

Cultural capital as a measurand

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Abstract. The necessity for developing metrology due to extension of its application sphere is noted. The efficiency of the metrological approach to measurement of multidimensional quantities in the field of humanities is shown using the development of cultural capital interpreted by L. Harrison. The cultural capital is defined as a measure of the society structure complexity and adaptive capacity.

1. Introduction

Many years ago the need for interaction between society members has resulted in originating the concept of “measurement” and developing metrology. At the end of the 20th century only physical quantities were subjected to measurement, while metrological traceability being provided solely by the comparison with measurement standards or reference materials. At the beginning of the 21st century chemical, biological and other nonphysical quantities, the most of which are of multidimensional (multiparametric) character, were recognized to be measurable and the concept of “reference measurement procedure” was introduced [1].

Metrology is shifting to a higher level, which will enable metrology to be used as an efficient cognition instrument in a wider range of knowledge, including humanities [2-4]. Metrology experts will have to deal with new fields of knowledge studying, in particular, person and society including the processes of their development. At the same time, it will be necessary for experts in the humanitarian sciences to develop understanding of metrology requirements providing recognition of the estimates obtained by experts all over the world.

The most important stage of the multidimensional quantity measurement is the development of a measurement model using an equation, algorithm, or block scheme linking the measurand with its key parameters measured directly.

An analysis of the society development dynamics is of interest as an example of the metrological approach to investigations in the humanitarian field.

Actually, to perform such an analysis is possible to apply human capital (“the quality of the work force”) associated with G. Becker, social capital (“the tendency of a society to encourage association of its members”) addressed by G. Loury, J. Coleman, F. Fukuyama, and R. Putnam, or financial/resource/property capital studied by A. Smith, K. Marx, T. Piketty, and others.

In particular, in [5] based on statistics data characterizing the dynamics of financial capital development T. Piketty proves the relation between emerging political and economical crises, on one hand, and the concepts of the modern model of market economy, on the other hand. A rate of return on capital is significantly higher for long periods of time than the rate of growth of income and output. This fact leads to high concentration of wealth. If modern economic tendencies continue, by 2050 a thousandth of world population will own (40-60) % of global wealth. T. Piketty considers that the best



thing to do is to impose a global tax on capital, although at present “a truly global tax on capital is no doubt a utopian ideal”. In our opinion, just in a future, it will be hardly ever probable to impose such a tax without military confrontation.

Investigations of the financial capital dynamics give an opportunity to look at one aspect of future social prospects and reveal some problems due to the capital of such a type. It is also of interest to consider other ways of thinking. The concept of social capital appeared approximately 100 years ago and at present it is characterized by various definitions.

L. Harrison’s book [6] has been issued recently in the USA. In this book the author uses a concept of “cultural capital” (CC) that is a multidimensional quantity being formed by “a set of values, beliefs, and attitudes”. According to his opinion, the CC drives evolution of society toward the goals of the UN Universal Declaration of Human Rights: “democratic governance, including rule of law; social justice, including education, health care, and opportunity for all; and, elimination of poverty”.

In contrast with the social capital, the CC concept has been formulated recently, it is of a complex character and opens an opportunity to take into account a greater number of parameters affecting socio-economic processes. Book [6] aroused much controversy in society. It contains a lot of research information, but metrology experts have many questions with regard to the details of this concept. All in all, these issues inspired the authors of this paper to rely upon this book while considering the features of the metrological approach to studying the society development dynamics.

2. Cultural capital from metrology standpoint

L. Harrison evaluates the CC by 25 parameters that represent values, beliefs, and attitudes dominating in a given society. L. Harrison’s parameters are as follows (inverted commas show exactly his own words):

- “worldview” that reflects the perception of “religion”, “destiny”, “time orientation” (planning the future), “wealth”, and “knowledge”;
- “values and virtues” that include the attitude to “ethical code”, “the lesser virtues” (everyday virtues), and “education”;
- “economic behavior” that is defined by the perception of “work/achievement”, “frugality”, “entrepreneurship”, risk, “competition”, “innovation”, and “advancement”;
- “social behavior” that includes the attitude to “rule of law/corruption”, “radius of identification and trust”, “family” (role of a family in the society), “association” (cooperation), the concept of “individual/the group” (the very role of a person in society), “fertility” as well as features of “authority”, “role of elites”, “church-state relations”, “gender relationships”.

