Information Modelling and Knowledge Bases XXXIV
M. Tropmann-Frick et al. (Eds.)

doi:10.3233/FAIA220503

Digital Priority Management Mechanisms in the Goal-Setting System of Enterprises as a Component of Economic Security

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Abstract. The article deals with issues related to the creation of digital mechanisms for managing the priorities of goals in enterprises in the context of inter-goal conflicts. A system-dynamic model of a system for forming and serving a queue of goals has been developed and it has been shown that with an average load of such a system, even at 90%, large delays in the execution of goals are already observed. It is also shown that the introduction of a feedback mechanism through goal priority management can significantly increase the effectiveness of the goal setting system. The concept of goal priority is proposed as a complex parameter consisting of 10 components that form the static, dynamic and purchase parts of the priority. A digital mechanism for the formation and management of enterprise priorities is proposed. The obtained results make it possible to increase the economic security of the enterprise due to better coordination of strategic, operational and tactical goals, as well as to accelerate management processes and increase their transparency.

Keywords. Goal-setting, goals, priority, management, system dynamics, economic security, digitalization

1. Introduction

The digital economy is based on digital transformation - this is the transformation of existing analog products, processes and business models, which is based on the effective use of digital technologies. Transformational processes associated with the use of digital technologies, like any other transformations, carry with them the likelihood of risks and real threats to the economic system of an enterprise. The most significant digital changes affect the area of economic security, since the high openness of enterprises to the external environment entails a number of threats and risks to their activities.

One of the most important aspects of ensuring the economic security of a business entity is due to goal-setting processes. It is the goal setting that determines the global goal of enterprises, is the foundation for the formation of reserves in passive and active adaptation to internal and external threats, determines the directions and methods of using resources, directs the definition of planned indicators, etc. On the contrary, erroneous goal setting acts as a limitation on the introduction of innovations in enterprises, causes a significant number of deviations and imbalances in production and

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management processes, as well as a low level of staff motivation, which ultimately affects the economic security of the enterprise.

Improving the goal-setting system of an enterprise requires significant changes in the management of the processes of collecting, storing and using data. At large enterprises, it becomes necessary to introduce flexible HRM (Human Resources Management) and ERP (Enterprise Resource Planning) systems, or upgrade existing ones. The effectiveness of the goal-setting management system is directly related to how deeply it is integrated into the enterprise management system. At the same time, it is obvious that the collection of data for goal-setting management should be carried out transparently for the employees of the enterprise and should not distract them from their main work. The solution of these problems is most expedient to carry out within the framework of the complex digitalization of the enterprise. In fact, digitalization can be considered as the most important tool for implementing a goal-setting management system and, accordingly, ensuring the economic security of an enterprise (Fig. 1).

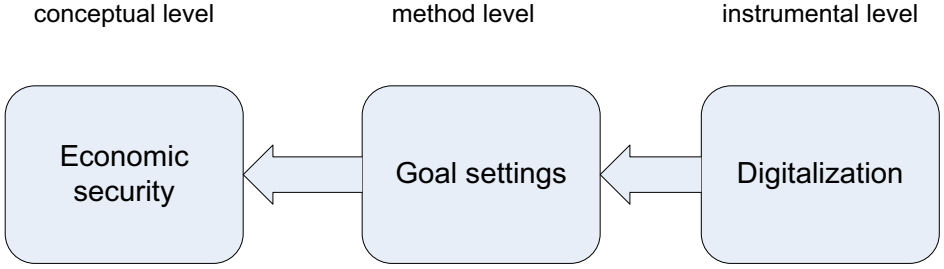

Figure 1. Goal-setting in the system of economic security of an enterprise.

An analysis of existing studies related to the improvement of goal-setting processes at enterprises shows that their authors also develop the idea of digitalization and algorithmization of goal-setting processes, which were previously considered as the exclusive competence of a person [1-6].

A significant problem of organizing goal-setting at enterprises, the existence of which has been repeatedly emphasized by domestic and foreign researchers [7-8], is the problem of inter-goal conflicts that arise in cases where the goals set by departments cannot be met, which most often happens due to a lack of resources (temporary, material, financial and other). At the same time, the practice of organizing management at domestic enterprises develops in such a way that managers are required to achieve all their goals, regardless of the circumstances.

