Strategic Planning of Science City Socioeconomic Development

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Abstract. A Science City (SC) is an urban development vision of a Smart City that includes a powerful city-forming scientific-industrial complex in an advanced fashion with a view to managing a city's assets and human capital. Therefore, the strategic planning of the SC's socioeconomic development requires as special scientific-industrial and cultural marketing analysis involving citizens in strategic processes (civic participation). Certain factors should be considered, such as the fact that SC strategic planning must be coordinated with the federal government and regional authorities, as citizens are demanding more accountability from the government and it is necessary to create conditions for networked group self-organization. So, SC strategic planning has become a transparent networked multilevel decision-making process where marketing analysis and civic participation are the challenge for Smart City strategic planning methodology. Under such conditions this paper aims to develop the author's convergent approach (CA), which would help to accelerate the networked strategic meetings by applying Situational Center, Cognitive Modeling, Genetic Algorithm, and Big Data analysis technology for the verification of cognitive models. This study is an attempt to address the issue of applying CA for accelerating SC strategic planning with civic participation and marketing analysis. To portray the issue of scientific-industrial complex and cultural marketing analysis in these terms, Quality Function Deployment was used. This ground was tested in the SC strategic planning process in the SCs of Korolev and Fryazino, Moscow Region, Russia. It was shown that the CA helps to speed up the traditional strategic planning significantly.

Keywords: Civil participation · Convergence approach · Decision-making · Networked strategic meeting · Science City · Smart City · Strategic planning

1 Introduction

The strategic planning of the socioeconomic development of an e-City (Smart City) is especially challenging in relation to a Science City (SC). Regular state strategic planning in Russia began in 2014 when the relevant federal law, number 172, was adopted. Special laws (in 1999, number 70; in 2015, number 100) were adopted for the SC. The laws ensure strategic forecast, planning and programming processes through special rules on the federal, regional and municipal levels.

The modern system approaches to city development planning have been considered (see, for example, [1, 2]). But it was shown that the SC has its own distinctive features for strategic planning. So, according to the above-mentioned laws, the SC includes a city-forming science-industrial complex. It develops and approves the strategy of social and economic development that has to be coordinated with the federal government and regional authority and includes a section with the characteristics of the scientific-industrial complex and innovative potentials of SC's organizations, such as the methods and mechanisms of their development. The road map for this strategy must be based on: the development of the science-industrial complex, including small and medium-sized enterprises; the implementation of innovative projects aimed at the creation and development of the production of high-tech industrial products; the preservation and development of Science City infrastructure. The relative number of scientific workers (researchers) from the science and production complex must exceed a certain threshold.

A Scientific and Technical Council of the Science City and a board of directors from leading city companies could be created to support the strategy-making processes. The chameleonic science and technology market dynamic must be taken into consideration in a special way. As the strategy is created to ensure the improvement of the quality of SC life and its citizens, it is very important to organize civil communities and civic participation to discuss different issues. Civic participation is the individual and collective actions designed to address and discuss strategic issues of public concern.

So, the strategic planning in the SC is a networked multilevel decision-making process that could take into account a lot of (up to 100) poorly predictable factors, such as: global science and technology market dynamics, nuances of domestic and foreign policy, financial constraints, civil groups' requirements and experts' opinions, digital technology development, etc. There are about 50 well-known models for strategic thinking [3], the Mintzberg's 10 schools of strategic thought [4] and other different approaches in the field of strategic management [5] and decision analysis for unstructured problems [6]. The scientific and technical council, groups of people and experts, and city citizens are the participants of the strategic processes; and it is required to get high-level agreement between the participants, including civil communities. Such an abundance of strategy-making approaches, inside and outside factors can make this strategic planning process unsustainable and divergent.

To make strategic management more efficient, sustainable and purposeful, managers of various companies around the world implement special management innovations, such as: introducing agile technology into the strategic process; reducing the number of control hierarchy levels; encouraging horizontal links; using project methods and technologies; increasing team confidence; implementing permanent and self-education principles; replacing salary with rewards; covering everybody with strategic planning processes; reducing financial control losses; creating broadcasting networks to improve transparency; placing more emphasis on intellectual property and intangible assets; organizing strategic conferences and conversations; creating and developing special networked expertise (e-expertise) decision support systems, etc.

