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## Consistency of quality management contours for the development of industrial enterprises on the basis of target contour planning

### Узгодженість контурів управління якістю розвитку промислових підприємств на основі планування цільового контуру

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#### Abstract

To solve the problem of the qualitative development of industrial enterprises, which lies in the inconsistency of the contours of the quality of the development of the scientific task. The article proposes a methodical approach to the planning of the consistency of the contours of the quality management of the development of industrial enterprises based on the planning of the target contour based on the three-level system model and the means of multifactor modeling, the use of which will allow the management of the industrial enterprise to monitor the state of achievement/failure to achieve the planned development goals and timely identify the cause of this phenomenon during the normal process of management coordination, destabilization and recovery.

#### Анотація

Для вирішення проблеми якісного розвитку промислових підприємств, яка полягає в невідповідності контурів якості розробки науковому завданню. У статті запропоновано методичний підхід до планування узгодженості контурів управління якістю розвитку промислових підприємств на основі планування цільового контуру на основі тривірневої системної моделі та засобів багатфакторного моделювання, використання яких дозволить керівництву промислового підприємства здійснювати моніторинг стану досягнення/невиконання досягнення запланованих цілей розвитку та своєчасне виявлення причини цього явища під час нормального процесу координації управління, дестабілізації та відновлення.

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As a result of modeling and simulation experiments, a bank of levels of operations for various purposes and source data is obtained. The obtained sets of action sequences can be used as "road maps" in case of a real critical situation.

The proposed approach can be used to develop options for future plans for qualitative development of the enterprise by setting a target situation for a certain future moment in time and finding a sequence of intermediate situations of qualitative development of the enterprise, which leads to setting a goal.

**Keywords:** planning, contours of development, quality of development, enterprises.

### Introduction

To ensure high-quality development of production, radical changes are needed not only in the technological policy of the enterprise, but also in the very ideology of strategic transformations. Among the main problems on the way to achieving high-quality development of production, it is customary to single out insufficient financial, material, technical and personnel support. However, the complete or partial lack of sufficient provision of production development does not explain the fact that at industrial enterprises where such a problem does not exist, the achieved level of production development can be called qualitative. Situations often occur when the enterprise has resources, set development goals and objectives, but there is no time to implement the planned initiatives or the moment is unfavorable. On the contrary, the time is favorable for development (which involves obtaining additional advantages due to the timely response of the enterprise to the needs of the external environment), but the enterprise lacks resources. Thus, the root of the problem is hidden in the inconsistency of such contours of development quality management as: time (necessary to perform the assigned tasks); goal; resources (necessary expenses).

A solution to the scientific problem of planning the consistency of quality management contours of the development of industrial enterprises, namely the consistency of the target contour with time and resources by using multifactor modeling tools and the simultaneous use of the advantages of simulation experiments, is proposed.

The expediency and necessity of planning the target contour of the enterprise's qualitative development is explained by the need to develop

В результаті моделювання та імітаційних експериментів отримано банк рівнів операцій різного призначення та вихідних даних. Отримані набори послідовностей дій можна використовувати як «дорожні карти» у випадку реальної критичної ситуації.

Запропонований підхід може бути використаний для розробки варіантів перспективних планів якісного розвитку підприємства шляхом постановки цільової ситуації на певний майбутній момент часу та знаходження послідовності проміжних ситуацій якісного розвитку підприємства, що призводить до постановки мети.

**Ключові слова:** планування, контури розвитку, якість розвитку, підприємства.

options for prospective development plans by setting a target situation for a certain future period of time and forming the necessary amount of resource support. That is, the process of planning the strategic goals of enterprise development cannot be separated from such important components as time (time contour) and resources (resource contour). Only that goal has a high chance of being achieved, which was set in a timely manner and its achievement was resource-based.

Based on the results of the study, it was possible to work out options for future plans for qualitative development of the enterprise by setting a target situation for a certain future moment in time and finding a sequence of intermediate situations of qualitative development of the enterprise, which leads to the set goal.

On the basis of the analysis of existing concepts regarding the planning of goals, the time required for the performance of tasks, and resources (chapter "Theoretical foundations or review of the literature", in the chapter "Methodology" an approach to planning the coherence of the contours of quality management of the development of industrial enterprises is proposed on the basis of the planning of the target outline based on the model of the three-level system and multifactor modeling tools for the development of options for future plans for the qualitative development of the enterprise.

In the section "Results and discussion" the results of simulation modeling of consistency of the target contour with time and resource are presented. A bank of transaction levels for

different purposes and output data is obtained. The resulting sets of action sequences can be used as "road maps" in the event of a real critical situation.

### Theoretical framework or literature review

To understand the process of achieving high-quality development of the enterprise, the concept of "contours of the quality of development: time, resources, goal" is proposed.