This approach has significant drawbacks, including:

- delay in meeting the goals, which negatively affects the economic security of enterprises;
- rush work of units, which worsens the psychological climate in them and negatively affects labor productivity, staff turnover and other similar indicators.

In the existing management systems at enterprises, middle and lower-level managers receive a significant amount of target instructions, not only from their immediate supervisors, but also from other services. At the same time, almost every boss, when setting a goal, requires its prompt implementation.

An experienced leader is able to improve the work of his unit by properly prioritizing the goals to be achieved. However, given that "the ability to prioritize" is valued as one of the most important qualities of a leader [9], only a few have the ability to do so.

Thus, the purpose of this article is to substantiate and form digital mechanisms for managing the priorities of goals at enterprises in the context of inter-goal conflicts.

2. Literature review

Currently, many scientific works are devoted to the study of enterprise goal-setting systems [9-12]. Business managers often spend a lot of time arguing about the meaning of goals and objectives, although from a practical point of view this usually does not matter. According to Doran, in some cases, the objectives are short-term, and the goals are long-term, in others - vice versa [5]. It is useful to separate these concepts, but only at the administrative level. That is why enterprises need to implement a goal-setting system. The introduction of this system must be implemented simultaneously with the addition of other market functions [13]. The methods of such systems are considered in the works of many domestic and foreign scientists [1-4]. So Mikhailik in his work proposes to consider the structure of the goal as a combination of parameters that set the result, time, resources, priority rank and connection with goals and values of higher levels [14]. At the same time, Bossidi L. and Charan R. suggest focusing on improving the goal-setting culture, and Donets (Donets, 2012) suggests using a fuzzy logic model to achieve goals, the structure of which can be changed and used at enterprises in various fields [3; 15]. Based on the foregoing, despite the large number of studies, it is important to create new methods for managing priorities in the goal setting system.

3. Results and discussion

The practical experience of enterprises shows that in a situation where a unit is not able to perform all the tasks assigned to it at the same time, many managers choose tasks based on the principle of "the least evil". That is, the goals, the failure of which will be followed by minimal sanctions, are postponed indefinitely.

The very existence of the described problem indicates the absence of a feedback between the recipients and sources of goals in the system of goal-setting of enterprises. We illustrate this with the help of Fig. 2.

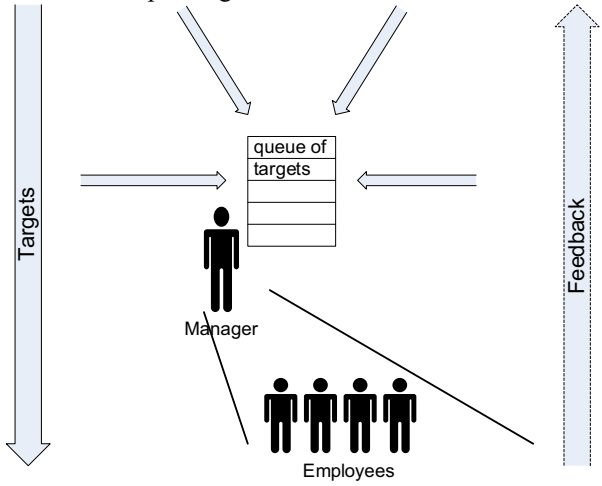

Figure 2. Mechanism for forming a queue of targets.

When setting goals for the unit, both senior managers and peer managers proceed only from their tasks. At the same time, the total number of goals set for the unit, and their relationship with the available resources, is practically not taken into account, which leads to the problems described above.

Let us substantiate this statement with the help of a simulation experiment. To do this, we use a dynamic simulation model made in accordance with the methodology proposed by J. Forrester [17] and implemented in the PowerSim package (Fig. 3).