A relationship of the CC with the parameters mentioned may be considered as a measurement model.

The conclusions drawn by L. Harrison are of great impression:

- The author proves that growth of the CC value leads to the economic and social development.
- Cultures that contribute to society development or impede it are brought to light.
- Among the main features distinguishing these cultures, religion is definitely mentioned.
- The author stresses that the Protestants, Confucians, Jews, Mormons, etc. are the most successful groups.

However, these conclusions are of a phenomenological character. L. Harrison does not explain the criterion of the selection of parameters. In many cases, the parameters chosen are interrelated. For example, a positive value of “frugality” corresponding to the high level of the CC (“the mother of investment and prosperity”) overlaps the parameter of “time orientation” (“future focus..., deferred gratification); “wealth” (wealth is a “product of human creativity”) is linked with “work/achievement” (“work leads to wealth”), and so on.

The influence of various parameters on the CC is different, which is noted in [6], but this different significance is not taken into account. For a number of scales high and low limits are not antonyms. Of the 25 parameters only 11 received “strong confirmation” and 3 received “moderately strong

confirmation". There is "no significant support" for 2 of them and no data are available for others. The essence of the CC has not been disclosed.

The metrology standpoint requires that a multidimensional measurand is to be defined and a measurand model is to be developed. To provide a model that would represent the "mechanism" of the measurand formation is desirable since it is likely to be the case when only a justified parameter set is taken into consideration. While choosing a parameter set, to apply the analogy between the dynamics of evolution of society as well as evolution of biological and technical systems, can be effective.

A concept of the interaction of a developing system containing a number of units, with its environment, which relies upon the "principle of the maximum of average mutual information" [7], makes it possible to approach the development of the measurement model of a multidimensional measurand. This principle enables the system to adapt adequately to unpredictable changes of the environment, when new threats emerge, and survive. It follows from this concept that 3 fundamental tendencies are inherent in functioning of such a system: growing diversity of the system behavioral reactions, maximization of the behavioural accuracy, and economy of the resource.

However, to achieve the growth of the diversity of the behavioural reactions seems to be possible only by the system complication. This comes from observed complication of multicellular organisms, communities of living creatures, human societies and even technical systems for thousands of years.

In nature, an "evolutionary change is not a continuous thing". Evolution "has indeed shown at least one vector: toward increasing complexity" [8]. As applied to technique, an illustration is a transition to the "Internet of Things" era that is characterized by a fast growth of production and service spectrum due to a significant growth of the number of links between both the animate and inanimate.

The Harrison's conclusion that the CC growth stimulates the evolution progress [6] as well as the results of research [7] enable the authors to define the CC as a quantity that characterizes the complexity and adaptive capacity of society.

Within the frames of this paper, as a measure of complexity, the number of reactions contributed to the system functioning, i.e. adequate ones, that the system itself can form as a response to threats having been arisen, may be proposed.

In its turn, these definitions give an opportunity to analyse the society development dynamics using an approximate evaluation of the CC on the basis of the number and efficiency of connections between the units of society. The units, basing on the totality of connections that have already existed and future connections that will arise in case of a new threat to the society, can form an adequate behavioural reaction neutralizing the threat. In our opinion, one should judge the efficiency of the connections taking into account the expected time delay of the adequate reaction.

Coming back to the CC measurement model being developed as a model of a "mechanism" of the CC formation, it should be noted that while determining its parameters a situation can arise which is typical for measurement of a number of other multidimensional quantities related to the humanitarian field: selection of parameters may be connected with the assumed method of their evaluation.

In particular, intention to be guided by usage of well-known statistical data may result in the fact that originally selected parameters, in their turn, will have to be considered as multidimensional quantities and then this leads to determining their relations with the others, the values of which are linked with the CC indirectly. As a consequence, the obtained parameters of the measurement model are of different significance.

In our opinion, the groundlessness of some part of the 25 parameter set given in [6] is possible to be explained, to a significant extent, by this feature.

However, for a number of other tasks, the list of the original parameters may be useful.

