SOCIO-ECONOMIC ASSESSMENT OF TRANSPORT ON THE BASIS OF HISTORICAL COMPARISONS

Macheret, Dmitry A., *Moscow State University of Railway Engineering (MIIT), Moscow, Russia.*

ABSTRACT

Historical analysis made by the author shows that the emergence of new transport communications contributes to creation of new major economic and cultural centers, while traditional centers, which turned away from traffic flows, lose their meaning. Research of transport conditions in pre-Columbian America (absence of wheel, horse-drawn, with the exception for the Central Andean region, and horse transport, a lower level of water communications development in comparison with the Old World) allows us to conclude that the lack of vehicles and the lack of private initiative in transport sector essentially limited the possibilities of social and economic growth in ancient civilizations.

Keywords: transport, socio-economic development, communication lines, ancient civilization, economic history, institutions.

Background. *Both historical process, and economic activity are filled with continuous changes. «... In the economic life only changes are constant», – wrote Ludwig von Mises [1, p. 141]. «The change is the only constant in history», – in fact, Jack Goldstone [2, p. 177] duplicates Mises thought in relation to the science of the past.*

One of the main problems in economic and historical research is to determine correctly what factors caused occurred or occurring changes and what is the impact of each factor. Only on this basis we can try to predict further development of economy and society, and to stimulate the desired trends and level the negative trends.

It is really a difficult problem because the factors affecting socio-economic development are numerous, diverse and are in particular interdependent on each other.

In the economic analysis at the level of the firm or production unit methods to determine weighting of influence of various factors on changes in resulting indicators have been tested adequately [3].

The total range of influencing factors is established based on analytical or correlation relationships, and to identify the characteristics of each of them elimination methods are used – calculated exclusion of influence of other factors. At the same time environmental factors (prices for resources, manufactured goods, etc.) are accepted as «ultimate reality».

In macro-economic, and especially socio-economic analysis to identify the main factors and even approximately to determine their weight is much more difficult. As it is known, «after that – it does not mean because of this». And given the considerable time lags between the measures undertaken and their effects, and the fact that some sort of measure (such as «credit expansion») may provide short-term positive effect, but lead to very negative consequences in the long term, the question of what factors contributed to or, conversely, hindered this or that socio-economic change, is often controversial.

To figure it out, it is necessary to take as a basis theoretical understanding of socio-economic processes. However, theoretical approaches offered by different economic and sociological schools often give different (and sometimes contradictory) answers to fundamentally important issues. Even great scientists may be stalled, trying to identify some factors of socio-economic changes. For example, a prominent British expert in the field of economic history Robert Allen found it difficult to determine which one played a crucial role in the growth of agricultural production in China in the years 1978–1984: economic reforms or application of nitrogen fertilizers and new high-yielding rice varieties [4, p. 208]. Different opinions are expressed by researchers concerning industrial revolution factors and other key topics of socio-economic development.

In natural sciences, in such cases experiments come to the aid. In economics and sociology an experimental direction is also developing, but the possibilities for experiments are extremely limited, and the results again can be interpreted in different ways.

Objective. *The objective of the author is to provide socio-economic assessment of transport on the basis of historical comparisons.*

Methods. *The author uses general scientific method, historical retrospective method, comparative analysis.*

Results.

1.

All this fully applies to the assessment of the role of transport in socio-economic changes. On conceptual and qualitative level, it was studied deeply [5–9]. In such research mathematical techniques are successfully applied, enabling to obtain quantitative estimates [10].

However, clarification of transport development significance, including some of its species, for socio-economic development remains an urgent scientific challenge.

In this regard, we should pay tribute to the research of Nobel Laureate Robert Fogel, who built a counterfactual model of the US economy of XIX century, putting as a condition the absence of the railway network. Vogel calculations have shown that if other types of transport, especially inland water transportation, were developed, then regional distribution of productive forces would have been different, and the country's economic development would have slowed down for a few years [11, 12]. At the same time there is reason to believe that Vogel's model does not fully take into account the missed effects of development of the railway network, in particular – acceleration of transportation and positive institutional implications [9].

In any case, these models with their absolute scientific value are largely hypothetical. The most reliable are results of «unintended experiments», recorded in economic history, when the consequences of appearance or absence of transport main line are obvious.