In management, it is customary to distinguish "control loops", which are understood as a closed chain of links of the control system, in which the subject and the object of control are connected using direct and feedback communication, for example: the loop of economic planning, the loop of controlling, etc. Daniel, Pierre A.; Daniel, Carole (2018). Also, management contours determine the general direction of the organization, its divisions, and individual employees Holmes & Leonard (2012).

Thus, a contour should be understood as a given direction and sequence of actions. In the work, the given direction is the achievement of the quality of the development of the enterprise.

Susan Antler, Leslie Cooperband, Craig S. Coker, Mary Schwarz, Robert Rynk (2022) Argued that enterprise planning involves a series of steps that include resource analysis; assessment of the company's strengths and weaknesses, opportunities and threats; thoughtful development of the company's vision and mission; goal setting; and assessment of business and financial options.

Xiuhua Shi, Fei Zhou, Zhe Wang, (2021) propose to improve the adaptability of situational analysis to supplement the technical basis of planning management.

Godwin Banafo Akrong, Yunfei Shao, Ebenezer Owusu (2022) highlight that large enterprises and governments increasingly rely on planning systems.

Emanuel João Martins, Fernando Paulo Belfo (2023) believe that one of the best ways to optimize business processes is to implement an enterprise resource planning system.

In the critical period of the digital reform of the enterprise, the market interaction between the enterprise resource planning system (ERP) and the production management system (MES), which is an important way for the development

of industrial enterprises. The performance of the new model Zheng-Xin Wang, Yue-Qi Jv, Ze-Dong Wang, Ji-Huan Ma (2023) confirmed its significant prediction accuracy and significantly increased reliability.

Muhmmad I. Nofal, Zawayah M. Yusof (2013), even a decade ago, suggested more attention should be paid to the integration of business intelligence and enterprise resource planning (BIERP).

Forecasting the time contour of the quality of the development of industrial enterprises based on certain components (dynamics of changes in technological structures in the country's economy; acceptance or rejection of a new product by the market due to changes in technological conditions; the speed of advancement of new technologies at industrial enterprises) makes it possible to achieve the smallest time interval between the emergence of the need for external environment and its satisfaction from the enterprise (Hroznyi, 2014).

A study by Zeyu Wang, Yue Deng, Shouan Zhou, Zhongbang Wu (2023) proposes goals for achieving enterprise development and applies a framework of recommendations for decision-making and resource optimization of entrepreneurial projects for sustainable socio-economic development.

Hroznyi I. (2014) believes that the achievement of a coherent state of consistency of quality management contours can be implemented through the determination of the necessary quantity and quality of resources.

Therefore, it can be concluded that despite the popularity of the planning of individual contours of development quality management, there are no studies that would consider the peculiarities of the coherence of such contours based on the planning of the target contour. Management of the quality of the development of an industrial enterprise involves the use of a set of methods of planning and forecasting the coherence of the contours of the management of the quality of development.

### Methodology

The management of the time contour of development sets before the enterprise the task of forecasting a favorable moment for the structural restructuring of the production process at the industrial enterprise in accordance with the needs of scientific and technological progress, which

leads to the achievement of qualitative development of production and satisfaction of consumer needs in the shortest possible time. That is, the time contour of the development of production should be understood as a specific time range in which the necessary measures are carried out or not carried out within the framework of the implementation of the development strategy.

The state of the external environment in relation to the enterprise can be favorable, unfavorable or neutral (Tarasova et al., 2021).

According to the results of forecasting the quality management time contour of the industrial enterprise development and determining the favorable moment for the realization of the intended goals and objectives, special attention should be paid to the resource provision of this process, because the level of balance between the time and target contours will depend on the planning of the resource management quality contour of the enterprise development. The resource contour of production development consists of a set of listed resources and their components. Ideally, in order to achieve a high level of production development quality, all components of the resource circuit should be in equilibrium, i.e., the quality and quantity of material resources corresponds to the level of development of the technology used in production thanks to the use of qualified labor and is within the limits of the financing of the production development program.

The target contour of the management of the quality of the development of the enterprise represents the directions along which the financial and economic activity of the enterprise should be carried out. This is a qualitative characteristic of goals. On the other hand, the goal should define the desired state of the system, which should be achieved after a certain period of time, necessary to obtain a certain quantitative and qualitative assessment.

The analysis of the goals of the enterprise as a system in various aspects makes it possible to distinguish the following types of system views: microscopic, functional, macroscopic, hierarchical and procedural (Hroznyi, 2014).

In this article, the concept of structure should be counted among the topological characteristics of the system of goals, i.e. it fixes the location of elements and links in this system.