The authors of the present paper propose a version of the CC measurement model as a model of the "mechanism" of the CC formation given below. In this version the CC is determined taking into account [6] by the following parameters that significantly influence the processes of origination and formation of the connections between the society units (the high and low limits of parameters are given in brackets through a slash):

- to characterize the worldview:

- life credo (active/ passive),
- need for knowledge (getting knowledge: continuously, in a broad area/ pragmatically, in a narrow area);
- to characterize the ethical values:
 - responsibility (personal/ conferred upon somebody else or collective responsibility),
 - attitude to the rights of other people (respect/ depreciation),
 - thinking style (independent judgements/ adherence to authorities);
- to characterize standards of behavior:
 - propensity to risk (moderate/low),
 - attitude to entrepreneurship (investment in creativity/ rent-seeking),
 - attitude to innovations (interest/ rejection),
 - attitude to laws (reasonable law abiding/ corruption),
 - association (trust, cooperation / mistrust to others),
 - features of authority (responsibility towards society; dispersed authority/ out-of-control, authoritarianism).

In contrast with [6], religion is not in the list of the parameters proposed since not religion but standards established in a number of confessions restrict the participation of many believers in the processes of origination and formation of the connections between the society units.

One should evaluate the parameters mentioned by relative units, i.e., numbers on special scales, and take them into account using the coefficients of significance. The increase in the values of these parameters like in those chosen by L. Harrison is an evidence that the society is approaching to the goals of the UN Universal Declaration of Human Rights and that its ability to withstand threats and adapt to new conditions is improving.

3. System structure, its complexity, and influence of inertance

Growing threats are a stimulus to increase the complexity of a developing system. The main reason for the threat origination is the system itself. The more the number of system units is, the more likely a defect will prevent the system from development.

The simplest multichannel measuring system including no more than a few dozens of channels with sensors as well as a data processing block, as a rule, has a hierarchical structure and usually performs better, having more sensors. An operator's observation together with traditional metrological maintenance may provide the system efficiency. In such a case, the growth of the sensor number increases the complexity of the system keeping a connection type. However, if one means a system including hundreds or thousands of sensors, which is typical for the "Internet of Things", then the traditional methods of the metrological maintenance are inappropriate. Meanwhile, an unnoticed metrological defect in one or two sensors or their connections can cause serious human and material losses. Such a threat leads to complicating measuring systems, supplying connections between channels (between the units included in various channels that play the role of the branches of hierarchical structures), i.e. introducing elements of decentralization, and organizing a metrological self-check with these connections as a basis [9]. The role of the metrological self check is to detect and correct defects, which enables enhancing the efficiency of the measuring system.

Similar tendencies are typical in society. The development of any society is accompanied by increasing the need for available resources. Attempts to obtain them by expansion lead to migration of population, wars, epidemics, technogeneuous catastrophes, etc. Long before, the increase in the CC value, in general, was caused by external expansion resulting in the increase in the number of society units and forming the simplest hierarchical structures in the form of states, which facilitated taking new resources and providing self-defense. At first, such structures were built relying upon a common language, but the expansion resulted in forming inhomogeneous society.

Appearance of religions contributed to strengthening the hierarchical structures, including those with people spoken different languages. Confessions specific for various states were formed.

The development of nationalism also contributed to strengthening the hierarchical structures. In nonhomogeneous society with large population, establishment of a national state with a dominant religion resulted in originating the elements of decentralization in the society structure. Local communities were formed basing on different religious and ethical doctrines with the focus on getting the resource for life by using the connections between the units related to various branches of the hierarchical structure. In particular, such doctrines are characteristic for the Protestants, Jews, Confucians, Mormons, Russian old believers, etc.

The development of technologies, enlargement of states, and their aggregation have led to diminishing the benefits from getting new resources in comparison with the resource losses caused by expansion processes. Since the 19th century, the role of the resource connected with intellectual activities has been increasing quickly and in the 21st century it became dominating. As a result, the tendency finally spread out leading to the complicating of society by origination and activation of the connections between the units at the low and middle levels of various branches of the hierarchical system, that is the system decentralized and a net started forming. However, such a process requires significant time.

In techniques, the activation of the connections between system units if such activation is provided in automatic mode can occur for a few seconds or faster. If not, the activation can be performed with the help of a man for a significantly longer time interval.

In structures of living creatures, in particular, in the nervous system, such activation can take several months being a basis for curing, e.g., after stroke. The time needed for activation depends on individual features of a living creature.

In society the activation of connections between units and corresponding opportunity to form an adequate reaction to the threat arisen with the minimum consumption of resources at the highest speed, depends on worldview, ethical values, and standards of behaviour [6]. The parameters characterizing the worldview, values, and behaviour are of inertial nature. They can change gradually as new generations grow up, even in case of abrupt changes of the society governance system.

