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Unification and Convergence of Hierarchic Structures Such as Organizational Separations and Product Projects at Creation of Recommending Decision Support Systems

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Abstract:

Studied the problem of integrated self-management of multilevel hierarchic groups and quasi-groups under modern economic conditions, based on intellectual recommending Decision Support Systems (DSS).

Split-level stereotypical linear organizational structures and project organizational quasi-structures involved in implementation of separated product projects and project groups have been conceptually unified.

Proved that this unification in question engenders, for each management level, a coordinating inter-project managing system that is toponymical identical to the managing system of this level. Demonstrated that relevant management is organically whole and can be viewed as self-management of a general corporate structure.

Discovered that hierarchic economical management can be in principle reduced to a finite sequence of bilevel economical managements of general corporate structures, where the order of hierarchy levels descends from the top level to the bottom one. Presented a schematic description of the basic procedural modes of operation of the respective recommending DSS.

Keywords: *Organizational separation, product project, corporation, quasi-corporation, enterprise, subdivision, hierarchy management, management unification, corporate decision support system.*

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1. Introduction

One of the main and indispensable conditions for successful globalization of the economy is the transition to highly intelligent control systems at all levels. The preservation of archaic management systems inevitably gives rise to primitive isolationism. Therefore, in Russia, and even in the most developed countries considered to be the most developed management, the main factor in the success of development will be a high level of development of Decision Support Systems (DSS).

By now, institutional schemes of economy organization have undergone dramatic transformations from the "national economy – industry – enterprise – division – project" pentad to the "global economy – national economy – industry – enterprise – division – project" sextad, with a national economy being largely a generalized statistical entity controlled at the macroeconomic nonselective actions level. It is worth noting that the latter management aspect – the "project" – is conceptually heterogeneous in respect to the rest of the aspects, for it is not an organizational separation.

Accordingly, management areas related to corporations, enterprises, divisions, and projects have become dominant and separate in term of good results, with several enterprises formally or adopting intrapreneurship schemes, thus considerably democratizing intrafirm administrative procedures. However, an internal incompatibility between management schemes and their excessive multitude has formed at meso-micro level management. Alongside with this, so-called "project-management" (hyphenated and viewed as a special management type) has appeared and become rather widespread. Nonetheless, all those management areas have proved conceptually dissimilar, which engenders an unacceptably low quality of management. All the factors above necessitate the adoption of conceptual convergence of managing systems at meso level and micro level, from perspectives of various product projects, including those that involve their unification, specification, and convergence through coordination.

Currently, the problem of micro level, macro level, and project management is developing rapidly within the public domain in both theoretical and applied studies, as well as in practice of managerial staff activities. On one hand, the changes have objectively led to the formation of:

- meso level intra-corporate and micro level intra-preneureal management (self-management) areas; and
- an area of interaction between meso level and micro level, as well as project and interproject management.

As a result, an integrated poly-project management area has formed at meso-micro level. Within all the areas in question, there exist considerable conceptual,

organizational-economic, organizational-legal, tool-related, methodological, staff-related, and other voids. Lack of intellectual development in managing systems, incompatibility between them even in terms of their concepts, and, sometimes, their quasi-scientific conceptual basis adds considerably to the problem.

The financial and economic crisis evolving currently necessitates new high-quality requirements to justification of managerial decisions. Sometimes, managerial decisions tend to lack scientific justification, amid inertia of corporate, enterprise, or division managerial staff that has chosen either to follow expectation-biased paternalistic behavioral patterns or to remain stuck in a rut with managerial routine.

All of the above management category circuits are not interlinked, uncoordinated, and normally depend on scientifically unjustified, highhanded (intuitive empirical), and undocumented management that in practice proves lame, lacking transparency and legitimacy, the fact that aggravates the problem. Moreover, consequences of such management are normally unsatisfactory and have to be improved by means of commercial funding or artificially.

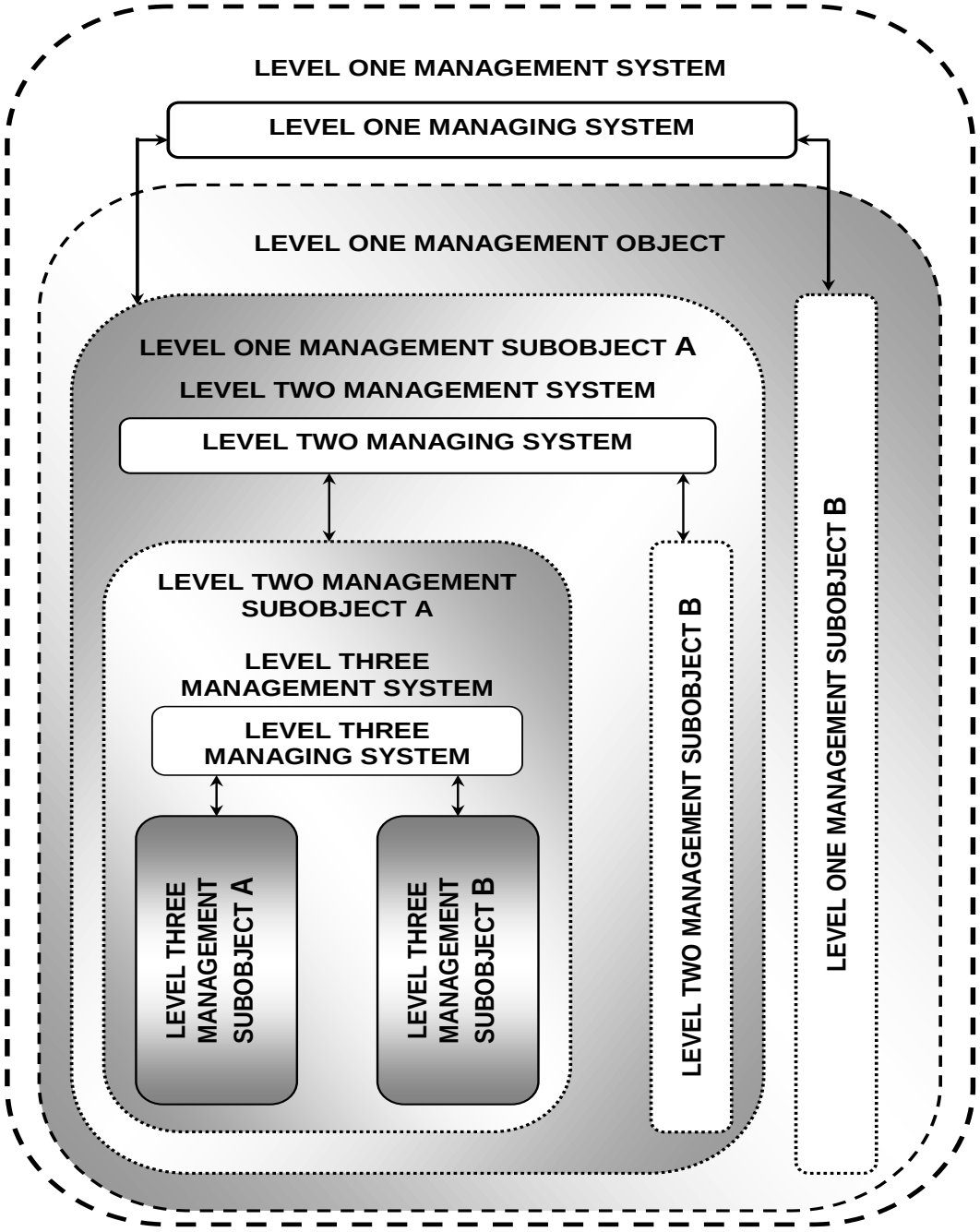
Accordingly, adoption of a scientifically justified management methodology harmonized at all its levels is an indispensable component of development of domestic and non-domestic enterprises including industrial ones. This is why we have to state that a management methodology, especially that of end-to-end or integrated type, like meso-micro level project management of organizational separations in economy (organizational economic separations) must, firstly, exist and be implemented in synthesis with the rest of respective managing system security types; secondly, the said methodology must be of an acceptably high quality and development level; thirdly, it must be synthesized in terms of the concept and implementation.

2. Research results

A management system is hierarchic if its management object within its framework is another management system, and, consequently, an a priori active and reasonably self-managed object. There exist bilevel and multilevel hierarchic management systems, depending on how many embedded managing systems they contain. E.g., a three-level hierarchic system comprises level one, level two, and level three managing systems, where level three managing system and its management object are the management object of the level two managing system, while, in turn, level two managing system and the entire level tree managing system and its management object are the management object of the level one managing system.

A mixed situation is not uncommon to hierarchic systems, when a management object comprises a group of managing systems and unmanaged objects. Please refer to Figure 1 to see a hypothetical three-level hierarchic management system.

Figure 1. *General structure of hypothetical three-level hierarchic management system*



Hierarchic management systems are constructed so as to comply with the marginal manageability postulate that there exists an objective marginal level of management object complicity, caused by the "dimensions" of the object, beyond which any acceptable quality management of the said object either has low-quality results or is impossible. There exist the following management levels under modern economic conditions, excluding international, national, and regional managing systems that, to a certain extent, are beyond the limits of the classical economical management and pertain to macroeconomic and legal management (Kanashchenkov, Dmitriev, Yekshembiyev and Minaev, 2013; Demchenko, Dmitriev and Minaev, 2011; Demchenko, 2011):

- high-level corporate structure (corporate group);
- corporate structures of the rest of the levels;
- enterprises (legal entities);
- enterprise divisions of all hierarchic levels, including enterprise subsidiaries located in various countries (Mal'ko, 2008; Zuyev, 2014).