For example, in the structural diagrams of organizational systems, we will consider the

center, active elements, etc. - creative, and the lines that connect them - real material and informational connections between goals.

To date, (Hroznyi et al., 2018), that in the mathematical theory of active systems, management tasks were set, an optimal plan was agreed upon, taking into account the interests of the system as a whole and the interests of the creators. The development of these ideas takes place within the framework of the theory of active systems, information theory of hierarchical systems. However, in many important practical cases, these theories lack accurate ideas about the structures in specific cases, their possible transformation in various environmental conditions, and the resolution of contradictions in the relationship between the constituent goals.

Enterprise development goals are multi-layered (Fobel & Kuzior, 2019). They form a hierarchy analogous to a planning system, i.e. the system of goals is the outline of the plan. Each structural unit of the enterprise must have and has a certain development goal, therefore the formulation of the goals of the strategic plan is successful in many respects when a balance is achieved between the goals of the organization, the necessary amount of resources for their achievement and a favorable time range for their implementation. (Hroznyi et al., 2014).

Thus, the use of a methodical approach to the planning of the consistency of the contours of quality management of the development of industrial enterprises based on the planning of the target contour should solve the following tasks:

1. Achieving a balance between time and resource contours of qualitative development of the enterprise.
2. Development of a mathematical toolkit, the use of which will enable the management of the enterprise to monitor the state of achievement/failure to achieve the planned goals and timely identify the cause of this phenomenon.

A number of factors (concepts) are characteristic for solving the tasks, the most important of which are the following:

goals that determine the direction of system development on a given modeling time horizon; actions (operations) leading to the achievement of goals; indicators reflecting the state of the system.

To solve the tasks, it is proposed to use formal multifactor modeling based on a three-level system consisting of graphs of goals, operations and indicators that interact.

The development of a methodical approach to the planning of the consistency of the contours of the quality management of the development of industrial enterprises based on the planning of the target contour based on the model of the three-level system includes the following stages:

1. Development of a basic model of the interaction of goals, operations and indicators in all possible states of coherence between development contours (state of stability, destabilization, recovery).
2. Analysis of the properties of the components of the three-level system: attainability of states at the level of operations and stability of transient processes of mutual influence of indicators on the state of achievement/failure to achieve the set goal.
3. Introduction of a component into the model that reflects the mutual influence of deviations of indicators from the norm (deviations) of the state of consistency between contours.

Cause-and-effect relationships are set on sets of goals, operations, and indicators, which are reflected by the corresponding levels. The goals of the system form a hierarchy in which the main (global) goal and intermediate goals - milestones on the way to the main one - are distinguished. The level of goals models the order of achievement of goals: from lower to higher. The operations layer models a flow of operations that can be executed both sequentially and in parallel. The level of indicators models the mutual influence of indicators.

The level of operations is modeled by a Petri net, the positions of which correspond to the

operations of the implemented process, transitions to the events of the change of operations. Each position of the operations level

corresponds to a Boolean variable  $p_i \in \{0,1\}$ : the operation is performed if  $p_i = 1$ , and not executed if  $p_i = 0$ . Transitions, in turn, are "loaded" with decisive conditions - logical functions from variables: time, values of indicators (or deviations of indicators from the norm), indicators of goal achievement. These logical functions must ensure the network's dynamism and determinism.

