Geogracom 5W+: Spatial Planning decision process from future vision to understandable results

INTRODUCTION

The ability to define general objectives, and then to find optimal in a certain way solutions for practical problems of extremely big complexity is revolutionary achievement of the science. It helps to avoid the situation when method becomes the goal, which for one's turn cause new practical rules, which mix with goals and etceteras down by chain to the confusion (Danczig, 1983). This thought is clear and was ventilated numerous times by scientists and politicians. Nevertheless mishmash in goals, methods and conditions is prevalent disease of real decision making process in spatial planning at least in the Russian Federation.

Scientific and consulting company “Geogracom” more then 15 years takes part in the struggle for new-way-thinking of officials responsible for transport system planning of regions.
We orient on ultimate goals of the society as a whole and every citizen in particular, shrinking the space and widening the possibilities of territories by means of transport.

The main goal of this paper is the general description of the spatial planning methodology, applied in creation of spatial strategies in the Russian Federation and CIS.

This paper considers the following questions:

1. Goals, methods and results of Spatial Planning Decision Support System. (SPDSS) “Geogracom 5W+”. Logical structure of the strategy-making process.
2. Planning parameters and criteria’s , used in Geogracom 5W+: particular and integral transport accessibility, equality in communication potential, transport deviation and transport discrimination, reliability of transport, ecology safety and road accidents caused by roads.
3. Links of used parameters with economic, social and demography regional indicators and cost efficiency approach to the development strategy based on that fact, realized by simulation in frames of SPDSS.
4. Strategy principles of sustainability to changes of factors like transport policy, demography situation and economy situation.

1. STRATEGIC SPATIAL PLANNING GOALS, REALIZED IN SPATIAL PLANNING DECISION SUPPORT SYSTEM “GEOGRACOM 5W+”

It is certain that the main goal of transport planning is the satisfaction of final consumer – citizen. Citizen’s needs forthcoming from space and transport system can be formulated this way: freedom, wide possibility and comfort of communication, equality in communication possibilities, personal security, guarantees of private life, good environment and landscape preservation. Main target model parameters, used in “Geogracom” methodology are gathered in table 1. Of course, system account or tracks such parameters like turnover of goods, passenger miles, profitability of transport and roads and etcetera, but they are not objective parameters.

Base principles of transport spatial planning are the improvement of integral transport accessibility of the territory (Bougromenko, 1987) and accessibility of certain zones, reduction of transport differentiation, elimination of transport discrimination and improvement of other criteria of Minimal Transport Standard (Bougromenko, 1998). Ideologically similar methods are used in accessibility planning in UK and Switzerland. It is important to say that system is not deadly linked to some ultimate formula of accessibility estimation, operating

various methods. The other important thing is that the accessibility is estimated by purposes of communication.

But let us explain the common sense of parameters gathered in table and discussed above.

Table 1 Model parameters, imaging final consumer's needs in Geogracom methodology

	Consumers need	Corresponding model parameter in "Geogracom" methodology
1	Communication possibilities	Potential zone communications Integral Communications potential (of the territory) Zone Transport Accessibility Integral Transport Accessibility (of the territory) Reliability of Transport System
2	Security	Road accidents caused by roads Evacuation schema in case of disasters
3	Possibility equity	Equity in communication potential Transport differentiation Transport discrimination Transport deviation
4	Environmental security	CO_2 emissions by motor transport Transport weight in air pollution Bicycle usage possibility in short trips

Zone can be settlement and other location of production service and characterized by measurable natural or economic volume or fuzzy parameter.

Zone Transport Accessibility is weighted time from certain zone to others and is measured in hours and varies from the purpose of the communication.

Transport zone potential images the potential quantity of communications from certain zone to other zones with certain purpose.

Integral Transport Accessibility (ITA of territory) is an aggregative measure of transport system quality (usually is weighted sum of zone transport accessibilities).

Integral Transport Potential (of territory) is another aggregative measure of transport system quality (usually is weighted sum of zone transport potentials).

Reliability of transport system images the ability of transport system to support communications with certain (normative) speeds and in certain (normative) time.

Normative state of transport system is the state of transport system, when every citizen will feel himself unimpaired in his rights. What is normative and what is not is determined by government policy. It is good when policy goes with results of gallops polls.

State of Transport System is real or simulating technical condition of transport infrastructure, transport net pattern, traffic organization in certain time.

Transport Deviation is the deviation of Zone Transport Accessibility from its normative.

Transport Differentiation shows the deviation of zone transport accessibility from typical (usually mean) value for this territory.