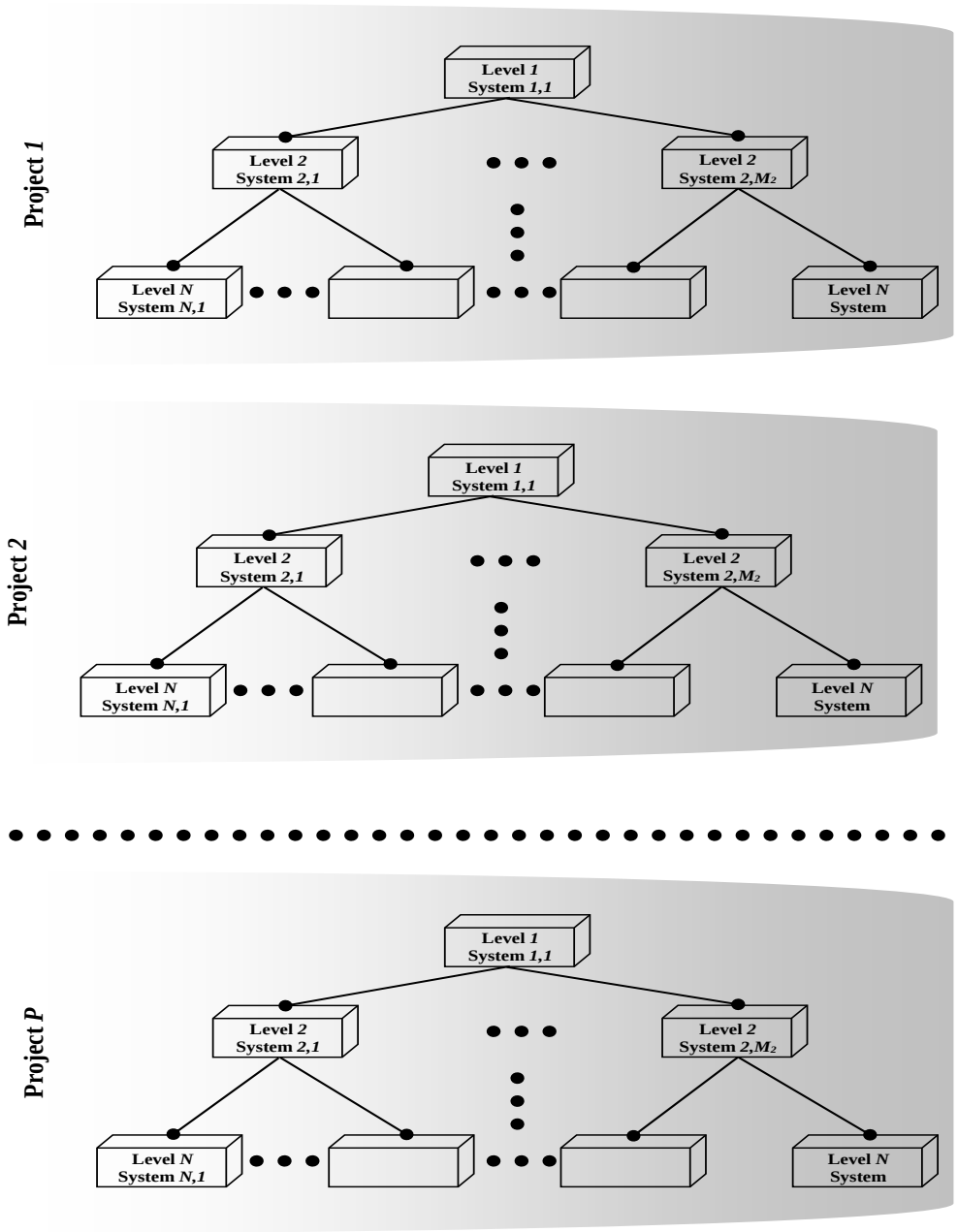
It is characteristic of those organizational separations that, in most countries, they are interpreted as divisions in the country where the legal entity is domiciled, and as enterprises in the country where they operate. Alongside with the above, the organizational and institutional hierarchy imagery projects itself on the product project space and is implemented there for each product project (Figure 2).

Accordingly, the first thing we are to do is to find a way to represent extra-organizational project localization as a typological heterogeneity and to include it in the general typological hierarchic concept. This is very important, as the very emergence of a project is practically inevitable – e.g., wherever public procurement is put out to state tender (Novikov, 2014; Zakharova and Novikov, 2016).

Undoubtedly typical is a situation in which any hierarchic structure implements a number $\boldsymbol{P}$ of product projects, in which case, each of the structural components inevitably projects itself on $\boldsymbol{P}$ product spaces. It is naturally, that the unique way to render the management system homogenous is to recapture those projections by their inverted mapping on a single space, while increasing the dimension of each organizational component $\boldsymbol{P}$ times. If any of those structural components does not participate in the product project, then the project may be interpreted as a void project, which is in total accord with manufacturing and managerial practice. The above clearly suggests that no special project management, like, e.g., that described in exists except in classical management due to reasons of objective nature.

Concerns and consortiums that sell product technology chains are rather a common yet interesting case of management of enterprises in terms of projects they implement. The case in question makes it possible and appropriate to implement the two management stages:

Figure 2. *Corporate structure localization in terms of product projects*



- *stage one:* to synthesize a dedicated economic environment, to create a structure of economically objective subjects or quasi-subjects, to establish interelement economic relations between them, and to codify regulations for the implementation of dynamics of their financial economical state and relations, that is, to implement an economic technology. It appears as an "immersion", "introduction" of the organization's structural components in a dedicated, even probably an artificial intraorganizational environment;
- *stage two:* to apply, stage by stage, within the framework of the codified regulations for the functioning of the economical mechanism and implementation of the economical technology, the whole range of the intellectual managerial information technologies to the economically regulated management object.

The above stage-by-stage technologies may undoubtedly yield productive results provided that those technologies are properly organized to form a complex, and are implemented within the framework of a synthetic, economic-information management technology. Based on the above statements about the problems, conceptual mechanisms, and prospects of intraorganizational management of functioning and development of modern Russian business organizations, we have come to a definitive conclusion that it is appropriate to adopt a universal approach to the formation and usage of the organizational and economic management environment at all levels, from the international to the division level, and that the approach in question is feasible. The approach is to:

- adopt a mechanism to interpret counterparty relations between active and passive management sub-objects as an emulated organizational-economic environment (of natural or artificial entrepreneurial nature) where they co-function and co-develop. The mechanism is recognized either on voluntary mutual consent of the parties that exercise management of the said sub-objects, or compulsorily by the administration appointed from outside and invested with authority over the parties;
- organize the management of the management object ordered by means of the above mechanism, based on intellectual managerial technologies.

Thus, we deal with a primary and a secondary management. Those two managements are multi-moment. Indeed, as appropriateness increases, the emulated organizational-economic environment where functioning and development occur, as well as the managerial decisions made within its framework, may change. Accordingly, there appear two levels or two categories of managerial decisions, namely, those that order, discipline, and interpret the intraorganizational environment; and those involving development and implementation of measures and campaigns within the framework of that environment.

Within the context of the mechanism formation, the whole activity, in a general case, may be interpreted (including its conditional interpretations) as entrepreneurial activity, while it is fair to consider its sub-objects as structural elements of a body corporate, a corporate structure, or, in our case, a quasi-corporate structure. A

corporation or a quasi-corporation like that is a general corporate structure and requires a more general interpretation than that mentioned above. This interpretation of activity is in accord with the overall approach – indeed, the target motivations of all the parties can be viewed in terms of conventional financial and economic result that is of the same nature as this economic category through various formalizations of concepts of profits/losses.

Accordingly, the very concept of product of a general corporate structure becomes more universal: the compliance with the corporate regulations by the corporate members can be viewed, in some cases, as the products (goods) of general corporate structure – together with the goods it manufactures and the services it provides etc. Role functions of a general corporate structure may also depend on the management level at which the organizational and economical management mechanism is formed some of those levels can be excluded. However, the role function of a general corporate structure as a product customer is indispensable for active sub-objects, regardless of the management level.

Therefore, we can resort to self-evident unification and visualize the universal organizational economic mechanism of functioning and development, including that of a modern Russian business organization, as it is shown on Figure 3, and provide its parametric definitions for respective management levels as in Table 1 below for modern Russian conditions. The nature of the environment emulation in question at the international level is determined by the international law and the enforcement mechanisms on the part of the global community. On the other hand, the compulsory nature is caused by the action of binding mechanisms that involve, e.g., the implementation of shares, articles of association, and franchise contractual agreements. For the above reason, an optimal intra-corporate management problem ultimately arises – for actual bodies corporate or quasi-corporations (emulated corporations).

It is natural to implement projects coordination in an integrated way, by their respective managing systems (Richardson, 2010), within each organizational separation, while applying, directly (Mesarović, Macko and Takahara, 1970) or with modification (Dmitriev, 2002), the project coordinability principle; and, to some of the lower hierarchic level systems, organization separation coordinability principle is applied. Vertical integration is most viable for this situation (Dmitriev, 2002). Vertical integration is the most complex integration type of all known managerial integrations, based on an assumption that there are optimization criteria for the managing system of the upper level K and optimization criteria for the managing systems of the lower levels K_{L1} and K_{L2} (see Figure 4, where L is short for “low”).