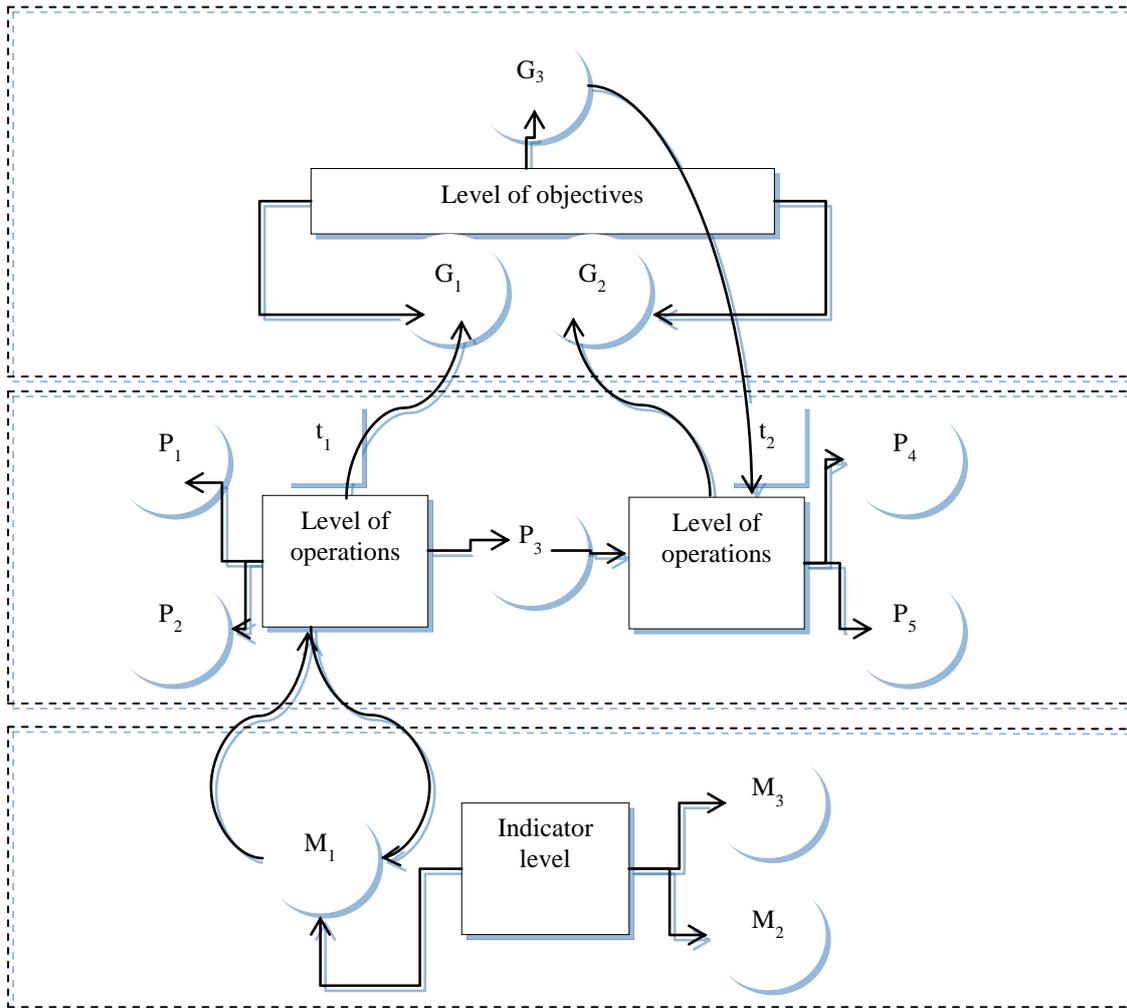
The level of goals is an acyclic Petri net, where positions correspond to goals, transitions reflect the achievement of higher goals as a result of the achievement of lower ones. Each goal level position corresponds to a Boolean variable

$g_j \in \{0,1\}$ , the goal is achieved if  $g_j = 1$ ,  
and not reached if  $g_j = 0$ .

An indicator level is an oriented level, the vertices of which are mapped by indicators. Transitions between levels reflect the mutual influence of indicators and are loaded with functions that transform their change. The vertices of the indicator level correspond to variables that acquire values from a set of real numbers

$$m_k \in R.$$

The diagram of the interaction of the blocks of the three-level system is shown in Figure 1, where the upper rectangle corresponds to a fragment of the level of goals, the middle one to a fragment of the level of operations, and the lower one to a fragment of the level of indicators.