Transport discrimination is deviation of communication time for achieving the most important services, defining quality of the life (health care, schools, police and fire stations, grocery) from some critical value. Critical communication time can be estimated from the distribution of degree of willingness of getting the service from the communication time. All this parameters are not linear and image synergetic and emergent nature of transport system. But the thinking man can say "It is still in the air. I can determine and estimate numerous quantities of measures. What was principle of the choice of these certain parameters?"

We can answer in this way:

1. Simulation of synthetic situations showed good relevance between model vision and expert vision.
2. In most part of cases the simulated vision of bad and good for real territories was close to the vision of real regional decision makers.
3. Listed parameters obey the economic low of diminishing return.
4. Listed parameters go with statistics!

During 15 years numerous researches on various regions of the Russian Federation and CIS showed the steady statistical relation between cost prices in some industries and services (the most of all in transportation, agriculture, timber industry and construction), investments, unemployment, security (crime rate), results of health-care and migration from one side and "Geogracom" target parameters from another side. This gives ground to suppose that the improvement of target parameters is at least the prerequisite for improvement of quality of life and economy efficiency.

Following this hypothesis makes possible to use the multivariate regression as a tool for determining economic, social and demography equivalents of increment of target parameters. Let us illustrate such results, got in frames of developing the White Book of Roads of Astrakhanskaya Region in 2007. The minimum values of regression parameters are cited as an example in table 2. Similar results are got by more then 20 regions of the Russian Federation and CIS.

N	Depended function (parameter)	Direction and value of ITA parameter (argument)	Unit	R-square
1	Plant growing price cost	Decrease by 62.5	cent/$	0.435
2	Construction price cost	Decrease by 3.65	cent/$	0.803
3	Passenger transportation price cost	Decrease by 0.4	$/10 pas*km	0.751
4	Cargo transportation price cost	Decrease by 2.96	$/10 ton*km	0.658
5	Unemployment rate	Decrease by 2.38	%	0.62
6	Crime rate	Decrease by 34.9	crimes/100.000 persons	0.749

Table 2 Economy, social and demography equivalents of increment of the Integral Transport Accessibility (ITA) per 1 hour
Source: The White Book of Astrakhan Region

Calculation of such equivalents allows performing cost efficiency analysis of transport improving projects, ranking them in usual terms.

2. THE DATABASE OF GEOGRACOM 5W+.

The methodology of "Geogracom" means combined study of transport kinds, operating the term of United Transport Network, including roads, railroads, river, sea and air networks. For the target parameters calculations it necessary to define zones and their data and to

estimate speed and regularity of communication for each transportation type. This estimation can be performed by “Geogracom” itself from technical condition data by transportation objects and transportation schedules.

It is taken into account that different purposes of communication use different transportation types. During simulation there are considered various purposes of communication from freight delivery to people communications for health-care and cultural leisure. Figure 1 reflects the main blocks of GIS and Database of SPDSS “Geogracom 5W”.