Figure 3. *Structure of emulated universal organizational economic environment for general corporate structure*

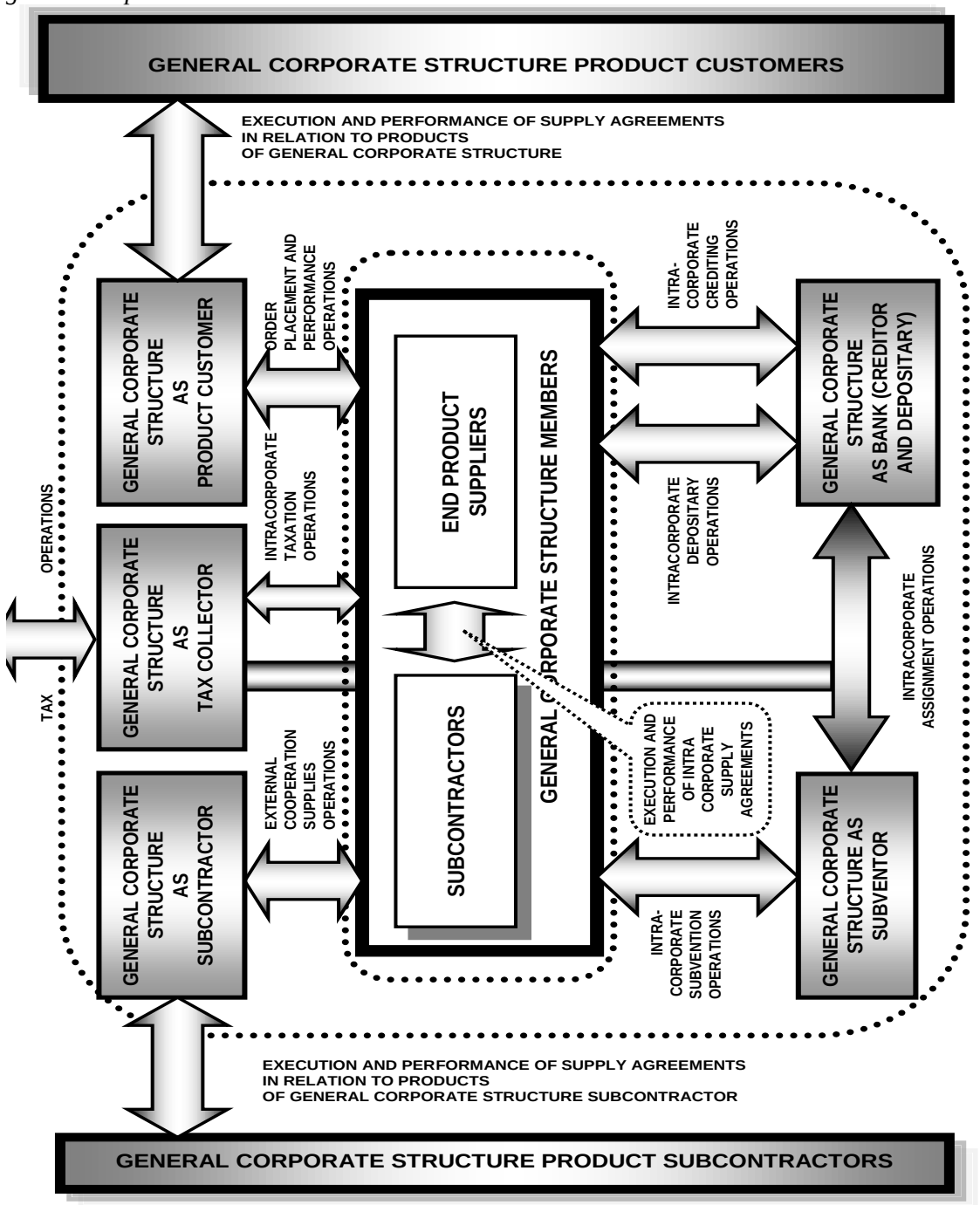


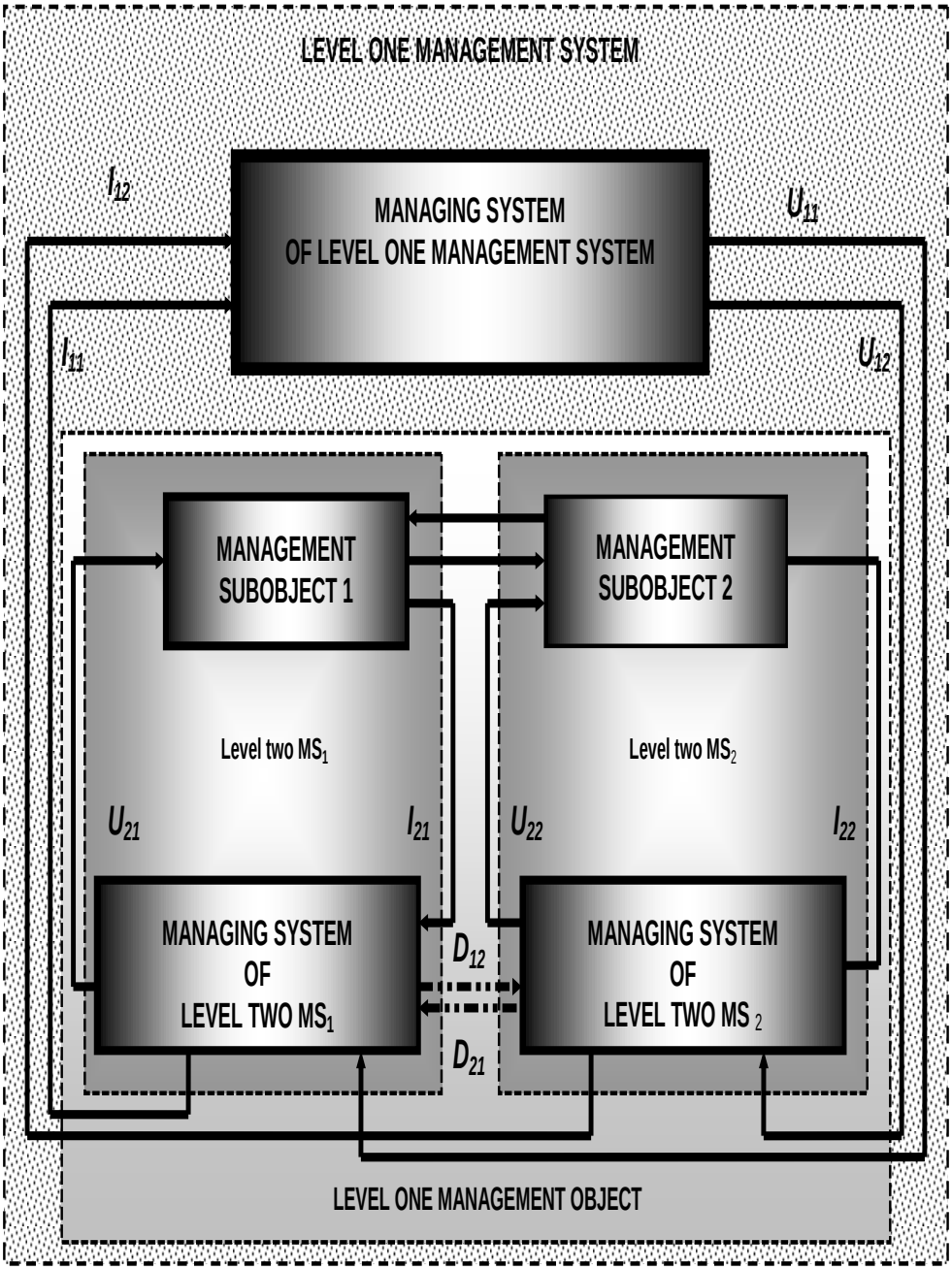
Table 1. *Parametric definition of organizational and economic environment for management levels*

Management level	**Character of general corporate structure members**	**Formalizing interpretation of general corporate structure members**	**Imposition of emulated organizational economic environment**
International	* Subjects of international law (states) * Inter-state agencies	Quasi-states	Voluntary-compulsory
Governmental	* Federal government agencies * Government agencies of federal constituent units * Legal entities * Individuals	Quasi-organizations	Compulsory
Regional	* Government agencies of federal constituent units * Legal entities * Individuals * Municipal governing agencies	Quasi-organizations	Compulsory
Corporate (intracorporate)	* Corporate substructures * Enterprises (legal entities)	Quasi-organization Organizations	Voluntary-compulsory
Intrafirm	* Divisions and units of various hierarchic levels * Individuals	Divisions Quasi-divisions	Compulsory
Intradivisional	* Divisions and units of various hierarchic levels * Legal entities	Divisions Quasi-divisions	Compulsory

The optimization criteria K_{L1} and K_{L2} are contradictory and not representative enough for an upper level managing system, because the very existence of the latter is unnecessary and horizontal integration of a lower level managing system would suffice, excluding creditor functions that can be assumed by a third-party extra-corporate bank organization. However, if we view an upper level control system as a source of resources, then rigid management should be introduced, for the managing system in question is only able to build up its resource by alienating newly created resource from a lower level management system – e.g., by deductions from their profits.

Vertical integration is installation of modified optimization criteria $K_{M1}(K_{L1})$ and $K_{M2}(K_{L2})$ into lower level management systems MS_1 and MS_2, and implementing the managerial decisions U_{12}^{opt} and U_{11}^{opt}, such that:

Figure 4. *Scheme of complex conjugation of management subsystems in vertical integration (hypothetical example)*



$$U_{2i}^{opt} = \arg extr K_{Mi}(K_{Li}); i \in [1,2];$$

$$U_{2i}$$

$$K_{Li}\left[I_{2i}\left(U_{2i}^{opt}, U_{1i}^{opt}\right)\right] \text{ no worse than } K_{Li}^{add}; i \in [1,2];$$

$$\{U_{11}^{opt}, U_{12}^{opt}\} = \arg extr K\left(U_{21}^{opt}, U_{22}^{opt}\right),$$

$$\{U_{11}, U_{12}\}$$

where K_{L1}^{add}, K_{L2}^{add} are allowable values of the optimization criteria K_{L1} and K_{L2} respectively.