**Figure 1.** Scheme of interaction of the components of the three-level system.  
Source: own research.

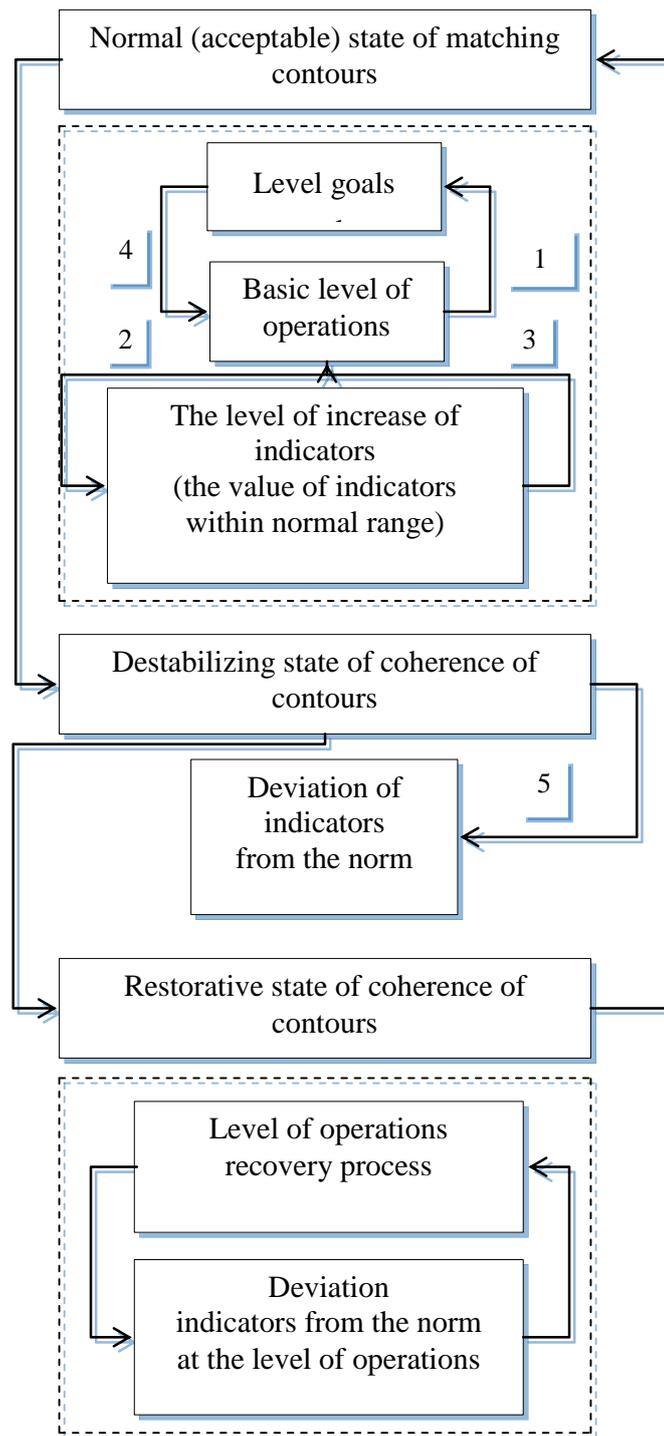
The process of managing the quality of the enterprise's development is modeled on two time scales - the operational one  $\tau = 0, 1, \dots, h$  and indicator  $\theta = 0, 1, \dots, H, H \geq h$ .

Intervals  $[\tau_{i-1}, \tau_i), i = 1, \dots, h$  are called operating cycles characterized by a subset of achieved goals  $G_i$ , where  $G_i \subseteq G, G_{i-1} \subseteq G_i$  ( $G$  - set of all targets).

This means the following: if any goal is achieved during the simulation on the time horizon, then it remains achieved until the end point of the

horizon,  $P_i$  - sets of operations,  $P_{iq}, q = 1, 2, \dots$  - vectors of indicator values characterizing operating cycles.

The qualitative development of the enterprise is reflected by the cyclic repetition of the sequences of the stages of the states of agreement (balance) between three contours: target, resource and time. The state of agreement can be: normal (acceptable), unstable and in the process of restoring the agreement density. Each of these states is characterized by the functioning of the levels of goals, operations, indicators and the interaction between them are shown in Figure 2.



**Figure 2.** States of consistency (balance) between contours in the management process quality of enterprise development.  
 Source: own research.

For the period when the contours are in a normal state of consistency with each other, the level of indicators is modeled using a weighted sign increment level. The dynamics of the change of indicators in this model is determined by the formula

$$r_i(\theta + 1) = r_i(\theta) + \sum_{G_i} \Delta r_j(\theta) \omega_{ji}, \quad (1)$$

where  $r_i(\theta)$  – the value of the indicator at the moment of time  $\theta, G_i$ ;

$\Delta r_j(\theta) = r_j(\theta) - r_j(\theta - 1)$  – increase of the indicator for the previous cycle;

$\omega_{ji}$  – indicator weight.

1. The interaction of levels is reflected by loaded (decisive conditions) leading from transitions between levels of operations to the top of goals and indicators. Feedback from these levels to the level of operations is revealed through the permissive conditions that load its transitions (Tupkalo, 2020).

The basic level of operations is the coordinator of the functioning of the modeled system during the normal state of coordination between circuits.

As a result of triggering its transition  $t_i$ :

upon fulfillment of the conditions leading to  $t_i$  in certain positions  $C_q$  goal level, goal

achievement is modeled  $C_q$  (arrow 1 in Figure 2). At the level of goals, a transitional process is launched, which ends (due to the acyclicity of the level of goals) with the establishment of equilibrium between contours;

guiding influences on the level of indicators are presented, which cause a jump-like change in their values (arrow 2 in Figure 2) and, as a result, a transitional process in the level of indicators, during which the vector of indicator values changes. The number of steps of this process can be estimated from above by the value  $\xi$ .

Let's assume that the transition  $t_i$  converted the level of operations into marking (state)  $D_j$ , in which transitions are activated (can work).