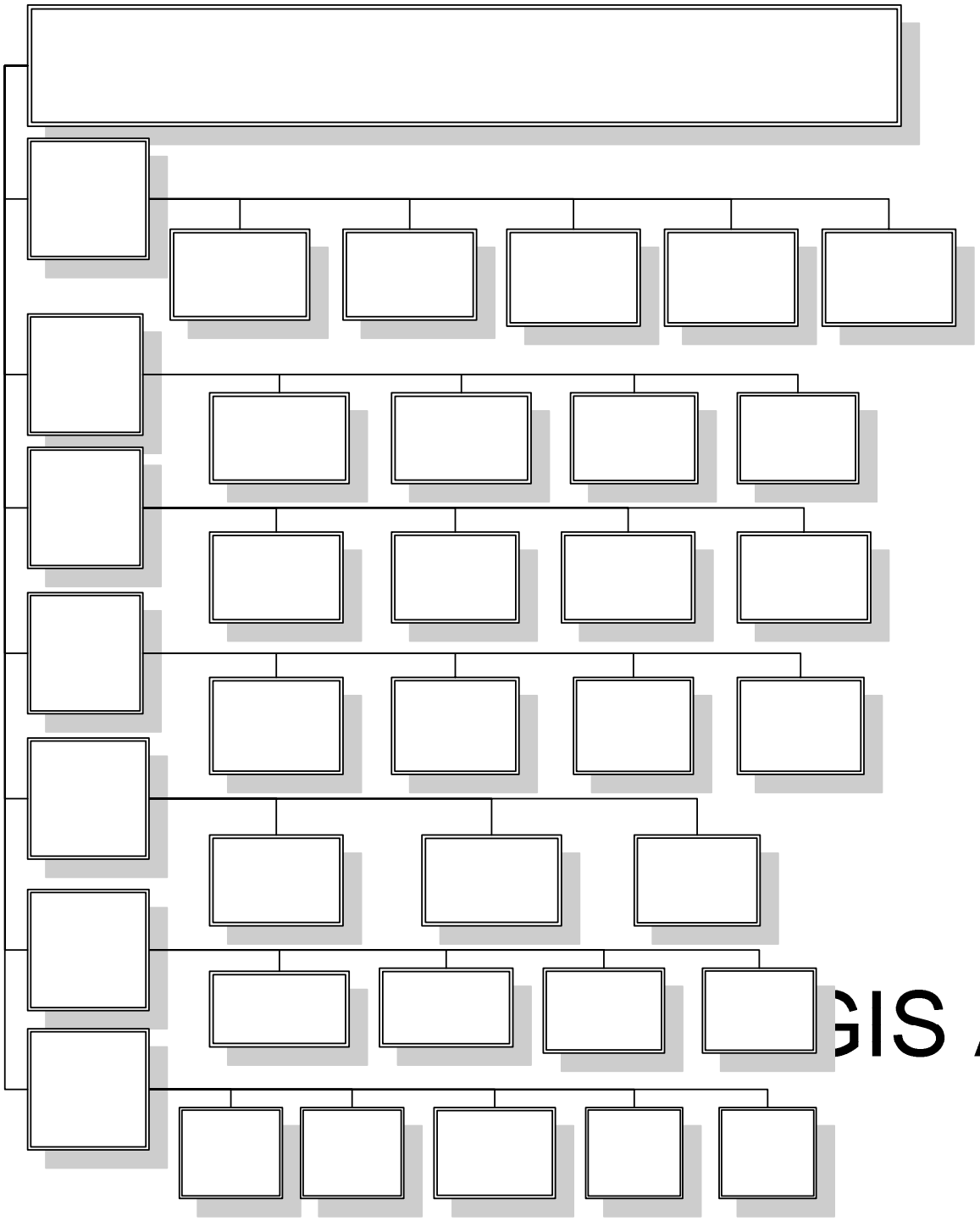

Figure 1. GIS and database data of Spatial Planning Decision Support System “Geogracom” Source: Author

3. THE SIMULATION PROCESS AND RESULTS IN "GEOGRACOM 5W+"

SPDSS "Geogracom 5W+" offers advanced planning aids, based on automated simulation of transport system transferring from start to final state. The set of final states can be automatically generated by software according to user's requirements or can be directly defined by user.

If all necessary data are available then the base report, called diagnostic, answers the following questions:

1. What are the target and subsidiary parameters of transport system?
2. Under what conditions were got such parameters?
3. How close is the concerned transport system to normative?
4. What are shifts from base transport system state?

Except information in table form, "Geogracom 5W" outputs conclusions in natural language, diagnosing critical demerits and underlining merits of transportation system.

The most part of results can be easily visualized and viewed on the map, for example as map of Zone Transport Accessibility as it is demonstrated on figure 2.