But the dynamically segmented science and technology market is getting more complicated and faster developing. Its predictability is reducing. Consequently, it requires new strategic planning approaches and additional resources to keep SC

development more sustainable and purposeful, and its business more competitive. In previous practice, building the strategy for a city has taken about 5–9 months and its administration had to keep special strategic planning and information technology departments. The new reality does not always allow this to happen; the duration of the strategic planning process may be restricted to 1–2 months and the process may be realized by the city administering themselves with invitations to 2–3 consultants with their special group strategy-making methodology.

To accelerate the SC strategic planning agreement and to make the strategic planning process with compulsory civic participation more purposeful and sustainable, the special author's *convergent approach* was applied and tested.

2 Convergent Approach for SC

Strategic decision-making in socioeconomic subjects is usually supported by different methods. It may be the well-known SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) method, the Analytic Hierarchy method [7], experts' procedures [8], marketing analysis, or statistical and sociological investigations. The strategic socioeconomic planning for the SC involves many groups of people, participants of social networks, crowds, etc. They develop their claim during the long-term strategic planning.

The success of strategic planning with civil participants depends on solving a set of issues from the fields of politics, economy, sociology, finance, technology, etc. Furthermore, the proposed mechanisms have to support the digital democracy processes of citizens' strategic discussions and decision-making, taking into account the possibilities of modern digital and networked technologies, including artificial intelligence.

One of the main restrictions to advancing the CA is the established traditions and laws that govern the citizens' processes of strategic discussion and decision-making. The development of democratic processes is very conservative. This domain seems impervious to the transformative effects of digital and networked technologies. Models of representative democracy, administration hierarchy, elections and experts' processes have not been changed much for a long time. The way in which authority interacts with the public and experts hasn't changed much either. The processes of public participation rarely involve effective virtual collaboration technology for giving citizens the power to make decisions [9].

Countries' leaders have designed the e-government activity around interconnection, openness, transparency and cybersecurity. Citizens have used e-voting in their national elections. The networked technology gives them a way to develop a pure market, driven by supply and demand, with the possibility of being decentralized and free from government control. In their turn, networked opportunities and thoughts that governments are dysfunctional and corrupt are pushing more to make social decisions outside the current state decision-making system, not by voting. Voter turnout is dropping in a lot of countries.

Blockchain and bitcoin technology has begun to support the development of democratic processes. Blockchain drives different transformations, such as: integrity, when trust and transparency become the most important characteristics of social

activity; citizen power, when people take more responsibility for their communities and collaborations. A number of hidden factors influence SC strategic processes. On the whole, the SC socioeconomic decision-making processes can be characterized by the following specific features:

- Poorly predictable and chaotic behavior of the environment and participants;
- Boundary fuzziness of groups and areas of their interest;
- Weakly formalized and ill-defined problems;
- Unsustainable and divergent discussion and decision-making processes;
- Unique problematic situations;
- Stealthiness of participants' intentions;
- Deviations of the global strategic plan realization;
- Importance of small actions, and others.

The convergent approach focuses on two essential aspects, namely: the stability (sustainability) and purposiveness of group strategic planning and control [10]. The convergent approach integrates:

- Strategic SWOT analysis methods for identifying and formulating the factors that influence strategic development;
- Networked strategic conversation technology [8] for speeding up obtaining the strategic agreement between the members of the authority team (administration) and groups of experts;
- Cognitive modeling and genetic algorithms for incorrect problem solving [10, 11];
- Big Data analysis for cognitive model verification [12];
- The logic of breakthrough thinking [13], etc.

The creation strategy for the SC requires taking into account the above-mentioned specific features of the SC such as citizens' opinions, which are to be agreed with the decision-making activity of the SC administration and groups of experts. The main components of the strategic decision-making processes in the SC are illustrated in Fig. 1.

The different features of the participants of strategic decision-making processes in the SC appear to suggest that the strategic planning has to be structured in a special convergent way to get the synergy of strategic decision-making processes on different levels. The convergent approach just provides this synergy. It ensures the control process of the various strategic meetings, discussions or conversations so that they are converging toward strategic goals. The convergent processes become purposeful in spite of the fact that the goals could be fuzzy. The processes become ill-defined because no formalized participants' activities (dreams, intentions, interests, feelings and thoughts, mimicry and gestures) are expressed by means of discontinuous and discrete words and images. At the same time, in the strategic meeting where these activities predominate, the duration of the process of getting an agreement may be excessively long and result in failure.