For example, city of Novosibirsk (former Novonikolayevsk) arose in 1893 in connection with construction of the railway bridge over the Ob river during construction of Trans-Siberian main line and then gradually developed into the largest economic and cultural center of Siberia and the third largest town in Russia. At the same time, such old centers of Zauralye as Tobolsk and Tomsk, which turned away from the main railway route, lost their former importance [13].

Veliky Ustyug, which was in XVIII century, a major trade center, which commercial ties extended from Arkhangelsk to Astrakhan and from St. Petersburg to Kyakhta (on the border with China), Kamchatka and North America in the next century, being far from the railway (they came here only in the second half of XX century) lost its commercial importance and turned into a modest county town [14, pp. 3–16].

In Western Europe, a good example is the city of Bruges in Flanders (Belgium). Located in the Middle Ages at the crossroads of the most important European trade routes and having an access to sea across the bay, at the beginning of XIV century it became, according to classification of Jacques Attali, a center of the first form of market, capitalist system [15, p. 55]. Subsequently, however, the connection to sea was lost (the bay was choked up), and the city went into decline, which lasted until the end of XIX century, when Bruges attracted the attention of tourists, and sea port of Zeebrugge was built in the surrounding area, which became the new «sea gates» of ancient settlements.

A number of examples of transport routes configuration influence on the development of various cities and regions are shown in [16, 17].

The comparison of long-term development of various regions at a significantly different level of transport support is of particular interest. The most ambitious example is pre-Columbian America, traffic conditions of which, first, in general, were radically different from the Old World, and secondly, were substantially isolated in separate parts.

2.

In pre-Columbian America, as we know, wheel was not used. At the same time the idea of the wheel was present. During the excavations figures of animals on wheels were found, which are considered either toys [18, p. 119], or cult objects [19, p. 50].

But in that America there were no animals that are habitually referred to draught (horses or donkeys). In the Andes, lama and alpaca were domesticated, but they were only used as pack animals [18, p.119], and even on the male lama load did not exceed 40 kg [19, p. 55].

That is, the horse-drawn transport in pre-Columbian America was absent altogether. Central Andean civilization (which occupied the territory of modern Peru, Ecuador, Chile and Bolivia) applied pack transport, Mesoamerican, located on the territory of the present-day Mexico and Central America (approximately from Central Mexico to Honduras), did not have even it, and all the land movement of goods was carried out by barriers. As a result, C. Ponting notes, trade in Mesoamerica «was limited only to luxury goods, whereas in Mesopotamia in 2000 BC Ur transported to Yixing 72000 bushels of grain per year» [18, p.119].

The features of the land freight transportation in pre-Columbian America, in comparison with the Old World are characterized by the following relationships. Average daily efficiency of Mesoamerican porter was apparently less than 0,7 ton-kilometers, that of lama was slightly higher than 0,7 ton-kilometers, and that of camel (the use of which in caravans dramatically increased the efficiency of land transportation in the Middle East [16]) was no less than 12–13 ton-kilometers, or almost by 20 times more. These figures show a degree of limitation of transport resources of pre-Columbian civilizations, as well as the fact that the use of lamas as pack animals only provided labor savings, increasing productivity of freight carriage only to a small extent.

The significance of transport infrastructure in pre-Columbian America was very high.

In Mesoamerica, says G. G. Ershova, «trade routes ran both on land and in rivers and seas, they crossed all Maya lands and went away on foreign territory – up to the present Panama. It can be assumed that the special importance was given to the development of water freight transportation – due to lack of draft animals. However, Maya attached utmost importance to the development of a network of roads sacbe[1]...» [20, p.114].

A similar pattern was observed in South America. Already in the early period of the development of Andean civilization, in I–II centuries BC, «the domination of one valley over the other depended on the availability of the road» [21, p. 72]. It should be noted that the term «valley» in the Andean region had not only geographical but also socio-economic importance. Valley is a province bounded by «natural and traditional ethnic borders», later in the Inca Empire, it became the main administrative unit in the state [19, p. 95]. In these provinces, the role of the roads grew steadily.

Although the development of means of communication is possible even with underdeveloped vehicles, the best way is balanced, harmonious combination of infrastructure and mobile means of transport, where capacities of both are realized in the best way. To do this, if we focus on numerous scientific assessments (see, in particular [24–26]), there should be 20–30-percent reserve capacity.