Seeing as the very question whether or not a solution in question exists is hard to answer, we can look for the forms of modified rational criteria K_{M1}^{R} and K_{M2}^{R}, as well as U_{21}^{R}, U_{22}^{R}, U_{12}^{R} and $U_{11_1}^{R}$ such that:

$$\begin{cases} K_{Li}\left[I_{21}\left(U_{2i}^{opt}, U_{1i}^{opt}\right)\right] \text{ no worse than } K_{Li}^{add}; i \in [1,2]; \\ K_H\left(K_{Mi}, U_{ji}^{R}\right);\ i, j \in [1,2] \text{ no worse than } K_H^{add}, \end{cases}$$

Where K_H - criterion of high managing system K_H^{add} - allowable values of the optimization criterion K_H. Therefore, there appears a distributed formation of managerial decisions (Johansson, 2012).

Vertical integration is practically reduced to solve multi-criterion managerial optimization problem and finding the region of non-improvable managerial decisions. Depending on limitations imposed, this managerial problem may have either a void solution, which is hardly probable, or alone solution (which is unlikely) or a set of alternatives. The necessity of internal generation of complementary rational criteria is the essential difference of this problem from its known multi-objective prototypes. One can clearly see from the above formulas that they are perfectly invariant and universal regardless of the fact whether a hierarchic management is being organized and exercised within organizational separations or project areas. Nowadays, there are many known standard scalarization methods of vector criteria for optimization (Koval'kov and Dmitriev, 1977). The following methods are most commonly used:

- ✓ transformation of all criteria, except one, into additional limitations. As a result, one of the components of vector criterion for optimization transforms into a conventional criterion, while the rest expand the initially formed set of optimization criteria limitations. Unfortunately, it is impossible to motivate rigorization of the system, which is why the method in question is in fact reduced to depletion of dimensions of the criteria space – that is, choosing

one of the optimization criteria as unique. Nonetheless, the rest of the optimization criteria excluded from any further consideration are not ignored and are considered within the criteria limitation system;

- ✓ introduction of a functional mapping operator that establishes a direct functional relation between components of the vector criterion for optimization and the scalarized optimization criterion.

The most typical methods are:

- ✓ additive utility method which means adding all the components of the vector criterion for optimization for each managerial decision. The method is applicable to full homogeneity of components of a criterion for optimization being scalarized;
- ✓ weighed utility method which means calculation of the scalarized optimization criterion value as a linear combination of components of the initial vector criterion for optimization, where the linear combination parameters are values normalized in terms of the importance of components of the initial vector criterion for optimization. It is preferable that the components of the initial vector criterion for optimization should be homogenous in this case; however, the condition is not mandatory, because linear combination parameters may be not only a contrasting measurement but dimensional unification also;
- ✓ general functional mapping method that represents the scalarized criterion for optimization as a function of components of the initial vector criterion for optimization. In particular, the method can be a set of procedures commonly used in expert systems – summarization rules. In the latter case, the component of the criterion for optimization being scalarized does not overlap the homogeneity of dimensions;
- ✓ egalitarian method means finding a component of the initial vector criterion for optimization with the worst value possible, and then the component in question is let to the extreme point of all components. In this case, the method must comply with a requirement that all the components of the initial vector criterion form optimization must be homogenous, and their preferred change must be synchronous; in other words, all those components must tend either towards the maximum or towards the minimum;
- ✓ expert scalarization method means choice of a managerial decision by an appointed expert group, based on the knowledge of values of all the components of the vector criterion for optimization, yet unformalized, and, possibly intuitive, insightful, and subconscious criterion – various expert assessment methods are used in the latter case, see, e.g., (Sidel'nikov Y. V., 2007);
- ✓ organizational scalarization method which is solving a vector optimization problem through an organizational consolidation procedure of management subjects and/or operating parties – by implementing organizational events to modify the management subject and thus finding an a priori scalar optimization criterion.

So-called arbitration optimization problem, which means introduction of arbitration optimization criteria (Dmitriev, 2011), deserves separate mention and discussion. Those criteria do not reflect objectives of a specific management subject but project an idea of a group justice or a group purpose (e.g., a general benefice or a general group value). The introduction of the institute of consolidated accounting balance for holding company groups can be an example of arbitration optimization. In a general case, scalarization of a vector criterion for optimization undoubtedly deforms the initial management purposes. Any managerial decision found from a scalarized criterion generally is not the same found as an optimal decision for one of the initial optimization criteria. It is worth noting that the vector representation of an optimization criterion (in terms of linear algebra constructions) is not a unique one, and its different conceptual interpretations are possible, including but not limited to the complex variable functions' theory (Dmitriev, 2016).

We have found from the research results that the simplest of the above scalarization methods is normally used – choosing a unique optimization criterion that is the most expressive of the interests of the management subject, those interests normally compliant with applicable legislation or the operation essence of the subject in question. While forming a criteria space, one can often face its dynamical transformations, including its dimensional discontinuity.
Accordingly, in case of meso-micro level management, modern Russian industry should prefer vertically coordinated management that, in a limit case, may be administrative – that is, rigid (e.g., within the administrative scheme of intra-corporate or intra-division management).

Now let us choose an optimally applicable conceptual synthesis pattern for management system and managerial decision justification. A conventional approach to designing integrated organizational economical objects, and, primarily, to designing their control systems is viewed as secondary organization of manufacturing, projects, investments, and other processes. However, considerable impediments to changing design sequences of a managing system and the management object can be cleared by reversing the generally accepted sequence or by organizing counter designing. Designing practically any management system of an integrated object these days, including a control system of an organizational economic management object is based on the two fundamental principles, namely:

- ✓ all security types of a managing system are tailored to maintaining management by an a priori object (pre-existing or being formed) with a known structure, normally defined parameters, fixed limitations of managerial decisions, and at least vaguely semantically set state indexes and optimization criteria;
- ✓ entire managing systems is either divided into subsystems (sometimes, with technologies of solving individual managerial problems separated) that are designed and/or adopted consecutively (falling into a number of so-called

sequences), or the managing system in question does not assume the management of the entire object but of a sub-object or a sub-object group.

The approach in question is without alternative, and the reasons that underlie it are natural and pragmatic. Firstly, an overwhelming majority of managing systems is implemented for preexisting objects (primarily, organizational economic objects – enterprises). Secondly, the existing resource limitations often impeded designing and adoption of complex and integrated managing systems. And, thirdly, no need of efficient management or incompetent managerial staffs contributed to adoption of informative and referential automated management systems. Being a priori inefficient, the latter systems impeded detection and assessment of flaws in management automation strategies.

However, it would be unfair to generalize and say that all experts are incompetent, as the fundamental postulates of the automated regulation theory have always implied a synthesis of the transitory function of a regulator through analysis of the management object and identification of its transitory function. In terms of design, managing systems were usually secondary objects – or, at least, derivatives. On the other hand, designing management of technological objects was always free of unjustified inconsistence, as the objects in question with local systems were literally inoperable. Indeed, no one would have thought of an extravagant idea of designing, e.g., an aircraft pitch managing system as a "top priority design project" and putting into operation a prototype aircraft or even a prototype group, only to adopt further onwards, "step by step", aircraft roll managing systems, fuel feed systems, landing gear lowering systems etc; while no one sees anything wrong with inconsistent management of enterprises that are as complex and responsible objects as aircrafts, and start by adopting a computerized accounting management system, then to zero in on sales management automation, then to place an emphasis on improving the efficiency of materials and technology supplies etc.

Taken inevitably asynchronously, project decisions lead to utilization of heterogeneous and conservative hardware and software used or they necessitate a resource-consuming reuse approach that is often a priori impracticable. Overall, designing and adopting management systems of organizational economic type objects, even their best examples, still conceptually bears resemblance to the notorious bottom-up approach, which is the piecing together of systems to give rise to more complex systems, or rather, a localized "demonstrative patch" designing.

Accordingly, a "management object to managing system" dyad design sequence – a direct design sequence – implies search for such a processor (hereinafter referred to as "the general view") of the managing system W_{MS} that secures the following:

$$K(W_{MS}) = K(W_{MS}, W_{MO}) \underset{W_{MS}}{\rightarrow} extr,$$

where K - criterion of optimization;

W_{MS} - closed management system processor;

W_{MO} - management object processor.

As a result, we get a "work in progress" so notoriously common in Russia, equipment installation in progress and emerging management at emerging enterprises, or, more commonly, a conceptual scheme of empirical management. Only few types of equipment for certain technological processes and nuclear power plants can be viewed as the only exception to the management system design scheme in question. We see it advisable to reverse manufacturing design in most cases – from the managing system to the management object. However, doing so, one can face a situation in which the management object may become impracticable. It is worth noting that cases in which the impracticable management object tailored to the managing system are far more common than impracticability of a managing system tailored to the ready-made management object. For the "control object to management system" dyad design sequence – a reverse sequence – the following optimization problem is to be solved:

$$K(W_{MS}, W_{MO}) \to \underset{W_{MO}}{extr}.$$

As usual, it is productive to consider this mixed design scheme free of flaws caused by extreme variants. This scheme implies a sudden expansion of the dimension of the optimizing variables space (which, in this case, should be viewed as an advantage) and a considerable reduction of a probability that we will obtain a void set of solutions. Based on this scheme, the following problem is to be solved:

$$K(W_{MS}, W_{MO}) \to \underset{W_{MS}, W_{MO}}{extr}.$$

It is appropriate to include a subproblem of decomposed designing in the problem, considering that:

$$W_{MS} = W_{MS}\left(W_{MS}^{1}..., W_{MS}^{n}\right),$$

$$W_{MO} = W_{MO}\left(W_{MO}^{1}..., W_{MO}^{m}\right),$$

where ***n*** is the number of managing systems, ***m*** – the number of management objects after the decomposition of the management system, which are set by the rules D_{MS} and D_{MO} respectively.

