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Innovative Value Creation in BRICS

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Abstract:

The main scientific problem is the development of the cost modeling methodology of value-added accounting for the purpose of obtaining estimates of the value-added level of innovative products, which is necessary for making managerial, investment, production and other decisions at all levels of management and for monitoring the results of such decisions.

The purpose of the article is to develop a methodology for accounting for the value added of innovative products, regarding the technology readiness levels for commercialization based on the analysis of problems and growth points of the national economy using the example of the BRICS international collaboration.

The article revealed the features of innovative development of leading and developing countries, the need for the national economy in international collaborations to intensify innovative development, the existing problems in accounting for the value added of innovative products, the developed proprietary methodology for accounting for the value added of innovative products, regarding the technology readiness level for commercialization.

The theoretical significance lies in the development of methodological foundations for accounting for the creation and distribution of value added, and the practical significance is determined by the fact that for the first time the methodology takes into account the technology readiness levels for commercialization, which gives a new approach to the practical assessment of the value-added innovation.

Keywords: *Innovation, activity, BRICS, cost, value theory, international economic order and integration.*

JEL Code: *D24, D46, F02, O3.*

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1. Introduction

The development of any country now is unthinkable without innovations, the world is on the threshold of the fourth industrial revolution and capital flows (including intellectual ones) are heading to the centers of innovation development. The BRICS countries have historical features of development and the specificity of the emerging markets, which are oriented first to either traditional industries or natural resources. In this regard, the consortium pays much attention to the intensification of innovative development. The hypothesis of scientific research is as follows. High-tech sector gives a significant increase in value added; however, depending on industries and countries, the level of created value will differ. It is therefore particularly relevant issues of accounting methodology of creation and distribution of value-added of products.

However, the assessment of the value added of innovative products has a number of features associated with the specifics of various high-tech industries and differences in the proportions of value created, depending on the technology readiness level (TLR) and, consequently, on the possible sources of innovation financing. To do this, the study proposed the normative methodology for formation of innovative products, taking TRL into account.

According to macroeconomic statistics, the new round of scientific and technological progress, which has a high spreading rate, has increased the gap between countries in their economic development, and in many ways has changed the economic models of society and the strategic principles and approaches characteristic of the stage of the information economy. Various official scientific associations collect and publish data on various indicators of innovative development, including those associated with the value and value added of an innovative product. The most famous source of such data is the Global Innovation Index.

2. Literature Review

The choice of the direction of the article relates to the fact that a significant transformation of the processes of value-added creation changing the role of the state in economic development and taking into account the pace of innovative development occurs in the world economy and in national economies. Evaluation of the above changes is most effective when applying the cost approach, which is impossible without the development of the existing methodology. The article is based on both classical theories of value and modern developments in the field of accounting for innovative products.

For example, Linder and Williander, (2017), West and Bogers (2017) explore innovative business models, their possible development options, and features of the open innovation concept. Johnson and Noguera (2017), Ceglowski (2017), Bems

and Johnson (2017) explore the issues of estimating the value added in various fields. Also, in this study, the authors relied on the own developments of the existing scientific school, where conceptual foundations of value-added accounting were previously developed. The lack of a current unified methodology for accounting for the value added of innovative products, regarding the level of technology development and sources of financing is a significant methodological flaw.

3. Material and Methods

The study is based on the use of the fundamental principles of the general theory of systems, the of economic systems development theory; fundamental methodological principles of economic theory (in terms of the theory of value). The priority methodological principle of this study is the normative one, providing not only a description of the possible results of high-tech companies' innovation activities, but also the formation of a normative methodology for creation of added value of innovations.

The developed methodology and classification of the results of innovation activities depending on the technology readiness level will be consistent with the principles of historical analysis based on macroeconomic models and indicators of technological development of the leading and developing countries.

Also, the following methods of scientific analysis were used: systematization and modeling, theoretical generalization and comparison, scientific search, study of literature, legislation, statistics, observation, generalization of experience, hypotheses construction, analysis, synthesis, abstraction, concretization, etc. Periodicals of Russian Statistics, OECD Stat Extracts, World Bank, interactive databases on EU countries statistics, databases on BRIKS countries statistics and other similar data were used as sources of information. Formation and distribution of innovation costs in this study was considered on the basis of the infrastructure approach.