Moreover, advancing development of infrastructure is required, but it is impossible to allow that the level of moving vehicles is far behind it. Underdevelopment of moving vehicles, an example of pre-Columbian America is just indicative, severely limits the possibility of progress.

3.

How does the originality of transport conditions influence the development of pre-Columbian America in comparison with the Old World?

As G. G. Ershova [27, pp. 42–43] demonstrates, that some cultural achievements on American soil came at about the same time as in Europe (more accurate solar calendar instead of lunar one), others much later (construction of pyramids, written language) and, for example, mummification – nearly three thousand years earlier. According to estimates of Manuel Galich [28, p. 87], the Olmecs, whose civilization was one of the oldest in America, in carving jade «attained the same perfection as the Chinese of Zhou era», which can be considered as contemporaries to the Olmecs. In I millennium BC North American tribes of hohocams developed a technique of dike dam construction «a few centuries earlier than in Europe» [28, p. 77]. Maya civilization that flourished in the second half of the millennium, in astronomy and mathematics, had surpassed their European contemporaries [28, p. 149].

[1] Sacbe («white road») – stone paved road of the ancient Maya.

But in general pre-Columbian America noticeably lagged behind in the development of civilizations of the Old World. And this gap had existed not initially, but grew gradually.

The transition from hunting and gathering to agriculture was of the utmost importance. In Mexico, domestication and breeding of useful plants began at about the same time as in a number of the oldest farming centers of the Old World [29, p. 8]. According to von Hagen, in the year 5000 BC Americans were not too different in levels of cultural achievement from people in any other place, including – in the Nile Valley, where one of the oldest civilizations – Egyptian civilization later blossomed.

In IV millennium BC in Mesoamerica mass farming extends, which in III–II millennium BC leads to emergence of civilization and proto-states [20, pp. 16–17]. In the Andean region there is evidence of very ancient centers of agriculture, but its mass distribution, apparently, occurred later than in Mesoamerica [28, p. 287–288]. Thus, the ancient civilization of pre-Columbian America is still a few «younger» than the most ancient civilizations of the Old World (such as Sumerian and Egyptian), but can be considered peers of the Chinese and were initially ahead in the culture of forest zone of Eurasia.

However, further development of civilization in America was slower than in the Old World. According to V. I. Gulyaev, Mexico and Peru, only by the end of I millennium BC had reached «about the same boundaries in economy, politics and culture, which had been passed by Egypt and Sumer still in IV–III millennium BC» [31, p. 44].

By XV century, when America became open to the nations of the Old World, even the most advanced American civilizations dramatically lagged behind in their level from European and Asian countries. Mesoamerican civilization existed in copper-stone age, the Andean in bronze age [32, p. 23–76]. Here at once it is necessary to pay attention to the fact that in general lag in the development of the New World from the Old World productive forces of the Andean civilization achieved greater success, than the Mesoamerican. This is largely due to the transport factor. As for the general backwardness of pre-Columbian America from the Old World, G. G. Ershova is building a correct logical chain: «lack of draft animals on the continent led to lack of demand for the wheel, which, ultimately, inevitably becomes a hindrance to the development of transport and communications and, as a consequence, civilization as a whole» [27, p. 43].

Since ancient times, the general trend of civilization development is that advanced civilizations through available communications transmitted achievements to «outsiders». As a result, «younger» civilizations passed appropriate stages of socio-economic development in the context of more advanced productive forces than the most ancient civilizations. So, if in Sumer and Egypt states emerged in a copper-stone age, then, for example, in Assyria – in the Bronze Age, in Italy – during the Iron Age, etc. This is due to diffusion of technical and technological improvements, which, spreading from the developed civilization centers, stimulated in peripheral regions production as well as economic and social development.

Contacts of pre-Columbian civilizations of America with the Old World due to great distances separating them and primitiveness of vehicles were irregular and random. «According to available data impact of these sporadic contacts on origin and development of ancient civilizations of the New World was insignificant» [31, p. 197]. At the same time, until the arrival of the Spaniards at the beginning of XVI century, apparently, there was no direct contact (at least – regular) between the most advanced pre-Columbian civilizations – Mesoamerican and Andean. Penetration in Peru of jewels from the territory of Mexico and Colombia, noted, for example, by M. Galich [28, p. 376], which could indicate the presence of such contact is likely to occur «by geographic filtering ... passing a way from north to south from tribe to tribe», and «not through direct contacts» [30, p. 512].