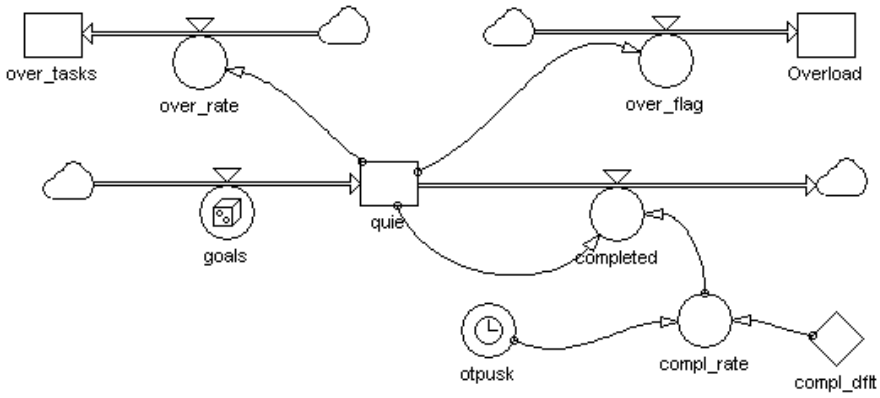

Figure 3. Model of formation and maintenance of the queue of targets.

The model shown in fig. 3 implements the approach to the goal-setting system as to a queuing system. At the same time, the simplest principle of forming and servicing a queue of goals is considered, according to which goals are executed as they arrive. This principle is known as "first in first out" (FIFO). To simplify the model, we will assume that all goals have the same complexity and the same time is required to achieve them.

We will provisionally take 1 month as the modeling period. The arrival of goals in the queue is determined by the variable goals, which in this model is a random variable with a normal distribution.

Execution of targets from the queue is limited by the completed variable, which corresponds to the throughput of the OU. Periodically, the capacity of the department decreases due to illness, vacations and other reasons. In the proposed model, this is implemented by introducing an additional variable otpusk subtracted from the throughput of the department. The otpusk variable is activated every three months.

Consider the behavior of the model for the following values of the main parameters (Table 1).

Table 1. Parameters of the simulation model for the formation and maintenance of the queue of targets

Variable	Setting method	Comment
goals	*NORMAL(90, 10)*	normal distribution with mathematical expected value 90 and standard deviation 10
compl_dflt	*100*	unit throughput standard value
otpusk	*PULSE (10,3,3)*	every three months, the capacity of the department for 1 month is reduced by 10

The results of experiments with the model (Fig. 3) using the parameters indicated in table 1 are shown in Fig. 4.

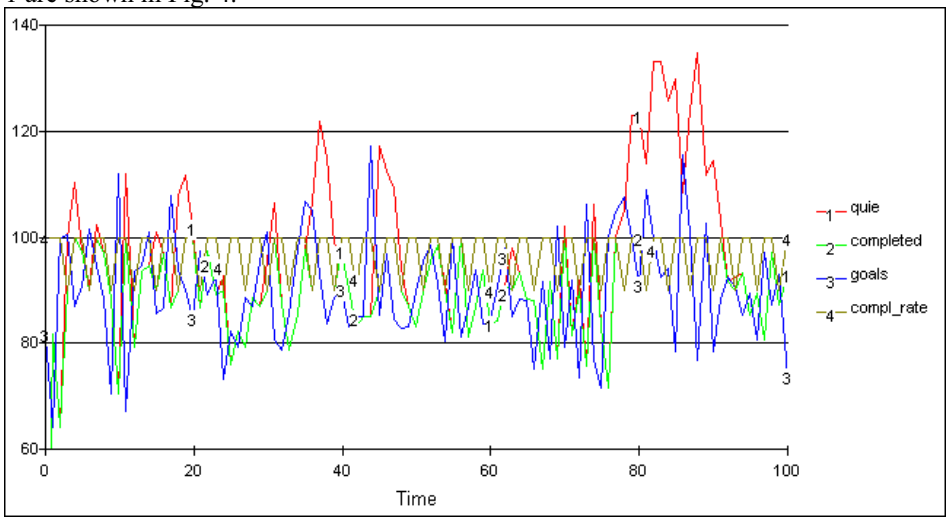

Figure 4. Simulation results for goals = NORMAL(90, 10)

As can be seen from Fig. 4, even with an average flow of applications at the level of 90% of the throughput of the department, there is periodically a significant excess in the number of applications in the queue of the throughput of the department, which can be observed over a long period.

Let us now consider the behavior of the model with an increase in the mathematical expectation of the flow of requests from 90% throughput to 95%. As you can see, this value is still less than the average throughput, even taking into account its periodic deterioration given in the model. The graph reflecting the simulation results is shown in Fig. 5.