4. Results and Discussion

The heterogeneity of countries is growing strongly, and more complex classifications appear based on diverse categories criterion. The same country can be referred to multiple groups depending on the classification approach. In the middle of the 20th century countries were mostly divided into "developed" and "developing". Currently more detailed classifications are used (Table 1).

Table 1. *Classifications of countries by the level of development*

Institution	**Country groupings**			**Classification criterion**
UN Development Policy	Developed economies	Transition Economies	Developing countries	The basic economic rate of the country.

Committee					
International Monetary Fund	Advanced economies		Emerging market and developing economies		Selection of the countries in two main groups based on the general conclusion of regional and analytical classifications.
World Bank	High-income countries	Lower middle – income countries	Upper middle-income countries	Low-income countries	The estimated level of gross national income (GNI) per capita for the preceding year.

***Source**: Compiled by the authors based on the World Bank Atlas method (World Bank, 2018) and report of the UN Committee for Development Policy (2014).*

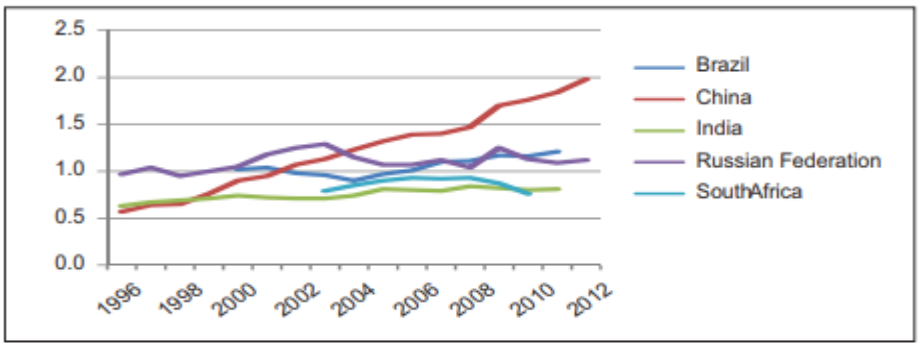
According to the UN classification, developing countries are those with low life standards, oligarchic government system, characterized by a lack of free market techniques, etc. Developing countries are mainly presented as independent, including former colonial countries and semi colonies (emerging nations), with struggling economy, low socioeconomic potential due to their historical development, and as a rule, with the continued existence of precapitalistic relations. These countries are trying to overcome the barrier of underdevelopment and reach the level of the developed countries and they, generally, depend on the developed countries economically, politically and culturally. Developing countries are the largest category; by some estimates, these include 4/5 of all countries of the world (more than 75% of the inhabitants of the planet).

Recently a new term – the BRICS has appeared (an acronym for Brazil, Russia, India, China, South Africa), which defines five major countries with rapidly growing economies: the Federative Republic of Brazil, the Russian Federation, the Republic of India, the People's Republic of China, the Republic of South Africa. This association was formed in June 2006, within the St. Petersburg Economic Forum with the participation of Ministers of Economics of Brazil, Russian, India, China, and South Africa joined the association in 2011.

The key principles uniting the BRICS countries are the following: the leadership within the region, possibility to influence the world economy and policy, significant growth, the size of their territories, economies and population. All together the BRICS countries have bigger influence in global society by the means of the synergy within the economic, social, political, and scientific collaboration. The BRICS association represents more than 42% of the world population (about 3 billion people), nearly 30% of global territories (almost 40 million km^2), and total GDP exceeding 22% of the global GDP (approximately 17 trillion dollars). Within the BRICS consortium, erratically economic growth is caused by several factors, including significant development of high-tech sphere and focusing on innovation. For example, China increased domestic spending on Research and Development from 0.56% of GDP in 1996 to nearly 2% in 2012 (and more than 2% in 2015).

Currently China takes the leading place in this field among the BRICS countries (Figure 1). However, despite the progress, the BRICS countries lag far behind other developed countries in the Research and Development sphere (Figure 2, Table 2).