For example, the society with a strict multi-step hierarchical structure unlike the democratic society, has significantly lesser number of effective links among the units and is more inertial in development of management decisions. Moreover, such society possesses a less adaptation ability to changing conditions of existence.

However, a formal transition to a partially decentralized system with the increased number of links which although being mentioned in laws, actually will not result in a quick growing of the CC. Memory about strict standards of behaviour in recent times will support the tendency of many people to isolate their interests within the frames of their families and friends.

There are many examples of such a kind in history, particularly in the 20th century.

It should be noted that a significant variation of the parameters determining worldview, ethical values, and standards of behaviour even in case of favourable conditions may require many years.

The inertance of formation of new connections between society units should be taken into account analyzing the dynamics of the society development in a future.

The threats the society has to answer in the nearest time are well-known. Among them there are the growth of economic inequality, mass migration, growth of terrorism, increase in the power of energetic facilities accompanied by the risk of damage. However, this list is not exhaustive.

For example, at the beginning of 2016 S. Hawking in one of his interviews said that the main future threats should be associated with the artificial intelligence, robots-soldiers, nuclear weapons, and genetically modified viruses. In the opinion of R. Kurzweil, during the 21st century a new breakthrough in science and technique will result in reaching such a scientific and technical level that would have been reached in 20000 years, if a present rate of development remained unchanged. Hardly ever, new threats are possible to foresee.

The avalanche character of technology development and globalization of links between people have resulted in the situation that for the first time in history, the threat growth pace has become higher than the pace of adaptation to them, meanwhile the range of the threats has become universal.

The idea concerning the dynamics of the society development has to attract the attention of metrology specialists to researches in the humanitarian field. In our view, first of all, new programs of upbringing and education, beginning from kindergartens up to universities, have to be developed and substantiated by scientific investigations with the emphasis placed on formation of independent points of view, interest in new knowledge, and ability for quick perception of changes in priority directions in science, production, and services.

4. Conclusion

In the 21st century one may notice the transition of the society interests to the field of knowledge related to person and society including the processes of their development. While performing investigations in the humanitarian field, the metrological approach became actual.

Using the analysis of the society development dynamics as an example and involving the concept of “cultural capital” interpreted by L. Harrison, the authors of this paper show the features of the metrological approach and appropriateness of applying the analogy between biological, social, and technical evolution.

The definition of the cultural capital is grounded as a quantity that characterizes the complexity and adaptive capacity of society. The dependency of the quantity multidimensional parameter set being measured directly and their coefficients of significance on an intended method of their measuring, is noted.

A criterion revealing the parameters determining a value of the cultural capital and a version of the parameter list is given as applied to the measurement model reflecting the “mechanism” of the cultural capital formation, is proposed. The role of activation inertance with regard to the connections between society units is emphasized for the cultural capital measurements.

Evolution of society is accompanied by the increase in the number of situations that may result in tragic consequences for the mankind. An increased danger is due to the fact that the rate of the growth of cultural capital becomes lower than that of the threats to the society development.

References

- [1] *International Vocabulary of Metrology – Basic and General Concepts and Associated Terms – 3rd edn. – 2008 version with minor corrections* BIPM, JCGM 200(2012)
- [2] Rossi G B, Berglund B 2011 *Measurement* **44** 815-22
- [3] Sapozhnikova K, Chunovkina A, Taymanov R 2013 *Measurement* **50** 390-96
- [4] Sapozhnikova K and Taymanov R 2015 *Proc. XXI IMEKO World Congress* (Prague, Czech Republic August 30 - September 4, 2015) 6 p.
- [5] Piketty T 2014 *Capital in the Twenty-First Century* (Cambridge: Harvard University Press)
- [6] Harrison L 2013 *Jews, Confucians, and Protestants. Cultural Capital and the End of Multiculturalism* (Lanham, MD: Rowman & Littlefield publishers, Inc.)
- [7] Golitsyn G A and Petrov V M 2005 *Social and Cultural dynamics: Long-term Trends (Information Approach)*, (Moskva: KomKniga).
- [8] Ward P 2001 *Future Evoluton* (New York: Nimes Books, Henry Holt and Company, LLC)
- [9] Taymanov R, Sapozhnikova K, Danilova I, Druzhinin I, 2015 *Proc. XXI IMEKO World Congress* (Prague, Czech Republic August 30 - September 4, 2015) 5 p.