The convergent approach creates necessary conditions for ensuring the convergence of the discussion processes. This is achieved mainly by applying cognitive modeling and the genetic algorithm that help to solve incorrect problems in the cognitive model [10, 11]. These conditions may look like requirements for the special
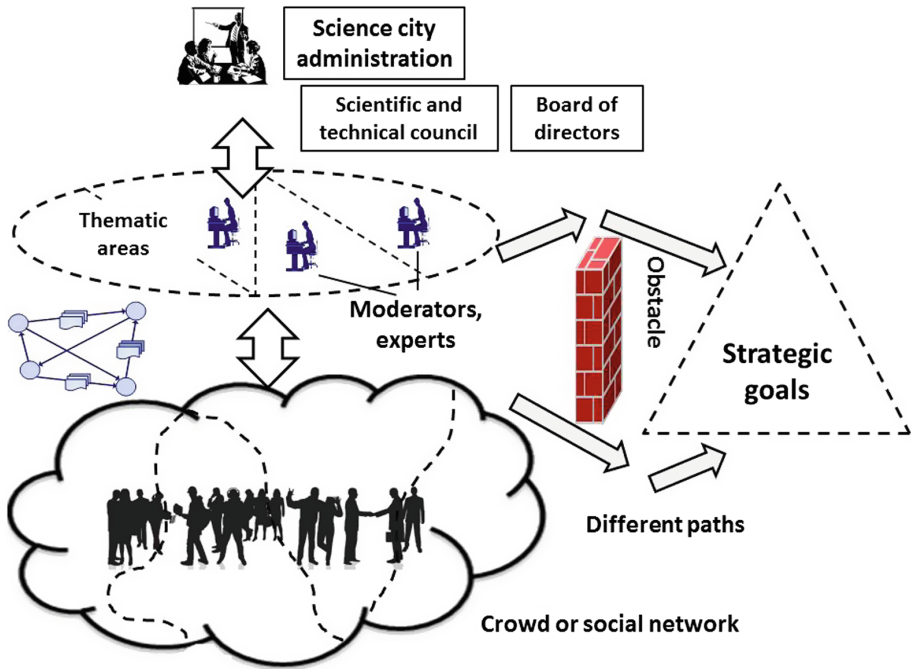
Fig. 1. The components of strategic decision-making processes in the Science City.

structuring of information processes and taking the mandatory steps. The requirements for structuring the special information helps to increase the stability of the consent attainment process in a team or group of people during the formation of the strategy. The moderator who is conducting strategic conversations needs to know certain rules and make sure they are adhered to, such as:

- Information openness and transparency of the discussion process;
- Stringency of the conversation schedule;
- Changing rates of information openness and of stringency in a special way;
- Support for the special level and rate of internal chaos generated during the discussion process, etc.

There are mandatory steps (algorithm) in the strategic conversation between the participants of the SC authority team and groups of experts:

- Separate goals, resources and actions;
- Create of a goals tree by categorizing goals as: main, internal and external;
- The goals are to be ranked by using, for example, the above-mentioned Analytic Hierarchy method [7];
- Decompose the resources into a finite number of parts by using, for example, the well-known SWOT analysis method;
- Define a few strategic directions (priorities) by using the SWOT analysis method;
- Create a strategic cognitive model [10];

- Verify the cognitive model by using Big Data analysis technology [12];
- Define the optimal actions by using the genetic algorithm on the cognitive model [10];
- Identify mechanisms for managing the strategy implementation, including financial and investment tools;
- Write the strategic document and road map.

At the same time, it is necessary to take into account the citizens' decision-making and the consumer characteristics of science and technology market forces to complement the author's convergent approach that has been applied only for strategic conversation between the participants of the SC authority team and expert groups through two new components:

- Integration of the participants of the SC strategic planning;
- Marketing analysis investigation, adapted for SC product policy.

3   Fractal Civic Participation Integration

The main participants of the SC strategic planning are the administration of the city, management of enterprises, expert groups and self-organizing population activity (crowd). The self-developing and self-organizing digital democracy processes have to be supported. The networked decision-making situation consists of people, goals and requirements of different teams, groups, headquarters, experts and moderators, and obstacles on the way to the fuzzy goals (see Fig. 1). The problem is to find a strategic agreement among all of the networked groups of participants in the shortest amount of time. This problem is ill-defined, incorrect, wherein the emotions, thoughts, feelings and transcendental states of mind of participants advance the decision-making process. The administration and moderators have to control the networked activity so as to ensure the strategic consent of the participants' decision-making. For this aim the moderators have to know the CA at least.