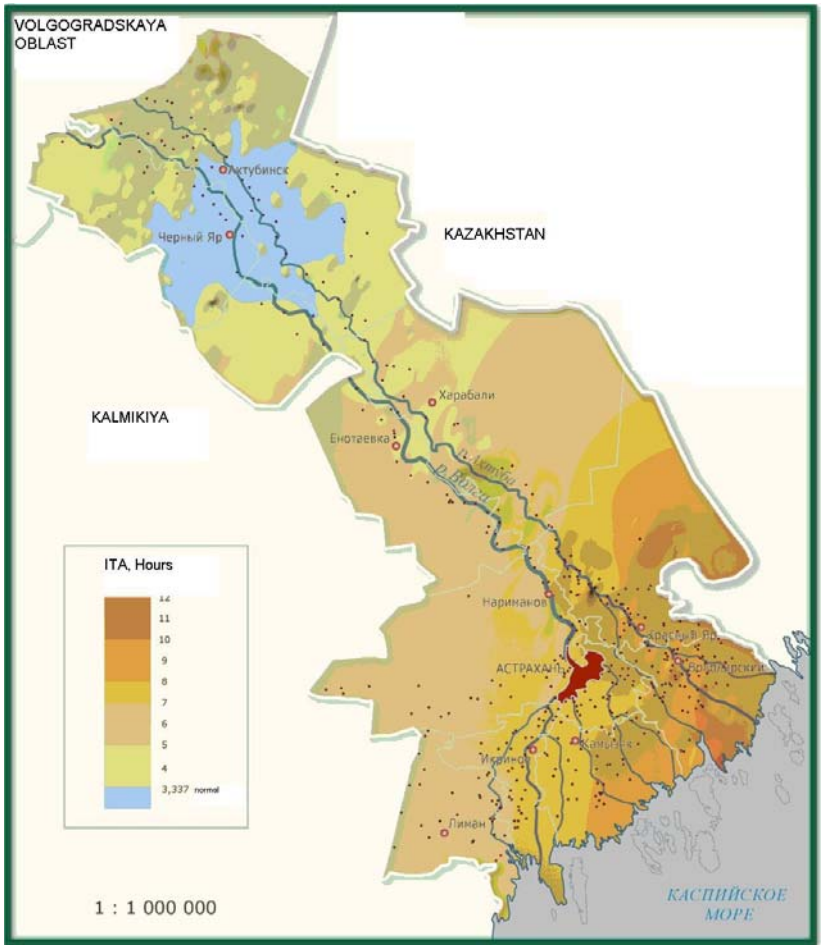

Figure 2. Zone Accessibility of Astrakhanskaya Oblast of the Russian Federation (2007) Source: The White Book of Astrakhan Region

The kind of "Geogracom 5W" is the possibility to model whole system trajectory from start to finish state by selected parameters. Under system trajectory we understand the process of changing selected model parameters in time from the planning start time to planning finish time. Each trajectory corresponds to the certain set of scenarios (see the bottom of Figure 1), which must be predefined. From the trajectories the stability of the strategy of the

transportation system can be learned.

Transport strategy can be accepted as stabile if it goes the following principles everywhere:

1. The principle of funding stability. “Jumps” of funding are sources of risk.
2. The principle of evolutionary development means that on each step the strategy must have a feasible result. People don’t want golden mountains in the distant future if they have nothing today.
3. The principle of run without loss. Operative costs of transport system must be lower then economic benefits from its exploitation, **including shadow effect (!!!)** which can be estimated with economic equivalents of target parameters.
4. The principle of adequacy. The curve of returns (by all parameters) from investments in transport system has well observed saturation point. There is no need to invest billions for nothing.

In common case strategy can violate listed principles on certain terms, but it must be assessed as a risk and reserves for it compensation should be provided.

The result of the methodology is generation of detailed program of activities, determining:
-what to do for reaching target parameters?
-when to do each activity?
-what is the effect of each activity and its weight in total effect?
-how much does the whole strategy and each activity cost?

The general steps of forming the strategy with “Geogracom” methodology are presented in table 3.

N	Strategy forming step	Step results
1	Gathering data	Maps, data slices
2	Defining normative criteria	Vision of “bad” and “good”
3	Diagnosing start state	Diagnostic report, maps, graphs visualizing target parameters
4	Statistic analysis	Natural and economy equivalents of target parameters
5	Defining final states	Maps and data for final states
6	Generating unordered list of program activities for each final state	Unordered list of improvement program activities for each final state
7	Determining scenarios	Scenario data
8	Selecting base scenario	
9	Diagnosing final states	Shifts learning reports
10	Cost efficiency analysis for final states based on selected scenario	Cost efficiency reports
11	Ranking and ordering activities in program	Ordered activities of improvement program
12	Generating pairs of final states (with ordered activities) and scenarios	
13	Transport system trajectories simulation for all selected pairs	Transport system trajectories, diagnostic reports for each pair
14	Learning transport system trajectory stability (the stability of program activities)	Stability report
15	Selecting final state and approving program of civilities	
16	Generating detailed activities program	Detailed activities program, data for the White Book of Transport

Table 3 General steps of forming strategy with "Geogracom" methodology
Source: Author

CONCLUSIONS

The methodology of “Geogracom” is just a step forward to the spatial strategic planning for the citizens.

The first advantage of the methodology is the presence of Decision Support System, which gathers input data for all kinds of transport and zones together and integrates storing data, simulation functionality, reporting and mapping functions in one software product.

The second advantage is the possibility to estimate multiple visions of regional transport and rank them by final results and stability of the strategy, determining risky steps of strategy implementation.

The third advantage is the possibility to estimate future vision in generally accepted indicators, got by transforming of model parameters by means of multiple regression analysis.

As a whole methodology the Decision Support System is in permanent improving, always open for new thoughts and approaches both theoretical and practical. That allows us to hope on improving of decision quality, getting with its aid.

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