***Figure 1**. Gross-domestic expenditure on R&D as a percentage of GDP in the BRICS countries*



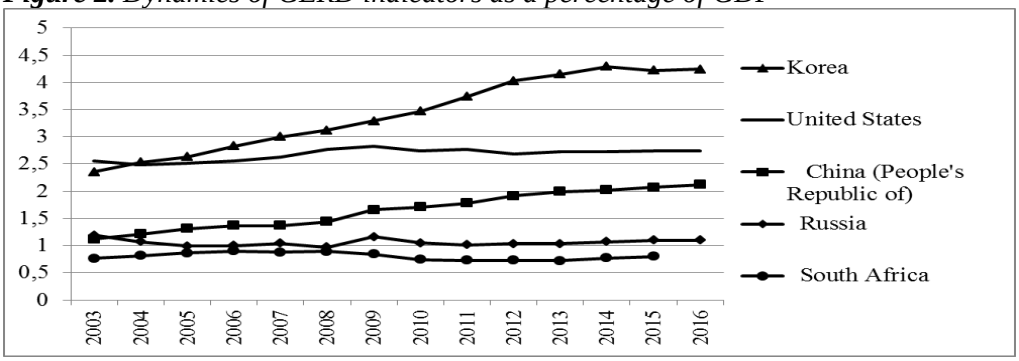
***Source**: Observer Research Foundation, 2017*

***Table 2.** Main Science and Technology Indicators*

MSTI Variables	GERD as a percentage of GDP													
Unit	Percentage													
Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Country														
Korea	2.35	2.53	2.63	2.83	3.00	3.12	3.29	3.47	3.74	4.03	4.15	4.29	4.22	4.24
United States	2.55	2.49	2.51	2.55	2.63	2.77	2.82	2.74	2.77	2.69	2.72	2.73	2.74	2.74
China (People's Republic of)	1.12	1.21	1.31	1.37	1.37	1.44	1.66	1.71	1.78	1.91	1.99	2.02	2.07	2.12
Russia	1.19	1.07	0.99	1.00	1.04	0.97	1.16	1.05	1.01	1.03	1.03	1.07	1.10	1.10
South Africa	0.76	0.81	0.86	0.90	0.88	0.89	0.84	0.74	0.73	0.73	0.72	0.77	0.80	

***Source:** Main Science and Technology Indicators, OECD (2018)*

***Figure 2.** Dynamics of GERD indicators as a percentage of GDP*



***Source**: Prepared by the authors based on Main Science and Technology Indicators, OECD (2018).*

Thus, in collaboration the BRICS China is the leader in innovative development. It also competes on the world level in the number of scientists engaged in Research and Development and the amount of R&D expenses. Substantial attention is given to the issues of innovation incentives in the BRICS countries based on the government programs and approved the BRICS Action Plan for Innovation Cooperation 2017-2020. The main theme of the 5th BRICS Science, Technology and Innovation Ministerial Meeting was "Leading through Innovation & Deepening Cooperation". There are several problems connected to innovation development in the BRICS countries (Table 3).

Table 3. *General and problems of innovative development in the BRICS countries.*

Problems	China	Russia	South Africa	Brazil	India
Low industrial activities compared with the developed countries	+	+	+	+	+
Low impact of patents and publications in the innovation development	+	+	+	+	+
Regional imbalances within the country	+	+	+	+	+
Dependence on commodities and resource-based industries		+	+	+	
Low general innovative indicators and the demand for innovation in business sector compared with the developed countries		+	+	+	
Imbalances in education and workforce			+	+	+
Ecological imbalance within the country	+				
The prevalence of "the secondary innovation"	+				
Low general innovative production					+
Low level of patent applications				+	

Sources of innovation financing are both public and private programs to support innovation at different stages of an innovative product creation. The own funds of organizations and individuals, business, government, higher education systems are used as sources of funding. In statistics, the key indicators characterizing innovation activities include the indicators of R & D costs as a whole (Table 4) and the funding of scientific research from budget sources (the federal budget) (Table 5).