Everybody in a group has to comply with the convergent rules of strategic meeting conduction and structuring the information for ensuring the purposiveness and stability of discussions that can be implemented in the network. The duration of the online networked or apparent strategic discussion (meeting, conversation) should be around 4–8 h. During the discussion each participant has to make a decision in a short time regarding the strategic targets of the group. It may coincide with the global decision of all groups. Sometimes it happens that someone will have to agree with the global decision, but it may coincide with his dissatisfaction. The moderator has to bear in mind that dissatisfaction is the enemy of desire to do anything. The behaviors of various participants are different. The behavior of authority and expert groups may be to obey the strict rules, but the behavior of social networks could bring chaos to mind. These two types of behaviors have to be synchronized.

The information and communication technologies and networked decision support systems help to accelerate the strategic processes; thanks to them the democracy becomes more transparent and direct. It gives people the opportunity to influence

policy more directly. However, strategic thinking requires networked group consensus, which differs from votes, when some participants may have their own opinions. Consensus is group agreement when each member of the group accepts the general goals with full responsibility.

Digital democracy activity appears as practices of citizens' control and group decision-making [9]. Nevertheless, in our opinion, these processes have no effective methodology and technology to provide sustained acceleration of citizens' group strategic decision-making. And the CA has to be complemented by the special universal (fractal) constructions that could help to synchronize the processes of strategic planning between various multilevel participants with different types of behavior. There may be at least two fractal constructions: for a multilevel decision-making process and for information representation. The first fractal construction is illustrated in Fig. 2. The idea consists of the recommendation to crowd groups to use Agile technology [14] for organizing strategic processes. As can be seen, in this case the steps of strategic planning on the different levels of control are very similar.
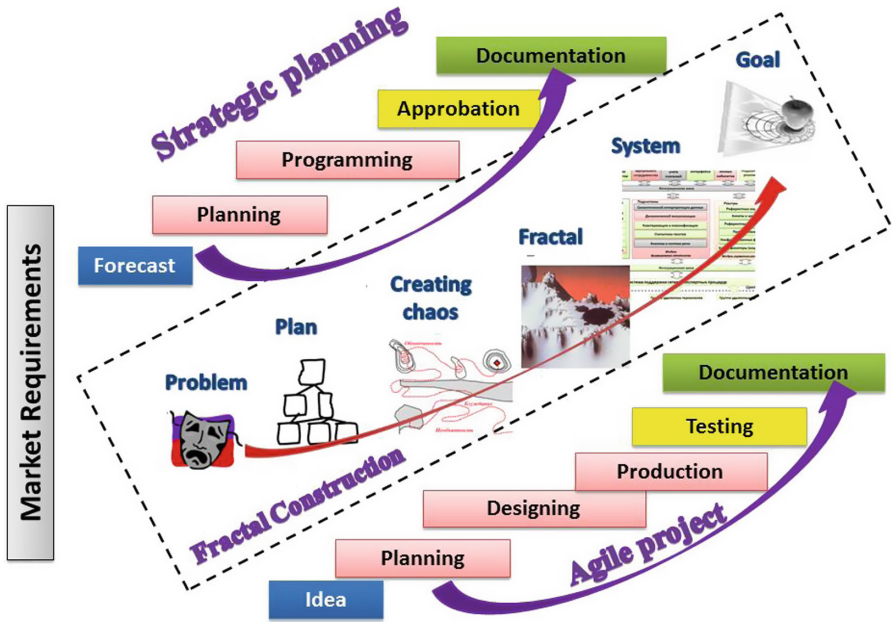

Fig. 2. Fractal construction for strategic planning multilevel decision-making processes.

The fractal construction, represented in Fig. 2, comprises five main elements. The first one is the "Problem" that appears when there is a need to satisfy the market or other external environment requirements. The second is the creation of a draft plan. Thirdly there comes a time of chaotic search that looks like search in a Klondike space [13]. Then, fourthly, there come the ordering spaces in the forms of elements of strategic planning or claims of advances. The result of the fifth point is the system,

which may be in the form of production, a prototype of a plan or program. Then come the moments of approbation (testing) and achieving the goal. The goals of strategic planning and creating a product with Agile technology are the same – documentation to advance the results into real practice.