In pre-Columbian America, developing in autarchy conditions, we see, in contrast to the Old World the combination of significant cultural achievements with archaic production base.

One of the most culturally developed ancient American civilizations created by the Mayan people and having complex systems of accounting and writing, cosmogonic representations, accurate calendar and outstanding architectural structures, use of stone tools, showed, perhaps the most striking example of the gap between cultural achievements and their technical basis. As explained by historians [32, p. 31], «in the country of the Maya there were no ores and metallurgic engineering could not emerge». But there were no metals, for example, and in the country of Sumerians, among many achievements of which, by the way, is invention of the wheel [33, p. 347]. Already in the first half of III millennium BC Sumerians began to bring from other areas metals, as well as wood and stone, which they also did not have. In exchange for goods they exported wool, fabric, grain, dates and fish [33, p. 356].

Maya due to underdeveloped transport, delivered mainly works of art and decoration under the long-distance trade [32, p.31].

4.

It should be noted that by American standards Maya had good transport using both sea and river traffic, and as mentioned earlier, paved roads. (For comparison, in other known Mesoamerican culture – Aztec – sailing was, apparently absent, and water transport was limited to water area of lakes and roads were poorly developed). River routes allowed the Maya to make transportation at a distance greater than 300 km [30, p. 328], to navigate through sea they used ships from 12 to 25 meters [30, p. 236, 328], to sail along the coast at a distance of 2,5–3 thousand miles, reaching Panama and perhaps approaching Venezuela [30, p. 329–330; 28, p. 189]. At the same time, by the time of the discovery of America by Columbus Maya navigation level was most likely lower than that of ancient Greeks and Romans, and dramatically lagged behind the level of the Old World.

The transport factor determined largely the difference between Andean and Mesoamerican civilizations.

In the Andean, as already mentioned, lamas were extensively used as pack animals, and this made it possible to transport food over long distances and to ensure their concentration in large volumes. For example, archaeologists discovered in Peru an ancient storage of corn with capacity of 450–700 tons, dated border of III and II millennium BC [19, p. 54]. This amount corresponds to the average net weight of the train on the local railways in the 1930s. In ancient Peru, such goods can be transported by 10–20 thousand lamas.

In the valley of the Peruvian river Tablachaka archaeologists excavated the settlement La Galgada, also going back to border of III–II millennium BC. It is located at around 1000 meters above sea level – in the high-rise zone, poor in natural resources, and unsuitable for agriculture. However, in this place we found the most monumental architectural structures of that period. This paradox can only be explained with the fact that this settlement was located on the shortest route from the coast to the mountains and served as a center of goods exchange [19, pp. 65–66]. Here is a natural analogy with the oldest known cities of Jericho, which was also the similar center [16].

By the middle of II millennium BC in the Andes the main way network had been formed. There were roads equipped with caravan terminals and not trails. Caravans of many hundred lamas passed along them [19, p. 54–58]. Due to this Andean civilization developed specialization, settlements emerged, whose residents were engaged in the cultivation of any single crop or manufacture of particular handicraft products.

In Mesoamerica, where pack animals were absent, only lightweight and less voluminous goods, like tissue and obsidian, could be moved for long distances [19, p. 57]. Agricultural specialization developed poorly and, moreover, craft could not completely separate itself from agriculture. Thus, the lack of developed transport made it impossible to use specialization as an important factor of economic growth and implement on this basis the law of comparative advantages. Against this background, after having reached the highest cultural heights Mayan civilization degenerated and died, apparently due to overcrowding and lack of food. In terms of «food shortages and difficulties of transporting products» [34, p. 226], as well as prolonged drought situation had come to this environmental disaster, which was compounded by cruel wars between individual cities [34]. A kind of «Malthusian trap», whose prisoners were all traditional societies, with limited transport capacity, hampering the exchange of products of mass consumption, proved fatal.

At the same time, a much higher level of development of transport in the Andean civilization compared with Mesoamerican led to such consequences, which may seem paradoxical.

In Mesoamerica, for example in the state of the Aztecs, trade flourished «at the market of the Aztec capital of Tenochtitlan where it was possible to buy everything». The fact was that local rulers collected tribute from conquered areas, and there were only some handicrafts that can be easily brought to capital and sold to the residents of the district. They had to pay with agricultural products, some of which also came onto the market [19, p. 57].

