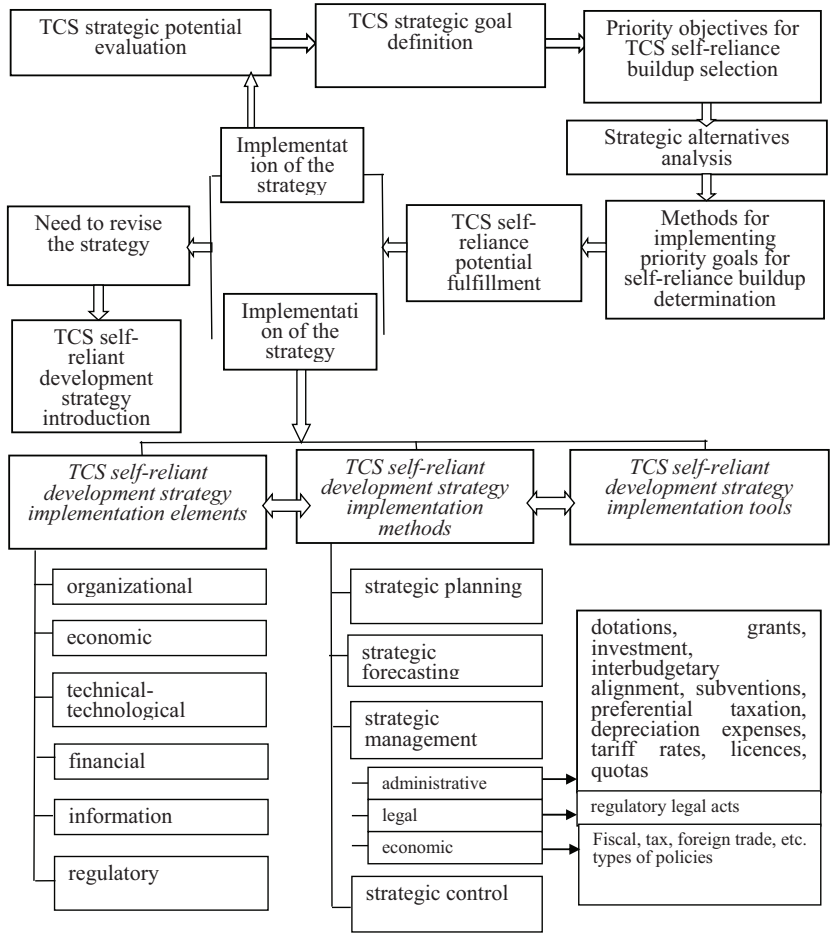


Figure 6.25. TCS self-reliant development strategy implementation algorithm

** Source: developed by the author*

Since the process TCS self-reliant development strategy design is complex and multidimensional, we will submit it in the form of diagram (Figure 5.26).

As you can see, the process of the "4T" strategy formulation consists of a collection of interrelated stages.

Consider the content of each of the stages of TCS self-reliant development proposed strategy.

The first is TCS strategic potential evaluation, which enables to determine its development priority directions. Ignoring such an approach could lead to theoretical content of self-reliant development strategy separation from those taking place in transport system at its development moment and, as a consequence, to results of the strategy as a whole implementation reduce.

The second stage consists in defining and shaping TCS self-reliant development ultimate strategic objective, as a certain integral objective with parameters to which the optimal system seeks specification. Integral it is due to the fact that is created from private objectives totality. Accordingly, general strategic objective should meet the requirements of feasibility, objectivity and reality.

According to TCS self-reliant development general objective its basic tasks are justified.

The third stage of the "4T" strategy development is its priorities, primary objectives of increasing transport-communication system economic self-reliance establishment which requires their ranking regarding importance and achievement complexity.

Coherent objectives and criteria definition provides the ability to manage by results, motivation system creation, which enhances strategic development programmes success; availability and comparability of variant solutions evaluation provides the resources on the strategy priorities concentration.

The fourth stage consists in strategic alternatives analysis and, on this basis, in a justified choice of the most optimal strategy. Rationale for the choice of a strategy from existing alternatives is one of the most important and difficult tasks of transport-communication system of the country perspective functioning strategic planning, the result of which is the best options for achieving the identified in the "4T" strategy objectives selection.