The second fractal construction is illustrated in Fig. 3. It is manual of recommendations for the participants of strategic decision-making, including citizens' groups, the scientific and technical council and board of directors, to put forward their claim in the universal template. It includes the list of information that has to be created by every group during strategic conversation. When groups or individual participants present the results of strategic discussions (the goals, external and internal factors, etc.) in this special fractal construction it ensures the synching and speeding up of SWOT analyses so that the results of all participants have a similar structure.
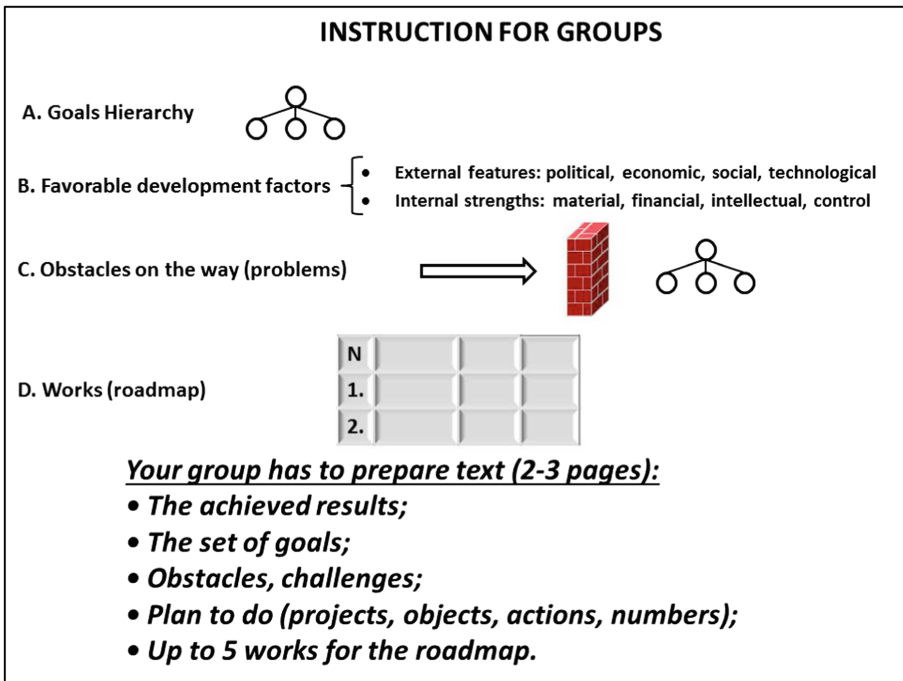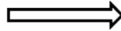
Fig. 3. Universal template for structuring information during group strategic conversation.

4   Networked Marketing Analysis

The Science City strategy must consider not only the global science and technology market. It is more important that the development of science and technology requires a creative atmosphere in the SC. In this way, the connected segments of the market could be very different and may go far beyond merely scientific and technical products. For

more general coverage consider one nontraditional and very difficult subject for the SC – cultural heritage reuses. This issue improves the creative atmosphere and SC attraction for the scientific and technological global society.

The processes of improving cultural heritage require networked expert assessments [8] of cultural heritage objects and the events related to these objects. Cultural heritage objects include: churches, industrial buildings, cultural landscapes, archeological sites (not specified yet), cultural heritage monuments, etc. Cultural heritage is not only a link to the past. It is the catalyst of current activity and supports movement into the future. The destiny of every such object is connected with a lot of events. The costs for the adaptive reuse of these assets have to be supported by the public sector, traditional private sector models and special networked expert groups.