In urban centers of the Andean civilization, the transport capacity of which was much more, «markets did not exist at all, and all the inhabitants received their allotted from state warehouses» [19, p. 57]. However, central redistribution of products of labor of the Incas was supplemented by local barter, which was carried out at fairs, where farmers and artisans exchanged the products of their labor, and listened to the new requirements of the authorities [28, p. 363; 30, pp. 411–412]. But it is obvious that these fairs were far from normal market relations.

How could this happen, and is it not in contradiction with the position of close relationship of trade and transport, justified, in particular, in recent years works [16, 17]?

5.

Yes, indeed, the development of exchange and transport are mutually determining processes, but the exchange is not always market-oriented. Market exchange cannot develop without adequate transport development, but, firstly, it is preferable that transport itself is organized on a market basis, secondly, institutions must be present, which are necessary for the existence of market, private property being key institution among them.

In Andean civilization transport and exchange processes evolved on a different basis. A variety of natural conditions in neighboring areas, characteristic of the region of the Central Andes, made specialization and exchange of products very profitable. But its effective implementation at the same time demanded three conditions – comfortable roads, developed transport cattle farming and effective control over intensive traffic of caravans consisting of many lamas (and this intensity and multiplicity were attributed to the small carrying capacity and productivity of cattle).

The fulfillment of these conditions, or even one of them could not be the lot of private initiative. It was a prerogative of one group of people, «which belonged to the power. Or, what is the same, the power inevitably belonged in the ancient Peru to those, who controlled transportation» [19, p. 125]. First power belonged to the highest ranks of the community, then to the authorities of chiefdoms and early states, and finally, to the Inca Empire, formed in XV century during the campaigns of conquest and united the vast area of about 1 mln square km [32, p. 60] with a population of about 10 million people [19, p. 78].

And the transport factor was indeed the key factor in the creation of this empire, and its existence for nearly a century.

At the beginning of their conquests Incas took possession on the shores of Lake Titicaca, of huge herds of lamas and alpacas, so their army no longer felt the need not only for clothes and food, but either for vehicles. These herds have been declared the royal property, which was the first significant contribution to the creation of the imperial economy [19, p. 81].

In the imperial economy, the transport system was the basis not of market exchange but of centralized distribution of wealth. The latter formed foundations of the Inca society in which «the position of each person depended not on the possession of any kind of property, but on his or her place in ... hierarchical structures ...» [19, p.120].

In figurative expression of M. Galic, an extensive network of roads cemented the unity of the empire of the Incas [28, p. 371]. In this connection, we should mention a system of Chaski couriers, who were on duty on specific positions along roads and, if necessary, ran to broadcast news reports or small loads on the relay. The speed of the transfer by different authors is estimated from 240 to 400 km per day [19, p. 58; 30, p. 490–492]. In any case, it is significantly higher than the rate of movement of similar relays in the Roman Empire, not exceeding 160 km per day [30, p. 490]. This system allowed the city administration of Inca to take their bearing in the situation in the country and to meet the challenges of operational management.

The longest of Inca roads was more than 5 thousand km [32, p. 64]. This is twice as much as the famous «Royal road» – the main land line of the Persian Empire. The total length of landscaped ways of the Incas, according to some estimates, reached 30 thousand km [19, p. 58]. This means that provision

of territory and population with land transport infrastructure exceeded here the level of the Roman Empire, which can be considered as a standard of transport development in the ancient world. And in a time comparable with the empire of the Incas Europe had no roads as comfortable as those of Incas [28, p. 379].

Roads in the Inca Empire were created using mita – labor duty, which consisted of periodic mobilization of the population with a release of permanent residence and daily work [19, p. 98].

«Spinal column» of the state was created by «densely populated mountain valleys and basins from Lake Titicaca basin, and later Cochabamba, in the south-east [of the country] to the area around Quito in the north. Here ran strategically important road with a number of branches, handicraft production centers and warehouses gravitated to it» [19, p. 88], «where the products came, and from where they were distributed on the basis of certain norms and traditions» [19, p. 204]. Directions of cargo flows were coordinated «in the first place with the need to maintain the imperial hierarchy» and reflected the direction of «vertical» power relations. At the same time «one caravan could have up to twenty-five thousand lamas» [30, p. 486]. It is clear that such transportation could be organized only with a strong state structure. Warehouses for food products and handicraft production of the Incas were placed so as to minimize traffic flows.