Strategic alternatives definition is to identify real opportunities that are most appropriate in a particular situation from the existing ones. Justified choice of the strategy provides for taking into account the results of strategic forecasting object evaluation and other analytical materials for calculating the set goals resource support.

The fifth stage of TCS self-reliant development strategy is to choose a strategy for economic self-reliance of transport-communication system buildup.

Thus, we have revealed conceptual bases of TCS self-reliant development strategy formation through the four priority goals of "4T" strategy implementation

- existing transport-communication infrastructure (TCI) optimization and upgrading;
- advanced technologies in the activities of all TCS parts introduction;
- export volumes i.e. TCS services trade increasing;
- transit perimeter expanding.

6.3. TCS OF UKRAINE SELF-RELIANT DEVELOPMENT STRATEGY IMPLEMENTATION MANAGEMENT

It should be noted that the "4T" strategy implementation as an element of strategic management structure consists of the strategy fulfillment and launching. Strategy fulfillment involves providing conditions for the direct strategy launching, thereby being a subsidiary process. Transport-communication system development strategy launching involves specific actions defined by the strategy fulfillment process [217]. The strategy implementation monitoring provides feedback that enables to adjust the goals and objectives for transport-communication system as a socio-economic system development. This element of strategic management objective is the results of achieving goals stages on their final achievement impact evaluation. The monitoring need is due to the environment transformation, constant emergence of risks and threats, and, therefore, new opportunities for TCS self-reliant development. Strategic control focuses on destination state approaching that defines a number of tasks:

– benchmarking for evaluating the strategy implementation and the required level of funding;

– priority of pay-off estimate of the activities for the strategy implementation for budget execution;

– pay-off with control level comparison and decision on the further strategy implementation expediency.

Elements of transport-communication system as a socio-economic system strategic management structure analysis allows concluding that this type of management is aimed at achieving the position that will ensure this sector of national economy effective functioning in turbulence conditions.

Managing transport-communication system development means managerial decision making aimed at all subjects included both in TCS structure and other business structures of transport-communication system development. Territorial development management is in managerial decisions regarding regional TCS development, divided according to the territorial principle (regions of the country), as well as concerning various business structures of the sector that function in a particular territorial entity and influence its socio-economic development. Managerial decisions towards transport-communication system institutional infrastructure development assume financial component totality, innovation sphere, information technologies etc.

TCS self-reliant development strategic management shall be carried out through the rules that make up the four basic groups observance.

The first group of rules is constituted by the criteria for all parts of the transport-communication system performance evaluating, i. e. TCS functioning impact on economic and social development.

Regulation of TCS relations with other national socio-economic branches and/or systems, as well as state

regulation principles, principles and mechanisms of competitive advantages relative to other means of transport achievement are defined by *the second group of rules*.

The third group of rules governs the relations that develop within the country transport and economic space between authorities at both national and regional level, as well as businesses and TCS services consumers.

The fourth group includes rules that serve as the basis for state administration in prompt managerial decision making that have an impact on the long-term and medium-term directions for transport-communication system development.

This kind of management theoretical aspect determines *TCS self-reliant development strategic management as a set of complex, dynamic and interrelated management processes, as well as strategic vision forming process, setting goals, developing and implementing a strategy for self-reliant development as well as their necessary adjustments*.

In this regard, transport-communication system strategic management structure should be seen as a combination of several elements, which functions implementing constitute the strategic management process.

Providing stable and sustainable transport services to the economy and the population of Ukraine, security of the state, as well as a positive impact on the country socio-economic development constitute the mission of transport-

communication system functioning. Direct determination of goals for TCS development in Ukraine is in direct dependence on its functioning impact on the economic and social development of the country, regions, industries, i.e. on transport-communication system goal orientation.

In general term *national TCS self-reliant development objective is to maintain this system in such a balanced state that allows ensuring the country's socio-economic development mainly at the expense of its own resources, helping to reverse dangers and threats of internal and external nature, thus ensuring its integrity and national security*.

TCS self-reliant development management strategy is objectives and programmes certain compliance, distribution of various resources to perform a course of actions aimed at economic self-reliance goals achieving, i.e. is in accordance to the following structure: goal — courses of actions — resources [6].