Based on the above, the general designing problem for an integrated management object should, in a general case, assume a form:

$$K\left(W_{MS}^{1}..., W_{MS}^{n},, W_{MO}^{1},..., W_{MO}^{m}, D_{MS}, D_{MO}\right) \to extr.$$

$$W_{MS}^{1},...W_{MS}^{n},W_{MO}^{1},...,W_{MO}^{m},D_{MS},D_{MO}$$

Considering that the management is bound with various sub-objects, we can pose and solve problems to find managerial competence areas for management subsystems and the sequence of arrangement of managerial activity – e.g., within the frameworks of utilization of methods derivative from the coordinability principle. The latter of the approaches analyzed seems the most efficient, as it secures incomparably a higher purposefulness of the object under control, enhances a probability that the project will be implemented, and resource consumption will be reduced.

On the other hand, the latter approach may pose a number of difficulties, as it excludes separation of designers of principal manufacturing processes and designers of the managing system, while imposing more requirements on those designers as to their communicability and academic versatility, which are more stringent, though often bearable in practice. Of course, counter design may follow a shuttle scheme: from the optimization of the managing system to the optimization of the management object, and then back again – to the optimization of the managing system etc.

It is worth mentioning that the generalized principle formulated above, semantically, has a lot in common with the counter programming scheme utilized when designing software for the support of intellectual information managerial technologies. In those cases when there exists a prototype (e.g., when an existing manufacturing facility with a portion of irreplaceable equipment and unchangeable technological processes is in progress, or when there is a functioning managing system etc), we must pose and solve a conditional optimization problem as a complex analysis and synthesis problem. In the latter case, the optimizing variables space narrows due to the exclusion of some of sub-objects, management subsystems and links between them with transformations prohibition imposed. As a result, there appears an optimizing subset as that shown here $W_{MS}^{*1},...,W_{MS}^{*n},W_{MO}^{*1},...,W_{MO}^{*m},D_{MS},D_{MO}$.

We know from practical experience that all the three methodological schemes of a management system synthesis are practicable, the latter two of them being applicable to implementation of business projects, primarily in the aviation business field, and are more efficient. Functioning of a managing system or a management system involves a single-moment (occurring only once), episodic (occurring at uncertain time moments – e.g., whenever necessary) or periodical (at every discrete time moment) implementation of managing system processor. The processor of the managing system, based on the above conclusion that the conceptual management method involving feasibility studies is preferable, includes formulation and solution of management problems as its sub-processors. Those sub-processors are localized within a sub-processor that corresponds to making managerial decisions, because they are sub-processors of the managing system. Conceptually, those procedures are

components of feasibility studies behind managerial decisions. Formulation of a managerial problem implies creation of a full feedback circuit (Dmitriev, 2005).

Finding managerial decisions within hierarchic management systems of organizational separations/projects is a special management type that, among other things, integrates the managerial activity of a number of management subjects in relation of an object-localized and subject-localized management object, in terms of certain types of objectives, prohibitions, and managerial impacts. Accordingly, to form managerial decisions, we are to implement a conceptual management scheme based on feasibility studies behind managerial strategies, allowing building a cybernetic feedback circuit (Figure 5). Corporate structure management is implemented from a three-stage scheme that implies the following:

- ✓ conceptual formulation of a managerial problem (task);
- ✓ formalization of the managerial task;
- ✓ solving the managerial problem.

Please refer to Figure 6 to see the conceptualization of those three stages. When formalized, managerial problems are scalarized and determined conditional optimization problems, with their target function set by a mathematical model of the management object.

The functional structure of an advisory managing system may imply five-, four-, or two-block decomposition of the development of managerial decision on technological macro-processing of information processing. A five-block structure comprises a current status assessment block, a forecast block, a comparison block, an analysis block, and an optimization block; while the analysis is excluded from a four-block structure (Figure 7), and a two-block structure only contains a currents status assessment block and an optimization block:

- ✓ formalization of the managerial task;
- ✓ solving the managerial problem.

Please refer to Figure 6 to see the conceptualization of those three stages.

When formalized, managerial problems are scalarized and determined conditional optimization problems, with their target function set by a mathematical model of the management object. The functional structure of an advisory managing system may imply five-, four-, or two-block decomposition of the development of managerial decision on technological macro-processing of information processing. A five-block structure comprises a current status assessment block, a forecast block, a comparison block, an analysis block, and an optimization block; while the analysis is excluded from a four-block structure (Figure 7), and a two-block structure only contains a currents status assessment block and an optimization block.