$t_{ji}, \dots, t_{je}$ , loaded and triggered by boolean functions  $f_{ji}, \dots, f_{je}$ . Two alternative results of the process at the level of indicators are possible (arrow 3 in Figure 2):

1. Any of the functions will acquire the value 1  $f_{ji}, \dots, f_{je}$ , as a result, the corresponding transition at the level of operations will be triggered, leading to the following marking.
2. The estimate will be reached and the simulation experiment on the three-level model will stop.

Another reason for stopping modeling is the achievement of all set goals (arrow 4 in Figure 2).

The destabilization of coordination between the contours of the quality management of the enterprise's development is caused by external influence (arrow 5 in Figure 2) or critical accumulation of internal changes in the system. This is expressed in the deviation from the norm of some indicators, which, due to the presence of cause-and-effect relationships, initiate the deviation of other indicators, etc. An uncontrolled process of the spread of deviations, characteristic of a crisis situation, is launched.

The introduction of deviations in the model of the quality management cycle of the enterprise development is explained by the fact that its application makes it possible to increase the adequacy of the modeling (due to the loading of linear functions) and facilitates the expert's understanding of the processes implemented in the system (crisis situations are usually perceived in terms of deviations of indicators from norms) (Hroznyi, Kuzmak & Rusinova, 2018).

For the period of the normal state of coherence between the contours, the model in Fig. 2 is three-component, and destabilization is reflected by a one-component model. A two-component model consisting of deviations that interact with each other and a special level of recovery operations corresponds to the recovery period of coherence between the contours. The goal of the recovery process is standard: bringing indicators back to normal, so there is no level of goals in this structure. The level of restorative operations controls deviations of indicators (arrow 6 in Figure 2) and gradually brings them to zero (close to zero) value

## Results and discusión

The following actions are performed during the simulation modeling of the consistency of the target contour with the time and resource contour.

For the period of the normal state of consistency between contours:

1. The achievement of the goals is checked on the given modeling time horizon. If all the goals are achieved, then the moment of achievement is indicated. If not, then the place and moment of "hanging" between the levels of operations and goals is recorded.

2. Time changes of the values of the system indicators for the period of the normal state are built.

For the destabilizing process of matching between contours:

1. If the destabilization process comes to equilibrium before the end of the specified control period, then the moment of establishing equilibrium and the final deviations of the indicators from the norm are fixed.

If it does not come, then the simulation is interrupted either by time or in case of critical deviations of the indicators. The moment (tact) at which the rebuilding process is started is selected and the initial deviations of indicators for this process are set.

2. Time graphs reflecting the dynamics of the destabilization process are built.

For the restoring process of coherence between contours:

1. The expert sets the value of the guiding influences of the transitions of the restorative level of operations according to deviation indicators and, on this basis, conducts a simulation experiment on the normalization of indicators. If the specified number of indicators is normalized (number of indicators), then we return to the normal operation mode. Otherwise, we correct the governing influences and repeat the experiment.
2. Time graphs reflecting the dynamics of the restoration process are constructed for each experiment.

In the period of the normal state of consistency between the target, time and resource contours, the indicators of the system are characterized by their normal point estimates, in this period, with their combined influence on another indicator, we find the resulting change as the sum of the effects of each indicator, therefore, we believe

that we are able to give an estimate of the change in the indicator from with a slight degree of uncertainty.

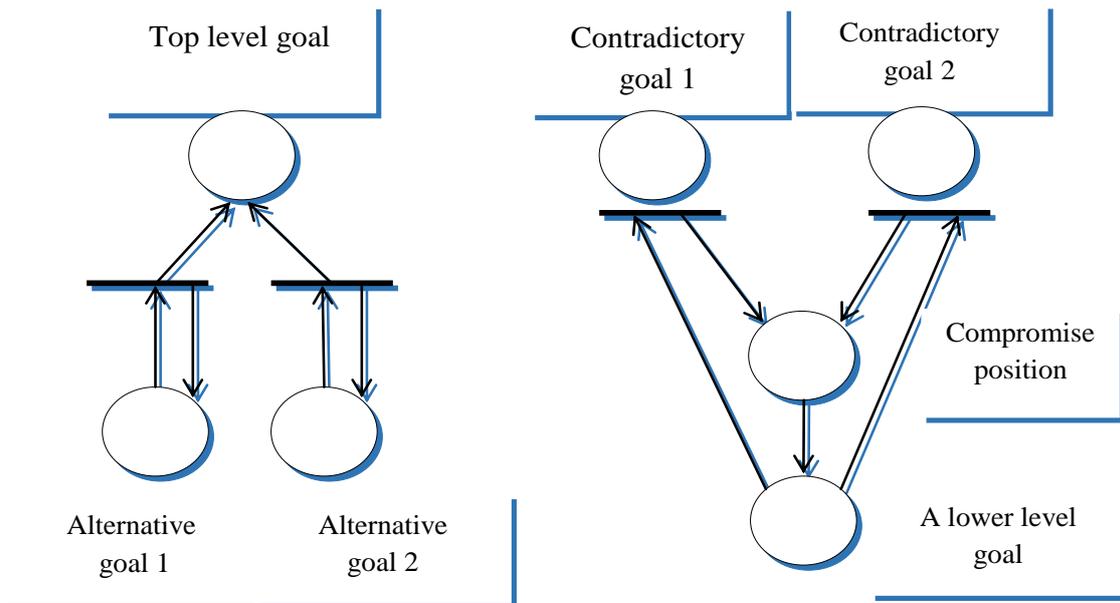
The degree of uncertainty in its assessment increases with the growth of the growth rate of the indicator. Finally, the point estimate of the indicator goes beyond the normal range, and the expert is no longer able to give an adequate assessment of it. In this case, the model of the mutual influence of indicators is replaced by a graph of deviations, in which the degree of deviation from this range is evaluated, not the point value of the indicator within the permissible range of values. At the same time, evaluating the joint influence of several indicators on one, it is difficult to assess the contribution of each of them.