6.

State control over movement and distribution of wealth in the Andean civilization was probably unprecedented in the ancient world in its totality, nevertheless it had counterparts in the «Oriental» societies.

In the ancient Middle East exchanges between the countries were often carried out by state agents. In medieval China, not only construction, but also the use of means of communication, goods movement management were controlled by the state [17]. Although private commercial interests occurred and were implemented.

Navigation and maritime trade were much more free by virtue of extraterritoriality of sea lines of communication. Maritime transport in antiquity and during the Middle Ages primarily manifested market principles, they were implemented in the states, focused on maritime trade, where market relations were dynamically developing [16, 17].

For Andean civilization, navigation, which was carried out with the help of balsa rafts[2], did not have as much value as in the Old World [30, p. 488–490]. But it is noteworthy that even in the Inca state foreign maritime trade, providing a link of the Empire with Ecuador, was conducted by professional traders, pursuing commercial interests, although probably not free from government control.

The activities of the same traders who carried out their operations on land, in the Inca empire were gradually suppressed. «The earlier this or that province became part of the empire, the lesser role in its economy continued to play free exchange» [19, p. 121].

Under the conditions of suppression of free trade, regulation of all sides of economic and social life of imperial structures, which became «an independent organism separated from society and parasitic at its expense» [19, p. 194], the Inca Empire by the time of Spanish conquistadors (1532) naturally came to a state of social and economic crisis. «A huge state bonded by force of arms and conquests, was falling apart» [35, p. 59], until it finally collapsed.

In general, productive forces of the Inca state were at the highest level of development in pre-Columbian America. However, the empire did not have internal strength, unlike the Roman. And the key reason for this, perhaps, is related to archaic institutions of Inca society. Although the Incas living in the Bronze Age, created a developed land transport infrastructure, comparable to great roads of the Roman Empire, their social organization was similar, according to von Hagen, to ancient Egypt and Sumer societies [30, p. 413]. In the apt words of Yu.E. Berezkin, Inca state was «the most developed among the archaic and the most archaic among the developed» [19, p. 12]. And the gap between archaic institutions and quite developed productive forces led to irreparable breakdown, which had fatal consequences in a collision with the enemies which were not numerous, but relying on the advantages of the incipient European modernization.

Returning to general problems of transport maintenance of pre-Columbian civilizations of America, it should be noted that in none of them a system of interacting modes of transport has been established (largely due to objective reasons).

The widest range of transport options (sea, river transport and comfortable roads) was used by Maya, but they did not have and could not have either animal-drawn or pack transport.

The Incas had an excellent system of landscaped roads and organization of traffic caravans of lamas, but they paid less attention to sea transport, and they had no conditions for development of river transport.

The Aztecs were «magnificent walkers» [28, p. 190], but this was the limit for their transport achievements.

But even in ancient times an important socio-economic importance was acquired by combination and interaction of different modes of transport. In Mycenaean Greece at the end of II millennium BC maritime navigation development was complemented by a network of roads. In the Middle East in I millennium BC a sort of multimodal transportation was organized, combining the advantages of marine and caravan transportation. In China, the existence of a unified system of land roads with a system of channels allowed to rationally allocate traffic flows [16].

The lack in pre-Columbian America of harmonious transport communications system limited the dynamics of socio-economic development. Development of overland roads and centrally managed traffic flows in the Inca empire did not save it from total crisis.

Conclusion. *The historical and economic analysis shows that transport support is critically important for socio-economic development at any scale – from a single locality to the whole continent. As the material basis of specialization of production and goods exchange of goods, transport contributes to the development of market relations and the dynamic economic growth only in the presence of relevant institutions. For long-term economic and social progress, a combination of harmoniously developed transport, of intensive market exchange and of institutions of an open society, stimulating economic activity, free and creative activity of people is required.*

[2] Balsa raft – a raft made using logs of balsa tree growing in Central and South America.

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Information about the author:
Macheret, Dmitry A. – D.Sc.(Economics), professor, head of department of Economy of construction business and property management of Moscow State University of Railway Engineering (MIIT), Moscow, Russia, macheretda@rambler.ru.

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