Figure 5. *General structure of managerial decision elaboration*

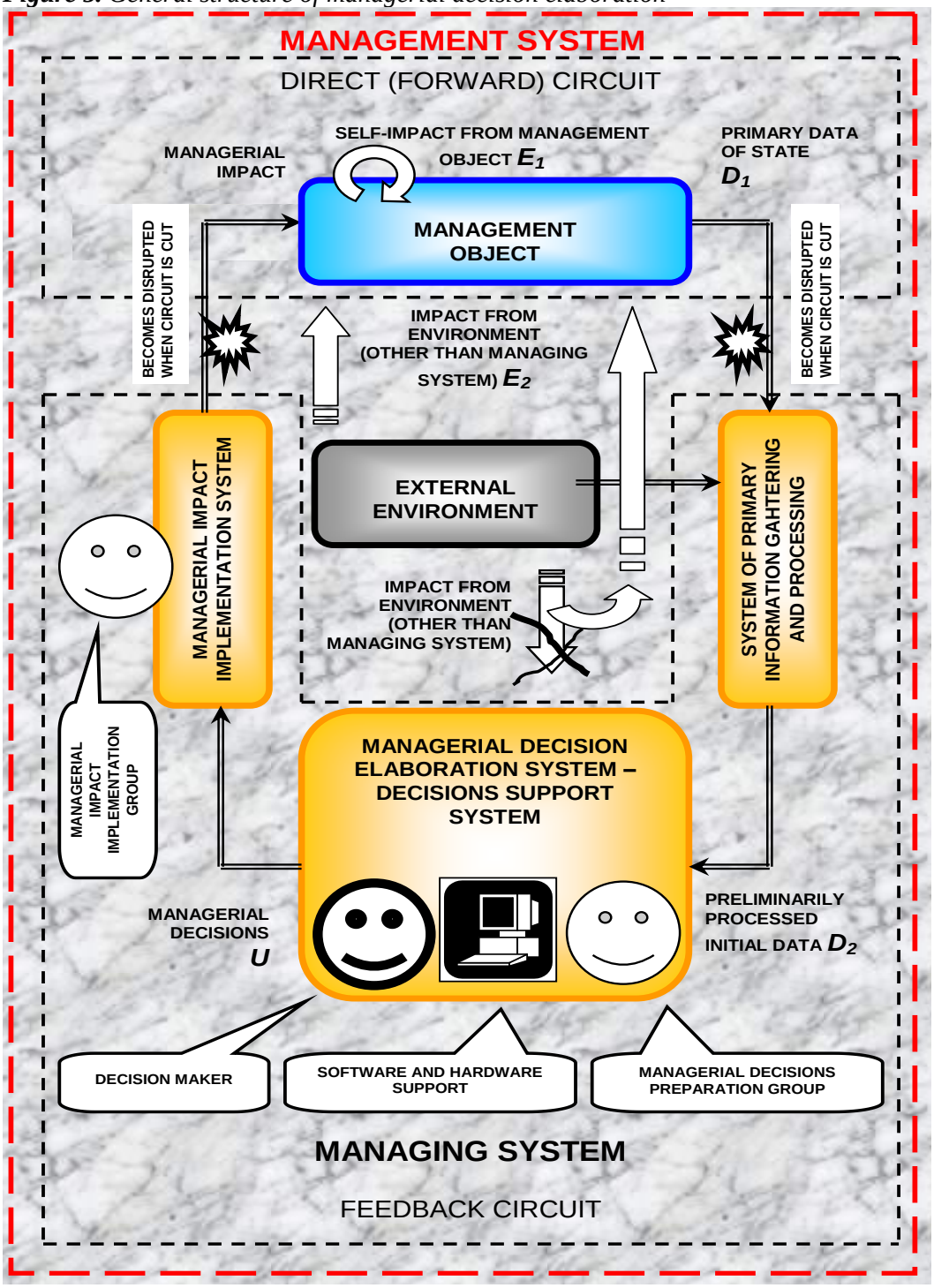


Figure 6. *The conceptualization in three stages*

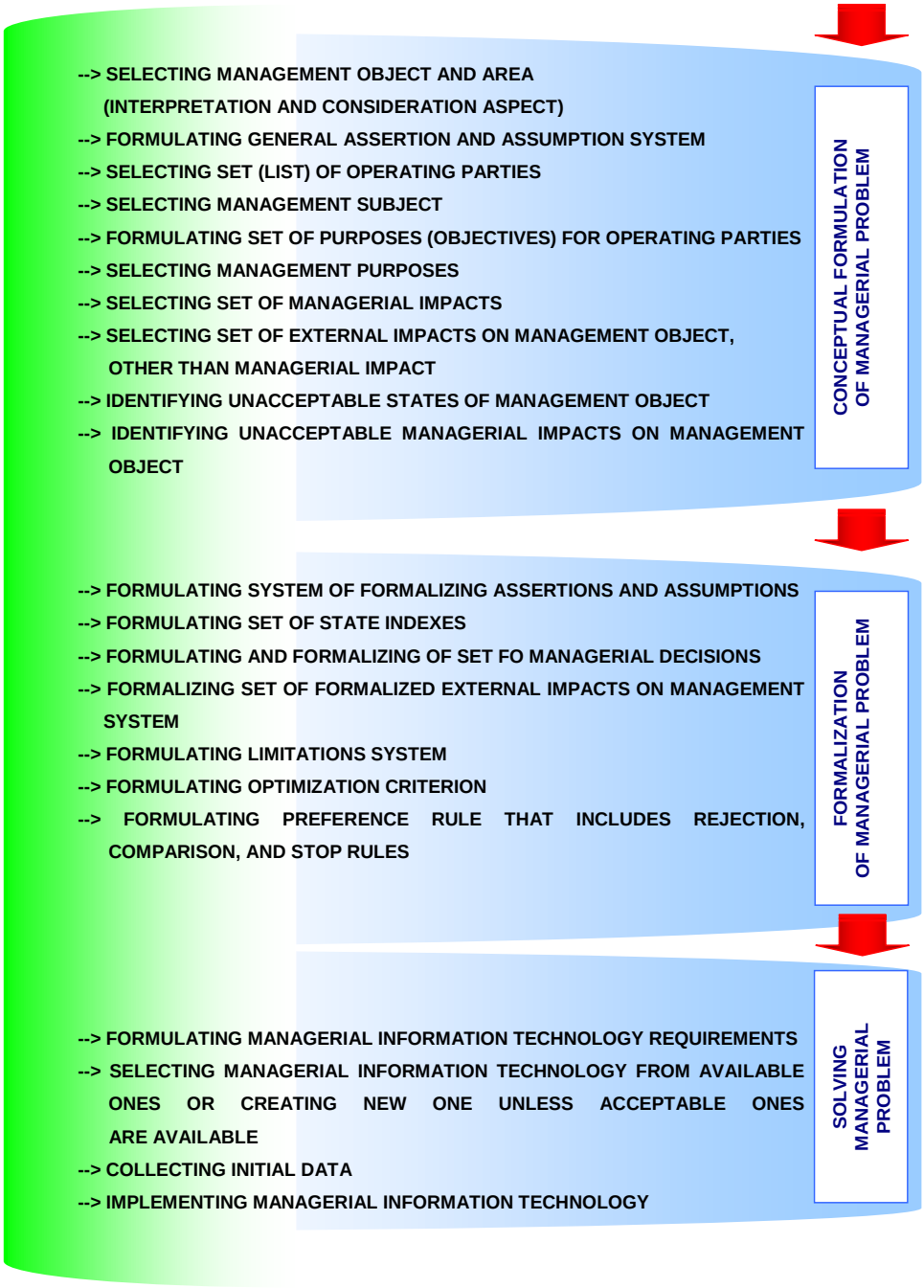
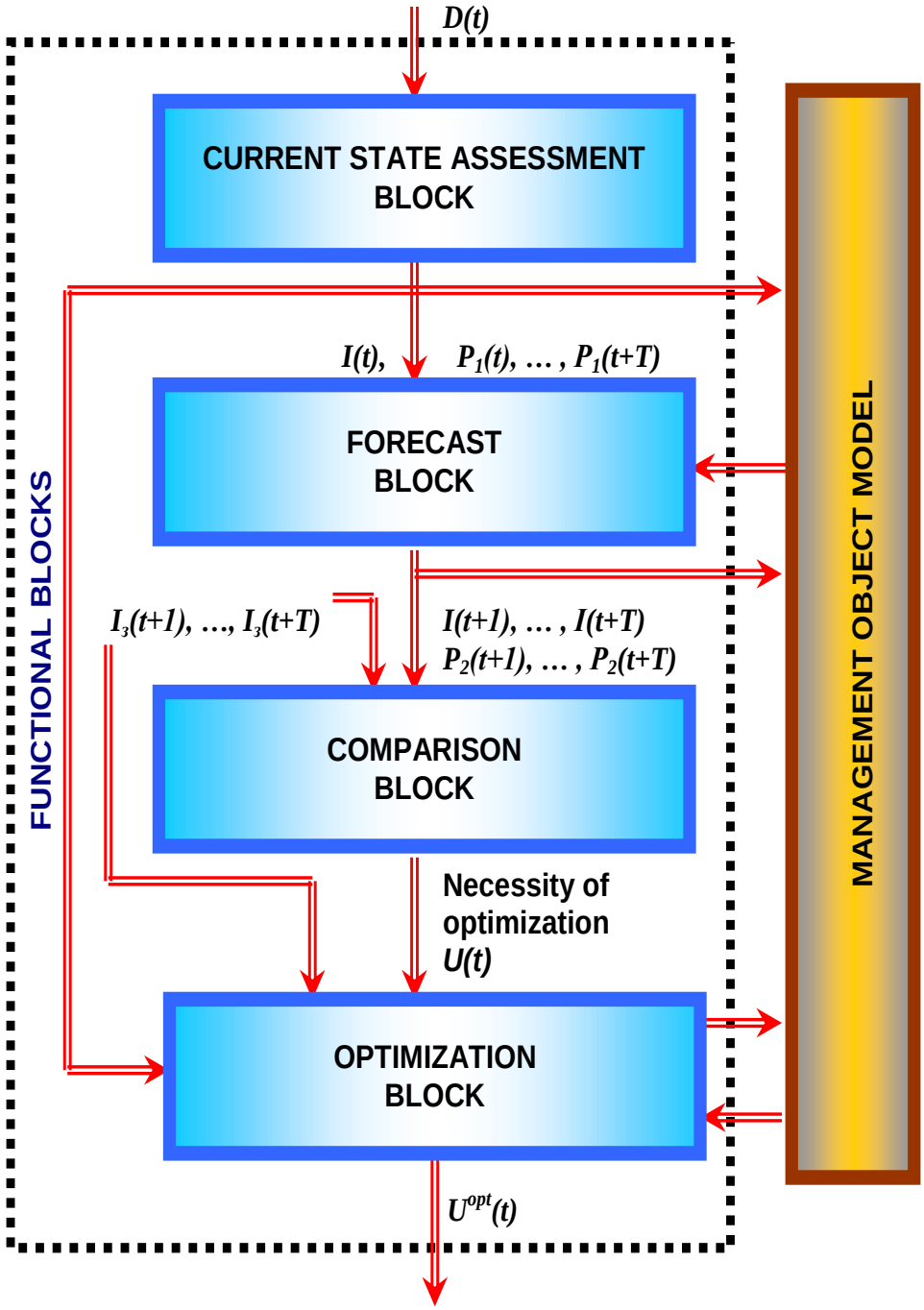


Figure 7. *A four-block structure*



A standard procedure for the functioning of managerial decision-making blocks and interactions between them are as follows:

Based on certain initial data $D(t)$, the current status assessment block assesses the current status values $I(t)$ and some of the management parameter values, based on which a model of a management object $P_1(t), \ldots, P_1(t+T)$ functions.

The forecast block assesses future values of the other side of the parameters $P_2(t+1), \ldots, P_2(t+T)$, and, from the values $P_1(t), \ldots, P_1(t+T)$, $P_2(t+1), \ldots, P_2(t+T)$ and $U(t-1)$, the values $I(t+1), \ldots, I(t+T)$ are assessed, where $U(t-1)$ are the managerial decisions made before the moment ***t*** (with their impact naturally covering the current and the future moments of time).

The comparison block compares $I(t+1), \ldots, I(t+T)$ with $I_{set}(t+1), \ldots, I_{set}(t+T)$, where $I_{set}(t+\ldots)$ are the set, required, or desirable state values before the moment $t+\ldots$. If at least one moment of time $t+\ldots$ is found, such that:

$$I(t+\ldots) \textit{ worse than } I_{set}(t+\ldots),$$

then the function of the optimization block is initiated. Here, the operator worse implies a procedure of finding a significant undesirable discord, with a preferable tendency in changes of the status value considered.

The optimization block searches for optimal managerial decisions in a form:

$$U^{opt}(t) = \arg \underset{U(t)}{extr}\{K(t+1),\ldots,K(t+T)\}.$$

To secure the functioning of the managing system, some of the blocks (namely, forecast block, analysis block, and optimization block) must be linked to their intellectual core – a mathematical model of the management object. Accordingly, corporate structures and their environment are subject to modeling (Figure 8), together with a set of mathematical algorithms. A mathematical model of a management object must include, among other things:

- ✓ model description of product stock to estimate the demand of those products (Dmitriev, 2002; Bodrunov, Dmitriev and Kovalkov, 2004);
- ✓ model description of the organizational separation state or the project area status, obligatorily including a description of its respective financial and economic potential (Dmitriev, 2002).

A managing system may function in either of the two different modes:

- ✓ mode that implies generation of many alternatives that are subject to comparison by (e.g., a decision maker, Figure 9);
- ✓ regular mode (based on the regular optimization algorithm Figure 10).

It is important that the circuit of the management system, provided above, is invariant accurate to a model description of the object, depending on what the management objects are – an organizational separations group or a projects group. Formulation of a managerial problem involves its conceptual formulation and formalization. Formulation is a single-moment procedure for most of managerial problems. Solving a managerial problem means either making a preferable managerial decision or finding no feasible decisions whatsoever.
We see it appropriate to switch over from individual designing of managing systems to their group designing, while considering interlevel and interlevel management for all hierarchic management levels in complex.

Management system designing is methodologically full if it includes the following problem components, as provided by the management general theory:

- ✓ general environment design – designing of the principle nature of the intraorganizational and interorganizational management environment;
- ✓ structural and organizational designing that provides hierarchic topology of intraorganizational structural entities, including the establishment of hierarchic set of organizational separations, as well as designation of the functional areas of managerial competences within the aspects of managerial rights and legally binding restrictions;
- ✓ procedural designing that implies formation of managerial procedures;
- ✓ security designing.

Generally, the security types of a managing system, which are subject to synthesis, are as follows:

- ✓ methodological;
- ✓ legal regulatory;
- ✓ special mathematical and computational that are now integrated into special software;
- ✓ general system mathematical and computational that are now integrated into general system software;
- ✓ informational;
- ✓ organizational;
- ✓ technological;
- ✓ economical;
- ✓ staff;
- ✓ methodical.