Therefore, only those indicators that have the greatest impact are taken into account (taking into account the sign) (Kuzior, Kwilinski, & Hroznyi, 2021).

So, in the first step, the levels of mutual influence of indicators are constructed during the periods of the normal state of consistency between the contours and the period of the crisis situation, the range of normal values of each indicator of the system is selected for the period of normal operation, and the degrees of influence of the indicators on each other for the periods of destabilization/recovery are set.

In the second step, the level of goals for the period of the normal state of coherence is built. The level of goals for the recovery period degenerates to one goal: to bring all indicators to the norm (that is, to obtain an estimate of the deviation of indicators from the norm in the range from "very small negative" to "very small positive").

The goals set can be contradictory and alternative. Examples of graphical representations of alternative and conflicting goals left and right respectively are shown in Figure 3.



**Figure 3.** Examples of alternative (left) and conflicting (right) goals.  
Source: own research.

Alternative goals are characterized by the fact that to achieve a higher-level goal, it will be enough to achieve any of them, which is shown in Figure 3. In the left column, when a marker is inserted into any of the lower-level goal positions, its output transition will be triggered, and the upper-level goal will be achieved.

Conflicting goals are characterized by the fact that the achievement of one of them excludes the achievement of the other, as shown in Figure 3 on the right. When a marker is placed in the "Lower Level Goal" position, one of its two output transitions will be triggered. At the same time, the marker will be transferred to only one of the upper level goals, and the second will remain unachieved.

The level of goals makes it possible to present the hierarchy and decomposition of goals and tasks set before the system, to highlight milestones on the way to global goals. In the general case, the level of goals does not have to be binding, it can be a set of trees ("forest") (Repin & Eliferov, 2013).

In the third step, the level of operations is built, which manages the level of indicators and the level of goals.

Before compiling the level of operations, an expert analyst forms a set of actions necessary to achieve the qualitative development of the enterprise. For each operation, the following is determined:

- what goals does the operation lead to and on the basis of which criteria the goal can be considered achieved;
- which indicators are affected by the operation and in what way (changes its evaluation by some fixed value, sets its value, etc.).

After that, the analyst builds chains of their execution from these operations in accordance with his idea of the company's development strategy. For the period of the normal state of consistency between the contours of the qualitative development of the enterprise and the recovery process, their levels of interaction are built.

In the fourth step, connections between the levels of goals, operations and indicators are established. Thus a three-level system model is formed.

At the same time, it is advisable to apply the aggregate-module principle with the use as modules of typical fragments of the levels of goals, operations, indicators and the formation of appropriate libraries.

In the fifth step, the expert conducts simulation experiments on the three-level model, applying external influences to its inputs. Tables and graphs obtained during the experiment are taken into account in order to determine the effectiveness of the corresponding strategy of system development. These tables, in turn, can be

combined into a graph-table model, which will display ribbons (sequences) of states on the levels - components of the three-level structure, as well as transitions leading to changes in these states.