The developed strategy effective implementation need determines a set of conditions identification (which could include organizational environment, resource support organization system, flexibility to the changing conditions of external externalities, emerging threats and risks and mechanisms of reactivity and resistance development, etc.) that defines transport-communication system as a managed object in a favourable or unfavourable economic conditions functioning.

Note that transport-communication system as a socio-economic system strategic management direction should

be characterized by the principles of coherence and relative symmetry, thus ensuring the unified TCS within TES effective functioning, which directly affects socio-economic development of the country as a whole. Consequently, TCS self-reliant development strategic management enables to minimize the probability of risks and threats of different nature such as informational, economic, political, environmental, military, etc., whereby it is possible to meet the needs of society and economy in TCS competitive services.

The main tasks in establishing the "4T" Strategy effective management system implementation are: strategies of TCS constituent entities with the specified strategy integration; strategy implementation with resource-supporting sectors of national socio-economic system linking; effective organizational models for the strategy implementation development and adoption; system of supervision and control development; system of statistical accounting in transport-communication system development; system to monitor implementation of targeted programmes and policies both at national and regional levels establishment; information-analytical system of management strategy creation and development; strategic planning system based on self-reliance balance establishment; automated information-analytical system of communicative management system in Ukraine creation and development.

In addition, the need to develop an effective management system for state-owned facilities and assets,

and resolve issues to improve TCS territorial management by creating regional governing bodies and competences between them and transport-communication system national authorities delimitation with a gradual transfer of a significant part of control functions to the regional level.

The "4T" strategy implementation involves a combination of risks that may impede the planned results achievement. Such risks could include macroeconomic, geopolitical, operational, social, technological and environmental risks:

Macroeconomic risks are associated with socio-economic system development and business activity in transport-communication system slowdown possibility as a result of budget deficit as well as political and economic situation in the country destabilization.

The sources of these risks are:

– lack of financial resources due to accelerated growth of prices in the economy supplying products for transport-communication system;

– decline in freight traffic due to the poor state of transport infrastructure;

– decline in freight traffic due to changes in their structure, high-tech goods share growth;

– transit freight traffic decline due to alternative foreign routes by-passing Ukraine development;

– lack of TCS production capacity and low technical and technological level of domestic mechanical engineering development;

– related means of transport infrastructure unbalanced development (lack of port facilities and storage terminals, etc.);

– destabilizing political and economic factors of external and/or internal nature on the stability and security of all branches of transport-communication system functioning influence prevalence.

It is therefore advisable to develop the "4T" strategy mechanisms and implementation plans in such a way as to minimize possible negative impact of such risks in its implementation.

CONCLUSION

Theoretical general conclusion and a new solution to the scientific problem of socio-economic system of Ukraine self-reliant development based on transport-communication system as one of the leading components is presented in the monograph.

The research results have made it possible to form theoretical and scientific-practical conclusions, the main of which are the following.

The beginning of the 21st century is characterized by the world space increasing complexity that requires competitive stalemates capable of balanced dynamic development in external externalities turbulence conditions. One of such structural competitive stalemates is Ukraine, as a complex, integral, multidimensional socio-economic system, which has all the potential to take its rightful place among the globalization arena actors. That is therefore, self-reliance research problem as a cross-cutting factor for ensuring national and, in particular, economic security of Ukraine is particularly important and meaningful.

Historical and evolutionary approach to socio-economic systems self-reliance evaluation evidences that self-reliance in its gnoseological essence is derived from the autarky. As a part of the study it has been discovered that the "autarky" and "self-reliance" concepts content identification, that is fairly common in modern scientific

literature, is erroneous. In fact autarky inherently denies market economy conditions, and therefore may not reflect versatility of polyphonic socio-economic system in the globalization self-reliant development process context.

In this work it is proposed to explore self-reliance from two perspectives that are in statics and dynamics. In statics self-reliance serves as a tool for economic growth, and in dynamics it is an indicator that shows the system status, which displays the point of a specific socio-economic system or its specific segment between the two poles (that are open economies and autarky) from the development trends perspective. A self-reliance classification apparatus in the 24 features context has been proposed. Self-reliance indicative function has been proven. Self-reliance scientific concept basic principles have been justified. "Self-reliance corridor" scientific and methodological essence has been proven.