Figure 8. *Management object and mathematical toolkit structure*

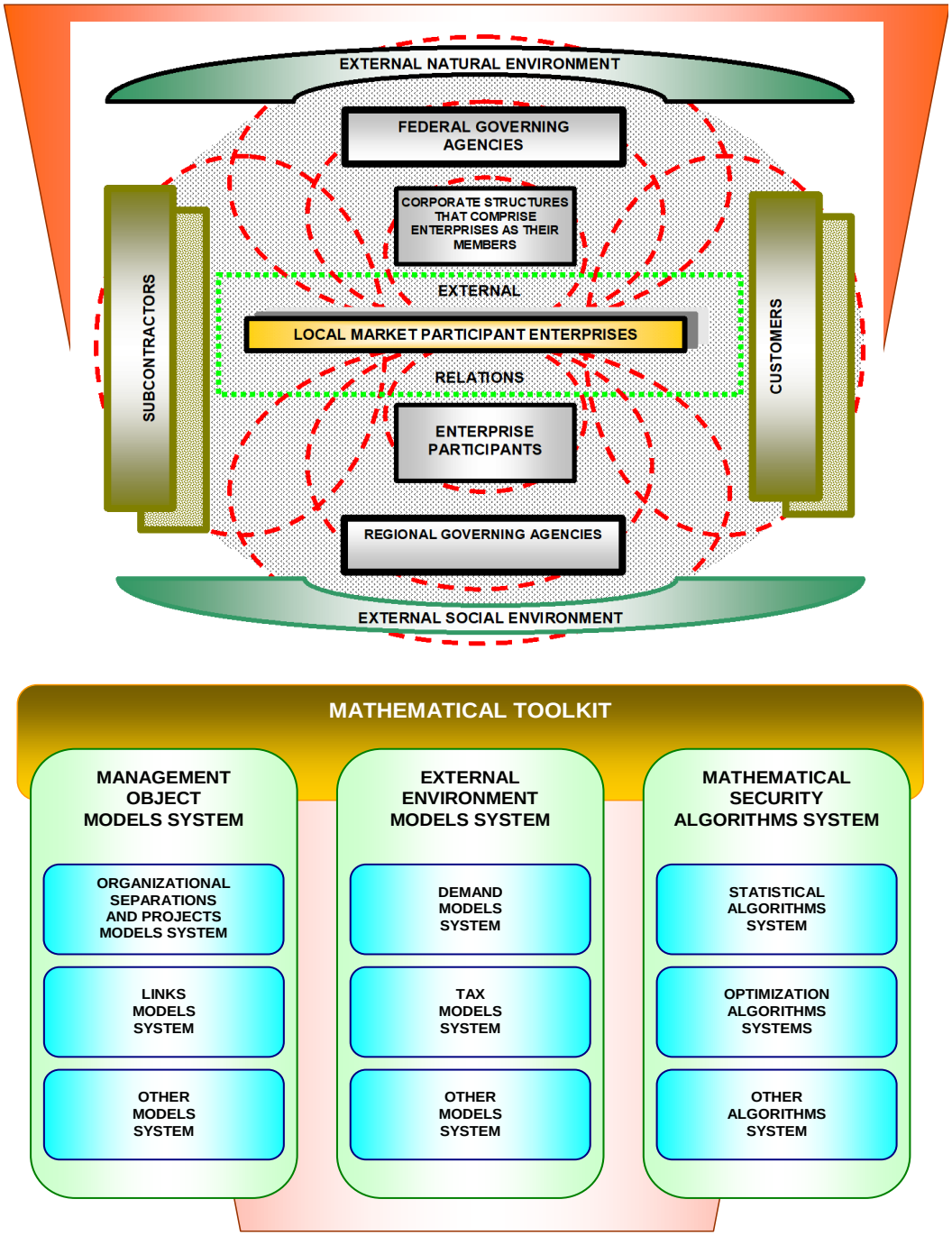


Figure 9. *Enumeration mode of heuristically generated managerial decisions variants*

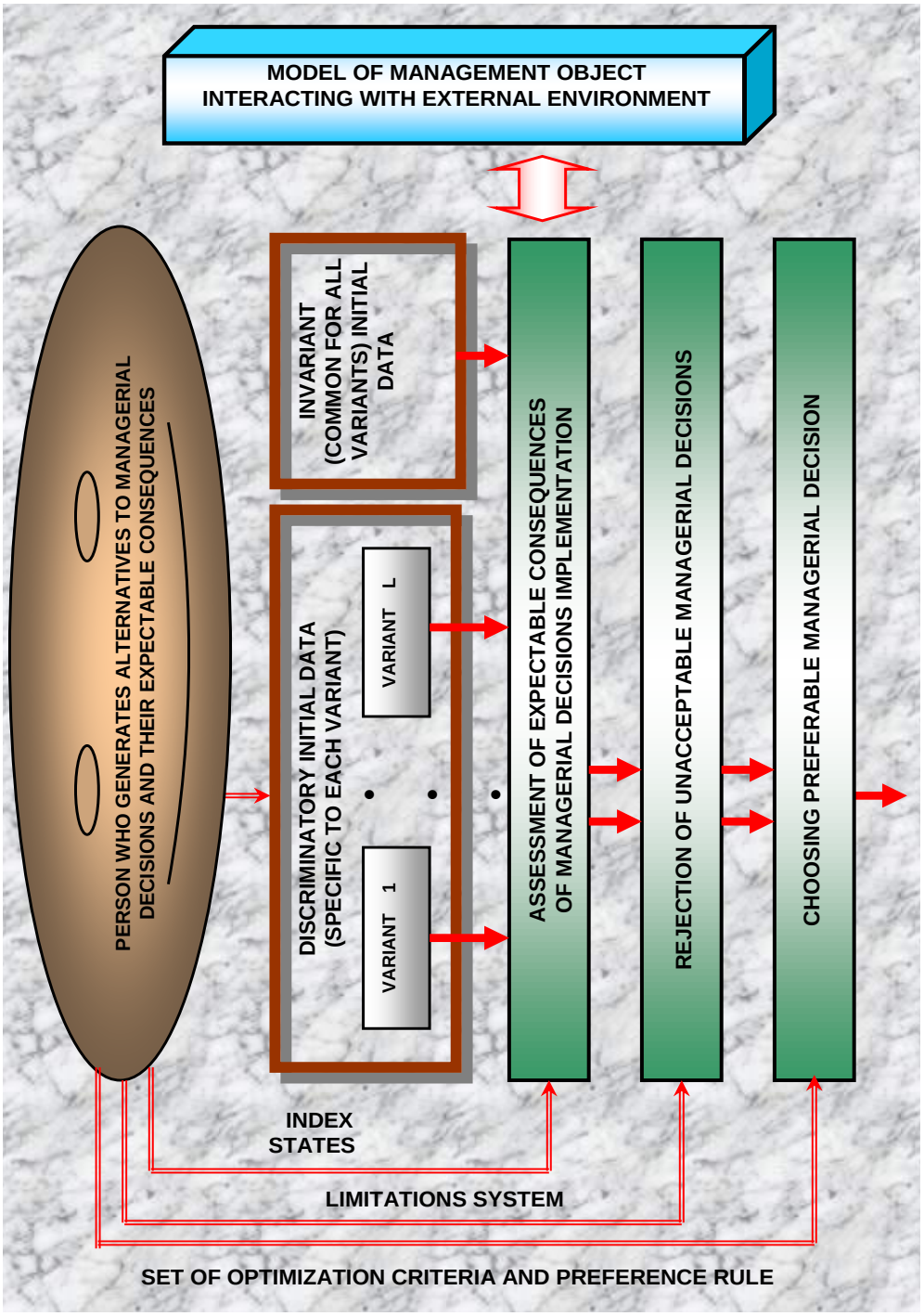
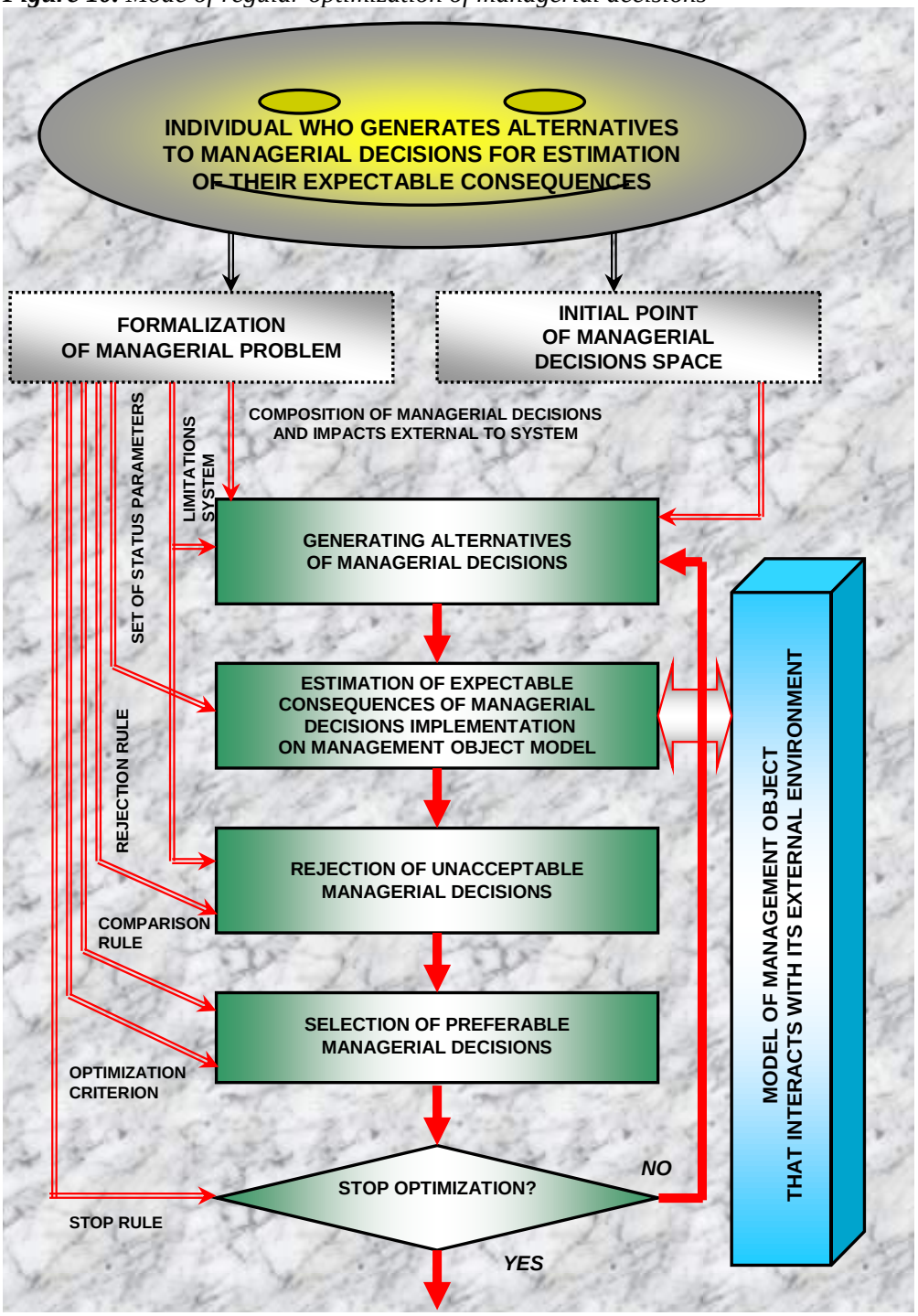