Table 4. *Indicators of R&D expenses by types of work for the Russian Federation as a whole, RUB mln.*

Index	**2000**	**2013**	**2014**	**2015**	**2016**
Internal current costs for R&D,	**73,873.30**	**699,948.90**	**795,407.90**	**854,288.00**	**873,778.70**

including by type of work:					
Basic research	9,875.70	114,829.10	130,618.00	132,064.90	132,565.10
Applied Research	12,117.50	133,788.00	155,231.40	169,654.60	181,157.90
Developments	51,880.20	451,331.80	509,558.40	552,568.50	560,055.70

Source: *Compiled by the authors based on official statistical data (FSSS, 2018)*

Table 5. *RF federal budget spending for scientific research financing, for the Russian Federation as a whole, RUB mln.*

Index	**2000**	**2013**	**2014**	**2015**	**2016**
Federal budget spending for civil science, including:	**17,396.40**	**425,301.70**	**437,273.30**	**439,392.80**	**402,722.30**
Basic research	8,219.30	112,230.90	121,599.50	120,203.80	105,247.60
Applied Research	9,177.10	313,070.80	315,673.80	319,188.90	297,474.70

Source: *Compiled by the authors based on official statistical data (FSSS, 2018).*

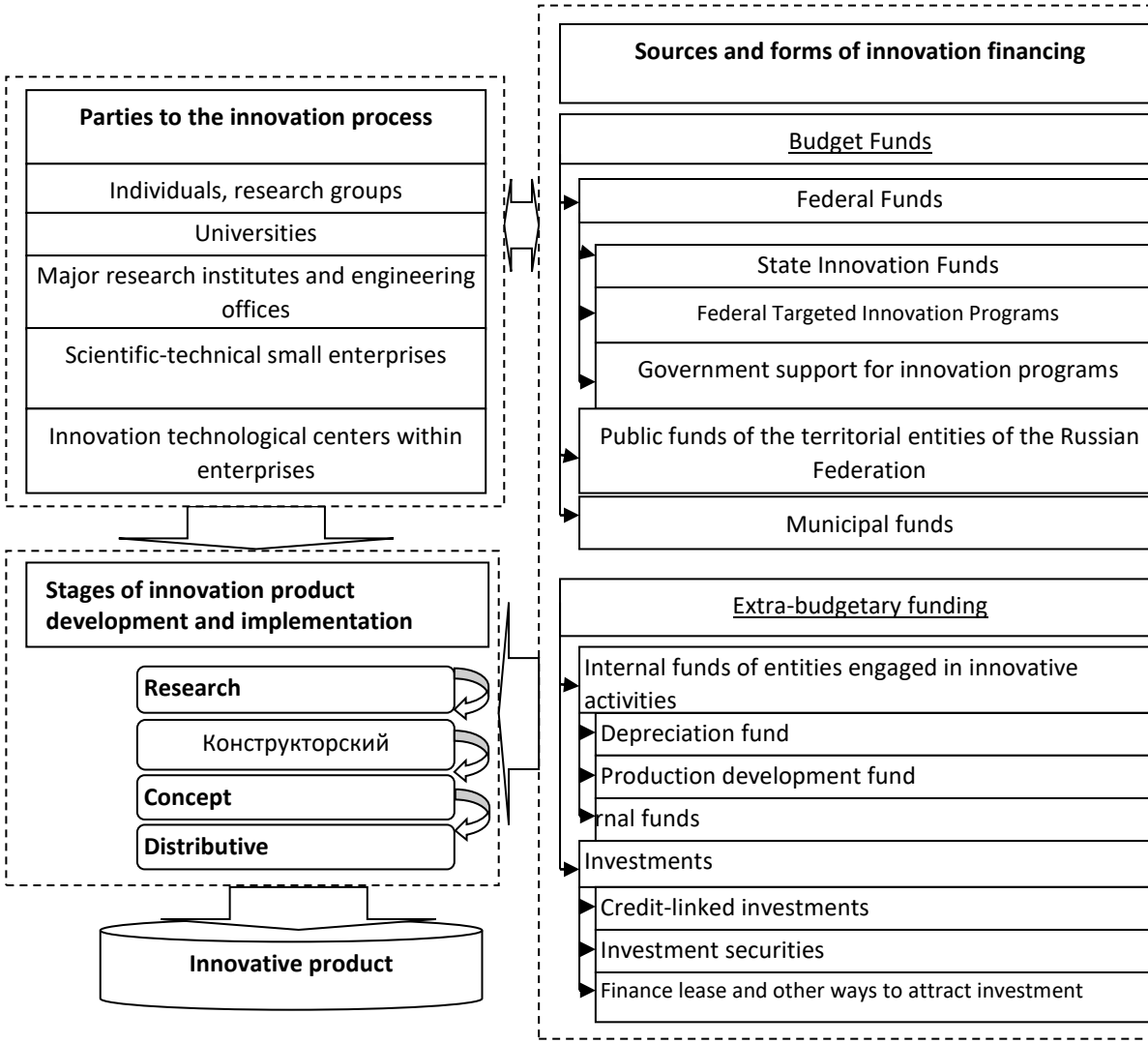
In terms of infrastructure interaction of the parties to the innovation process the following financing sources can be defined at different stages of innovation product development and implementation (Figure 3).