A three-dimensional model for transport-communication system self-reliance has been proposed by the author of the monograph that are: У-axis is conceptual ideas concerning transport system development and its strategic importance diachronic analysis; X-axis is conceptual views on the global development process genesis; Z-axis is self-reliance conceptual ideas and its role in national socio-economic system development analysis.

Based on theoretical and methodological generalization and the world leading countries economic models key components study results, a conceptual foundations model of self-reliant development of Ukraine

has been proposed. Economic self-reliance principles system-wide set is proved. Scientific recommendations, which consideration will improve our country's socio-economic development model and increase its self-reliance level, are proposed by the author. Self-reliance processes further study, due to the global economy, as a result of the countries-innovators active actions, dynamic development; new challenges and threats to safe development emergence; and new development prospects identification, must be taken into account in the state administration practice. A new model of self-reliant type of development based on the knowledge economy further scientific and practical investigation is of particular importance. Strategic prospects for national socio-economic system key sectors, such as transport-communication system, innovative development assess is particularly important.

Parametric identification of the Ukrainian transport-communication system analysis results has been identified as follows:

-For Ukraine, as for the other developed countries of the world, transport is national economy basic sector, an essential part of production and social infrastructure;

-In innovative capacity in the transport sector of the economy permanent build-up and this communicative environment sealing context, an obvious fact of organic information and communication systems into transportation system installation has been revealed. This factor in the context of modern externalities ignoring and

focusing only on the system transport component does not fully reflect their coherent unity;

-Terms such as "transport complex", "transport road complex", "transport system", "transportation system", which, in the face of constant financial and economic challenges, require meaningful transformation and adjustment use. In this regard, we have proposed and justified "Transport-communications system" category interpretation.

Transport-communications system is an artificial, particularly complex spatially -temporal, multifunctional, ergatic, techno-technological, socio-economic and organizational open system that: is an aggregate of interacting and independently functioning means of transport to meet population and social production transportation needs; serves as a point of economic growth and enhance national competitiveness in globalization context; is the transfer factor in national socio-economic system self-reliant development level ensuring; is an instrument for foreign economic objectives of development and integration implementation; is a factor in resistance to national security external threats.

Complementarity principle as transport-communication system basic attributive functioning principle, which lies in coherence, mutual complement and diffusion of communication and transport structures, ensuring based on their properties correlation in space and time has been proven. Under TCS structural elements complementarity we understand their attributive

property to act as interdependent and mutually influenced objects in a space-time continuum.

In the work methodological apparatus of spatially-temporal socio-economic systems has been substantiated and "transport and economic space" concept has been introduced into the scientific terminology. TCS structural organization with three strata allocation is proposed by the author, namely: Transport-Infrastructure-Interface. Possibility of obtaining system-technological resource synergy with TCS structural and functional organization improvement has been proven.

TCS binary behavior phenomenon, which defines safe development functional properties, is emphasized in the monograph. TCS functional apparatus binarity in its essence and economical nature is expressed through heteropolar factors combination on safe development by relevant effects of its implementation influence.

TCS functional classification in four features context, where "socio-economic system development stimulating" is marked as the key sign, is proposed by the author, i.e. the role of transport-communication system in promoting innovative, self-reliant, integrative, cooperative, regional and globalization development is justified.

In a period of globalization and macroeconomic stagnation, the need for transport-communication system as a priority area, capable of generating gross domestic income in the state budget and to become one of the main tools to ensure national security, recognition is strategically significant. Its value has increased even

more after the political crisis and military actions on the territory of Ukraine during 2014-2015. Recent trends analysis testifies that Ukraine is losing its position in virtually every world index.

Unfortunately, Ukrainian transport-communications system current condition is characterized by financial conditions critical level and practically worn out rolling stock and infrastructure. In cargo transportation structure, the largest share belongs to railway transport, and passengers' transportation is dominated by the road transport.

Low level of technical-technological and economic parameters for most types of domestic vehicles which do not meet international standards, leads to an inevitable loss in world competition on transit services market. Therefore, foreign transport and forwarding companies are expanding into the Ukrainian transportation market. Particularly acute this situation is felt in maritime and air transport.