Figure 10. *Mode of regular optimization of managerial decisions*



In each specific case, either designing or redesigning of a managing system is implemented. It is possible and necessary for each organizational separation to create a managing system – a self-organized intraorganizational managing system. We have proposed a conceptual approach that allows, due to its unification, manipulating organizational separations and projects, and those manipulations correspond their transformations consistent with organizational and organizational institutional separations, as it was proposed (Demchenko, 2011; Bazadze, 2002; Ivanov, 2003) for non-project separations, and for integrated "separation-to-project" managerial situations (Milovanov, 2014; Dmitriev and Gutkina, 2004; Dmitriev and Burdin, 2006; Dmitriev, Gnezdilov, Arkhipov and Rebiy, 2006).

3. Conclusions

Based on the research results obtained, we have every reason to formulate the following statement, conclusions and recommendations:
- Under modern conditions, economy management has undergone changes, including those in localization aspects. Organizational and product aspects are among the aspects in question, the fact that engenders semantic heterogeneity of decomposition, and, derivatively – heterogeneous localization of management systems, which is catastrophic, in every sense of the word, for the organization and the exercise of management, for it excludes, even in a purely theoretical fail-safe situation, any acceptably fruitful coordination and unification of all types of securing managing systems amid inevitably limited managerial resource and an indispensable pursuit of the management objectives;

- It is appropriate to harmonize the rule of decomposition by limiting it to the organizational hierarchy and by acknowledging the project hierarchy as a specific case of quasi-organizational hierarchies. In this respect, we find that viewing project management as an absolute or a special management type is a methodologically disputable step that requires at least profound proofs of its conceptual correctness. No such proof has been provided in any known sources yet;

- Being artificial to a certain extent, project localization inevitably engenders coordination between functioning of interproject and project-organizational management areas. Therefore, it is conditionally appropriate to reduce project localization to organizational localization, when an organizational separation is advisably viewed in several product project aspects;

- Meso-micro level management is necessarily subject to methodological and instrumental integration;

- An economic environment is an indispensable multi-level hierarchic structure. The division of this structure into levels can be and must be optimized, which can be codified by legal, regulative, institutional, contractual, administrative, and methodological provisions;

- Management of multi-level hierarchic economic systems can be built as a sequence of bilevel managements, with a vertical integration scheme used in both of them;

- To secure methodological feasibility, we suggest viewing hierarchically adjacent organizational and quasi-organizational separations as general corporate structures that are organizational-economic standard sense identifications;

- Management of organizational separations or projects should be based on a conceptual scheme of feasibility studies behind managerial decisions (using recommending DSS), which implies utilization of elaborate mathematical models of those management objects;

- The conceptual approach that we have proposed allows solving problems of optimal transformations in organizational separations and projects (including establishments, winding-ups, conceptual alterations, takeovers, mergers, splitting-ups, and spin-offs);

- Proposed conceptual solution allows to use a universal full featured recommending DSS that implement two basic procedural enforcement: search and compare the given variants and regular optimization of managerial decisions;

- The conceptual approach that we have proposed has been productively tested when establishing corporate groups, some of components of federal purpose project programs, and on divisional transformations in several enterprises.

References:

Bazadze, N.G. 2002. Organizational design and development of managerial potential of high-technology manufacturing enterprise. Moscow, Russia: AMI Publishing House.

Bodrunov, S.D., Dmitriev, O.N., Koval'kov Y.A. 2003. Structural assessment of consequences of implementation of managerial decisions on enterprises. Moscow, Russia: Gnom & D Publishing House.

Bodrunov, S.D., Dmitriev, O.N., Koval'kov, Y.A. 2004. Studies of supplies operations. In four parts. St. Petersburg, Russia: Aerospace Equipment Corporation Publishing H.

Demchenko, O.F., Dmitriev, O.N., Minaev, E.S. 2011. Identification methodology of organizational structures within the aviation industry. Moscow, Russia: Moscow Aviation Institute Publishing House.

Demchenko, O.F. 2011. Computational modeling methodology of organizational structures in the aviation industry of the Russian Federation. Moscow, Russia: KnoRus Publishing House.

Dmitriev, O.N. 2002. Analytical modeling of financial and economic potential of enterprises and corporate structures when developing intracompany and corporate strategies. Moscow, Russia: Gnom & D Publishing House.

Dmitriev, O.N. 2002. Intellectual information technology for feasibility studies of marketing decisions. Moscow, Russia: Gnom & D Publishing House.

Dmitriev, O.N., Gutkina, A.V. 2004. Civil aviation engines lease charging. Moscow: Gnom & D Publishing House.

Dmitriev, O.N. 2005. System analysis in management. The 5th Edition. Moscow: Good Word Publishing House.

Dmitriev, O.N., Burdin, A.K. 2006. Corporate leasing management. Moscow, KnoRus Publishing House.

Dmitriev, O.N., Gnezdilov, Y.V., Arkhipov, F.V., Rebiy, E.Y. 2006. Methodological basis under elaboration of development strategy of Russian region. Moscow, KnoRus Publishing House.

Dmitriev, O.N. 2011. Conceptual problems of justification of arbitration managerial decisions in economy. Proceedings of Moscow Aviation Institute E-zine. Issue 49.

Dmitriev, O.N. 2016. Typology of conceptual representation schemes of poly-criteria optimization problem for managerial decisions in aerospace field. Herald of Moscow Aviation Institute Magazine. Vol. 23. Issue 1.

Ivanov, Y.V. 2003. Methodology of strategic management of institutional development of industrial enterprise, as exemplified by aluminum industries of Russia. Published doctoral dissertation in economics, Moscow Aviation Institute (MAI), Moscow.

Johansson, R. 2012. Distributed decision-making and control. London: Springer.

Kanashchenkov, A.I., Dmitriev, O.N., Yekshembiyev, S.Kh., Minaev, E.S. 2013. Strategic corporate management: fundamental and applied problems. The 2nd edition corrected and amended. Moscow, Russia: Moscow Aviation Institute Publishing House and Good Word Publishing House.

Koval'kov, Y.A., Dmitriev, O.N. 1977. Vector optimization problems of quality and reliability automated managing systems: Analytical review. Automated Control Problems, a scientific technological collection, Issue 3. The Head Information Computational Center for Science and Technology of the Aviation Industry Ministry of the USSR.

Mal'ko, I.A. 2008. Organizational economic mechanism of managerial interaction between a Russian industrial enterprise and its subsidiary based abroad: as exemplified by a Ukrainian subsidiary. Published PhD dissertation in economics, Moscow Aviation Institute (MAI), Moscow.

Mesarović, M.D., Macko, D., Takahara, Y. 1970. Theory of hierarchic multilevel systems. New York: Academic Press.

Milovanov, P.D. 2014. Organizational economic mechanism of justification of re-corporatization decisions on space industry enterprises. Published dissertation on PhD in economics, Moscow Aviation Institute, National Research University (MAI), Moscow.

Novikov, S.V. 2014. Organizational economic mechanism of justifying decisions as to selection of scientific technological projects in top-priority development areas of the science and technology of Russia. Published PhD dissertation in economics, Moscow Aviation Institute (MAI, National Research University), Moscow.

Richardson, G.L. 2010. Project management: theory and practice. Boca Raton: Auerbach Pub. / CRC Press.

Sidel'nikov, Y.V. 2007. System analysis of expert forecasting. Moscow: MAI Print Publishing House.

Zakharova, L.F., Novikov, S.V. 2016. Competitive selection management of high-technology scientific engineering projects. Moscow, Russia: Moscow Aviation Institute Publishing House.

Zuyev, A.A. 2014. Organizational economic mechanism of organizational reengineering of an industrial enterprise with subsidiaries based in many countries. Published PhD dissertation in economics, Moscow Aviation Institute (MAI), Moscow.