There is no single definition of the term “innovation” in modern economic literature at the present time. Generally, innovations represent the processes of generating novel ideas and converting them into useful products or services. Within that approach scientists explain innovation as a result of creativeness, which practical use assists significant changes in functioning of the system. In a narrower sense, innovations represent a new practically implemented technological decision (Kvesko and Kvesko, 2009).

Innovative product is the result of innovative activity. It could be produced for inner purposes of a company as well as for the further implementation in the market. Under section 2 of Model Law on Innovative Activity innovative product represents an innovative activity result that could be used as new goods, production technology or other socially useful results (RF Government Decree No. 27-16, 2006).

Thus, an innovative product is a result of an innovation process represented in the form of a new or developed product (process) that is introduced in the market or available in practical use and adds value for consumers. Given definition, apart from all existing ones, contains special features of innovativeness that is implementation end, focus on customer and novelty product (technology approach). The innovative product life cycle must be considered in stages (Table 6).

***Figure 3**. Communication model of the parties to the innovation process and sources of finance at the stage of the innovation product development and implementation.*



Source: *based on the project part of the state task No. 26.2758.2017/4.6 for 2017-2019 (Stage 1 of 2017).*

***Table 6.** The life cycle of an innovative product ready for commercialization*

Stage 1 Research	**Stage 2 Design and Engineering**	**Stage 3 Conceptual**	**Stage 4 Distributive**
Initial survey of innovations market	Innovative product development	Detailed market study	Pilot sales

situation			
Conducting research and development	Copyright protection	Product testing on target groups	Full production launching
Market build-up	Testing of a product within the organization	Analysis of production experience	Entry of the product into the market
Preliminary techno-economic evaluation of innovative product	Fund raising	Business intelligence of a project and calculation of actual economic efficiency	
A detailed business plan drafting			

A methodology for determining of technology readiness levels within the projects of the Federal Target Program "Research and development in priority development fields of science and technology complex of Russia in 2014 – 2020" was developed by the Ministry of Education and Science of the Russian Federation in 2017.