The process of cultural heritage reuses demands special marketing analysis and every market segment can have many consumer characteristics. This "gap" could be estimated by different networked experts or groups of experts by using the well-known Quality Function Deployment method, which has to be adapted for the issue (Fig. 4). The numbers in the blocks indicate the order of the implementation process. The detailed descriptions of the scheme are given in [8].
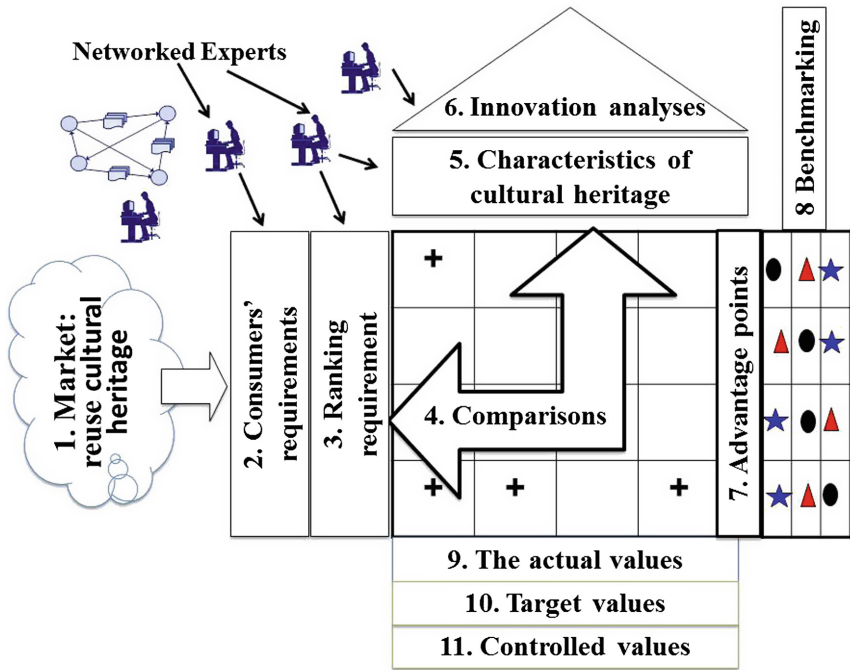

Fig. 4. Decomposition of the cultural heritage reuses estimation process.

The cultural heritage assessments can comprise a desk-based study, interviews of the expert groups from different countries, a wide-area survey, etc. It is very important to choose the right method and create an adequate list of questions. Furthermore, the

list has to comprise three groups of questions: holistic, performance-based and sustainability-based [15]. This decomposition helps to obtain the convergence of the decision-making process and implement the CA.

A cultural heritage object can be characterized by different quantitative, geometrical, qualitative and phenomenological parameters. Some of the parameters could be latent or hidden. For example, historical or archaeological places could be of cultural importance to a group of people who are neither historians nor archaeologists, but they may potentially be interesting for them for religious reasons. Moreover, if archaeological research takes place on a site of cultural heritage, the decision-making process regarding reusing the object can be delayed to enable evaluation of the site. This implies the participation of networked experts from different countries and various activities.

Given the multidisciplinary nature of the issue, and the large amount of information that has to be assessed and networked through the distribution of experts, the process of marketing analysis can only be realized with the support of the networked artificial intelligence mechanisms of e-Expertise and Situational Center [8].

5   Conclusions

The aim of this paper is to synchronize and accelerate the processes of SC strategic socioeconomic planning taking into consideration the scientific-industrial complex and cultural marketing analysis and involving networked groups of citizens in the process (civil participants). It provides that in these conditions the CA makes the strategic processes faster, more sustainable and purposeful. This is achieved by structuring information and processes in a special convergent way. The CA is based on some fundamental consistent patterns and artificial intelligence technologies, including cognitive modeling and genetic algorithm for solving inverse problems.

The multi-group self-developing and self-organizing digital democracy processes have been supported by introducing two special fractal templates. They integrate the processes and information structures on the different levels of strategic processes – from administration of the SC to the groups of people, including those who work in a social network.

The main parts of the suggested CA were verified in many cases, for example: the development of the Russian information technology market. It was applied for strategic planning in the fields of: regional higher and professional education, the public health service, social security, housing and communal services, property management, a youth policy and television viewer rating calculations. The results were successfully implemented to develop several governmental situation centers in the Russian Federation and to create business strategies for some commercial companies.

A socioeconomic development strategy for two Russian SCs – the cities of Fryazino [16] and Korolev, Moscow Region – was developed. The strategy describes different aspects of SC life, including issues of complex reconstruction and development territories, high and professional education, the public health service, a social security program, housing and communal services, a youth policy, changing the segments of the market, creating a smart city, etc. Every SC strategy was presented in the

form of 50 pages of main document and about 50 optimized points of the road map (action plan). It has been shown that the development of strategies through discussion in different groups of participants can take 2–3 months.

The proposed convergent approach in the condition of self-developing and self-organizing digital democracy processes could be used for strategic planning on government, municipal and corporate levels, mainly by those who have to support high-level group decision-making processes.

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