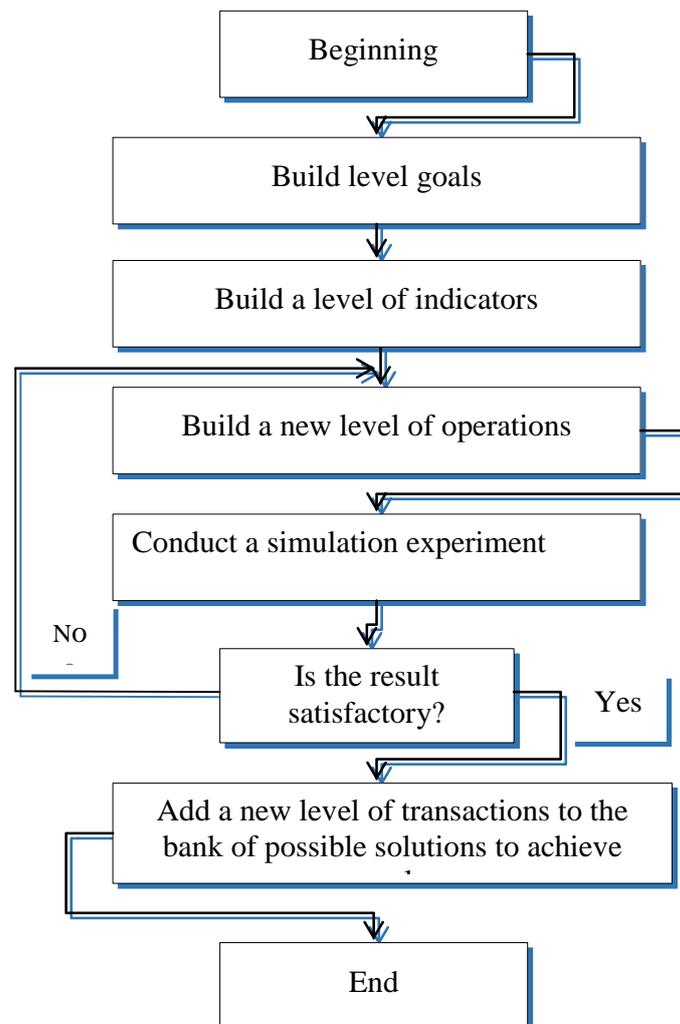
The three-level structure functions in a "slow" (operational) tact, which corresponds to the triggering moments of transitions at the level of operations, in which management actions are formed at the level of goals and the level of indicators. The interval between adjacent moments on the scale, called the local modeling horizon, consists of steps due to the "fast" (indicative) tact. On the local horizon in the three-level system, the process of changing the values of indicators (during the period of stability) and deviations of indicators from the norm (during destabilization and recovery) is realized.

After carrying out a simulation experiment and receiving its results, the expert makes a decision about its effectiveness and, if necessary, makes amendments to the level of operations:

- changes the composition and order of transactions;
- changes functions at transitions between operations;
- changes functions from the level of operations to the level of goals and indicators.

Next, the expert carries out a repeated simulation experiment with a new level of operations.

The process described above is repeated until the expert receives a level of operations that will satisfy him (taking into account the limitations of the external environment), or reaches the conclusion that the achievement of the set goals is impossible. In Figure 4 offers a general scheme of the modeling process.



**Figure 4.** Schematic of the process of simulation of prospective target situations. Source: own research.

After that, the expert can repeat the whole process again, specifying other initial values of the indicators for the period of normal (acceptable) consistency and deviations from the norm for the period of destabilization.

Thus, as a result of simulations and simulation experiments, a bank of levels of operations for various purposes and initial data is obtained. The obtained sets of sequences of actions can be used as "road maps" in the event of a real critical

### Conclusions

Thus, achieving a state of consistency of quality management contours becomes real by determining the necessary quantity and quality of resources in accordance with the set goals of the enterprise's development in a favorable time period. For this purpose, a methodical approach to the planning of the consistency of quality management contours of the development of industrial enterprises is proposed based on the planning of the target contour based on the three-level system model and multifactor modeling tools, which involves the use of a set of planning methods and forecasting of the consistency of the quality management contours of development by reducing the gap between the selected contours, bringing them into a state of balance and unidirectionality with the aim of achieving consistency between inherently inconsistent management objects, which makes it possible to realize potential opportunities for development and increase the level of quality due to meeting the needs of the external environment in the shortest possible time.

When planning the target contour based on the three-level system model, the following stages are defined: development of the basic model of the mutual influence of goals, operations and indicators in states of stability, destabilization and recovery; analysis of the attainability of states at the level of operations and stability of transient processes of mutual influence of indicators on the state of achievement/failure to achieve the set goal; introduction into the model of a component that reflects the mutual influence of deviations of indicators from the norm (deviations) of the state of consistency between contours.

As a result of simulations and simulation experiments of the consistency of the target contour with time and resource, a bank of levels of operations for various purposes and initial data was obtained.

The proposed approach can be used to develop options for future plans for qualitative development of the enterprise by setting a target situation for a certain future moment in time and finding a sequence of intermediate situations of qualitative development of the enterprise that leads to the set goal.

Prospects for further research in the development of the topic consist in the development of approaches to forecasting the time contour of the quality of the development of industrial enterprises on the basis of the dynamics of the promotion of new technologies at industrial enterprises.

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