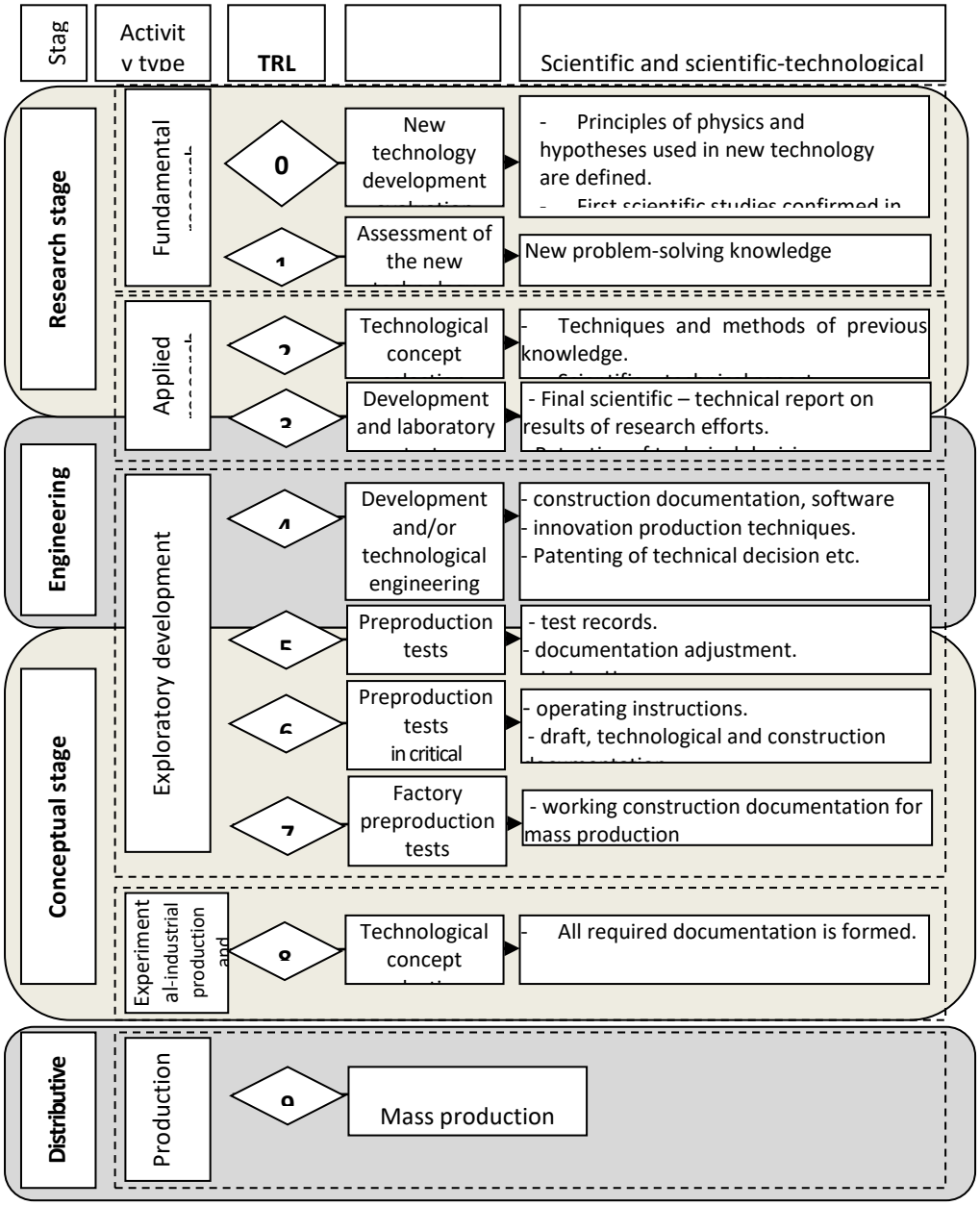
According to this methodology, the technology readiness level (TRL) corresponds to the "correlation between a particular technology and its maturity level from the idea generation till commercial production. It is represented in a specific scientific, scientific-technical and production result; it is measured by corresponding figures of efficiency and corresponds to the specific range of budget input. The methodology under consideration demonstrates the ranking of technology readiness levels. It includes 10 levels that describe the manufacturing and innovative product testing stages: where 0 is an initial level and 9 is the maturity level of technology readiness. At every stage of an innovative product life cycle the readiness level of innovative products that are proposed to development increases depending on the kind of scientific or scientific-technical activity (Figure 4). Elements of value-added innovation product do not exist independently, they are rather in a relationship, influencing each other and the entire cost composition. The concept of the methodological approach to the recording of movement, formation, actualization and taxation of the added value of an innovative product is shown in Figure 5. Introduction of the methodology will change the basis of cost classification and generalization in accounting and analysis. It does not affect the technical principles and methods, and therefore, allows considering value added created during the innovation process from a perspective of some specific innovative projects and products according to their development stages.

5. Conclusion

At the level of the state, priority tasks have been set in the sphere of import substitution and the rise of national production based on advanced scientific developments that are promising and effective for their commercialization, which