Methodical instrument to determine economic self-reliance level, that is self-reliance balance, has been developed and proposed by the author of the monograph. Self-reliance level assessment has revealed that in 2014 domestic transport-communication system did not reach the "self-reliance corridor" lower boundary and amounted to 61.27 per cent with the necessary 62 per cent.

Economic self-reliance as an economic and social system regime (mode) notion, involving operating costs primarily from its own funds sources (from 62 to 100 per

cent), has been defined and justified. A comprehensive mechanism for TCS self-reliance promoting has been proposed.

Based on scientific works comprehensive analysis, self-reliance is proved to be self-reliant development dedicated function. The state will be able to ensure national security, especially in the event that it mainly relies on its own strength and is economically self-reliant. Further to this, transport-communication system of Ukraine exceptional role in economic self-reliance and therefore national security ensuring assertion is quite logical and understandable. Transport security serves as an integral structural element of national security.

Constructive difference between transportation security and transport safety concepts has been demonstrated. Transportation security is the vital interests of a man and a citizen, society and the state (TCS service consumers), objects and subjects of transport-communication system security, which provides a self-reliant development, timely identification, prevention and neutralization of real and potential threats to the national interests.

Species structure system for transport safety has been proposed by the author. Despite the species complexity, any mean of TCS transport safety system must guarantee three basic types of safety, namely: Safety – goods, vehicles and security of passengers and carriers safety, i.e. transportation security; Protection– transport and economic space from external hazards and threats effects

due to emergency situations, natural disasters, terrorist acts, etc. safety; Defence – society against TCS functioning negative factors protection, that is, loss of life and health of the population as passive participants in transportation process as a result of anthropogenic and man-made TCS influences.

A mechanism for TCS self-reliance in transport security system ensuring has been developed and presented in the monograph.

In addition, the author has developed and deepened the "information security" notion substance, which is an individual, society and the state security against information that is harmful or illegal, and impedes an individual, society and the state self-development.

An algorithm to analyze and evaluate threats to the TCS critical infrastructure information security has been developed and presented in the monograph work. Critical infrastructure, among other things, includes energy and transport backbone networks, oil and gas pipelines, seaports, railway stations, high-speed and government communications channels

The author has proposed and justified the need to introduce "resistance" notion in socio-economic system safety management context into the scientific terminology. Resistance in a socio-economic system development appears as the system "genetic" property to survive (save itself from destruction); socio-economic system development cross-cutting function; socio-economic system self-reliance indicator; structural

elements of the system, ensuring its viability and resilience to destructive influences, organization and interaction form; national security mechanism. In addition, resistance mechanism in the system of self-reliant and safe development of socio-economic system ensuring has been developed in the study.

Rezistenciogenezis structural and procedural model has been established. Rezistenciogenezis is a process of resistance scenarios in socio-economic system past, present and future states interaction developing. In other words, it is an evolutionary metamorphosis resistance experience gained by socio-economic systems for its self-defense and survival. The author also proposed and interpreted socio-economic system "resistant plasticism" concept as a socio-economic system ability to adjust to structural reshaping with the view to protective properties strengthening.

The results of casual and correlative-regression analysis indicate that dominant factors of TCS gross income growth and therefore transport-communication system self-reliance are export volume, turnover, investments into the transport system and transit traffic volume. TCS self-reliance of Ukraine econometric forecasting model has been proposed and justified in the monograph. From the data received, we should forecast that transport-communication system of Ukraine enters the self- reliance corridor in 2016, i.e. aggregate earnings of own financial resources will cross the lower boundary of the "corridor" and self- reliance will reach 64.5 per cent.

While maintaining the trends of significant parameters, the effective indicator positive dynamics is observed. So, in the declared parameters in 2026 presence, TCS self-reliance will be below the average level i.e. below the "self-reliance corridor" median (81 per cent) and will amount to 74.61 per cent.

Conceptual transport-communication system self-reliant development strategy as the four dominant components development strategy, i.e. the "4T" strategy, which seeks to enhance self-reliance level is justified and proposed by the author. The major dominants of TCS functioning gross income build-up are: transport-communication infrastructure (TCI), trade, technology and transit. It should be emphasized that all four objectives, namely transport-communication infrastructure, technology, trade and transit are closely related and bound in the proposed "4T" strategy. The algorithm of TCS self-reliant development strategy of the "4T" implementation has also been developed in the monograph.

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