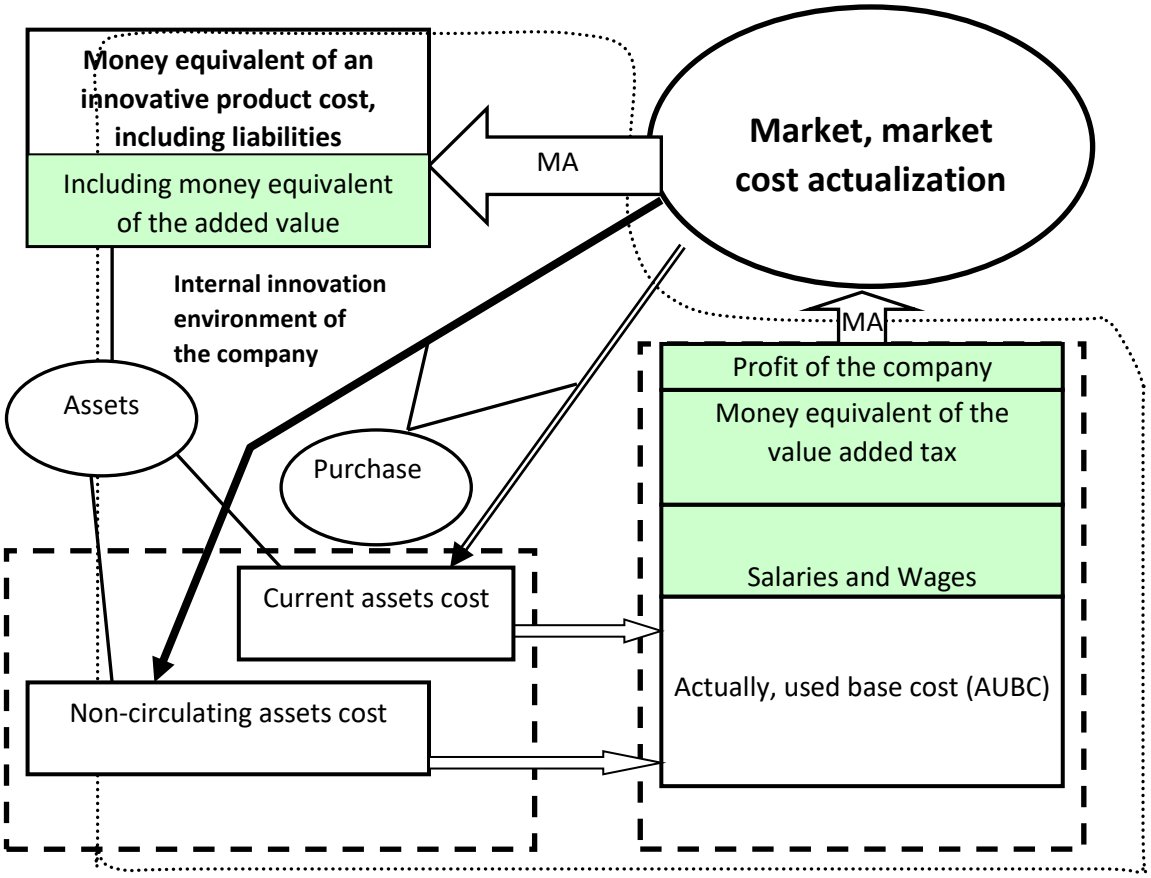
characterizes the level of updated value added (this means one-off sales and sustainable solvent demand for an innovative product).

***Figure 4**. Description of the technology readiness levels and their comparison with the activities and life cycle of the innovative product*



***Source:** Based on the project part of the state task No. 26.2758.2017 / 4.6 for 2017-2019 (Stage 1 of 2017).*

Figure 5. *Regulatory methodology recognized in accounts and analytical system of innovative product cost distribution.*



Source*: Maslova (2006).*

National innovation strategy should be built based on an analysis of the current situation in the world, both from the point of view of technological leadership and from the perspective of topical socio-political aspects.

In this article the authors consider the sources of innovation financing and provide statistics on developing and developed countries in terms of the proportions of financing innovative activities. To assess the effectiveness of financing of invested funds, it is necessary to adequately assess the cost parameters of the innovative product being created and implemented. The stages of the innovative product development and implementation are identified in the article based on the research of the categorical apparatus of the innovation sphere, considering the technology readiness level for commercialization in conjunction with possible sources of financing and stages of the life cycle of innovative products. Understanding the process of innovation value formation in the context of infrastructural interaction

between actors of the innovation process and sources of financing at the stages of an innovative product development and implementation is an important aspect in studying and analyzing the activity of innovative enterprises. To summarize, it is necessary to evaluate and analyze the increment in the cost of innovative products, considering the degree of the innovative product readiness for commercialization, which will enable to adequately assess the effectiveness of the innovation financing invested (including from the point of view of the public costs of innovation).

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