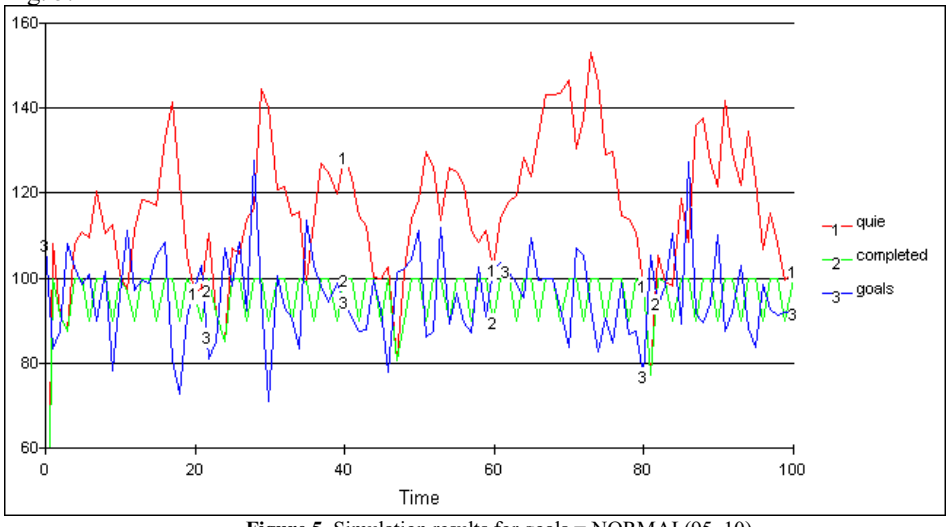

Figure 5. Simulation results for goals = NORMAL(95, 10)

As can be seen from Fig. 5, for a significant part of the model time, the number of applications in the queue is significantly greater than the throughput of the unit, and at times their ratio exceeds the level of 140%, which is the equivalent to a delay in the fulfillment of goals up to half a month. The collection of experimental statistics and its analysis showed that under such conditions, on average, in 71% of cases, the number of applications in the queue exceeds 100.

Traditional ways to solve the problem of staff shortages to meet the goals set for the unit are hiring new employees, or increasing the productivity of existing ones. The latter can be carried out both intensively, through training in new methods of work and the introduction of advanced technologies, and extensively, through overtime work. All these methods have significant drawbacks, which are expressed in increased costs, or an increase in social tension in the team, and ultimately lead to a decrease in the economic security of the enterprise. Therefore, the solution to the problem must be sought from the side of reducing the load on the unit.

Let us consider the possibility of introducing feedback into the model considered above. To do this, we introduce a mechanism that identifies the overload of the queue and corrects the flow of requests. The modified model is shown in Fig. 6.

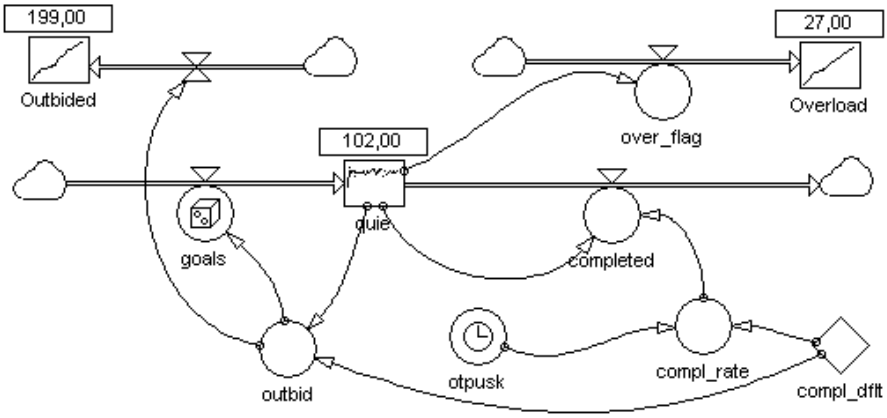

Figure 6. Model of formation and maintenance of the queue of targets with feedback.

In this model, the remaining unfulfilled requests are removed from the queue. An analysis of the results of experiments with the model showed a significant reduction in queue overload, which can be interpreted as an improvement in the quality of goal execution. The graph of changes in the model variables with a mathematical expectation of the flow of applications of 95% is shown in Fig. 7.

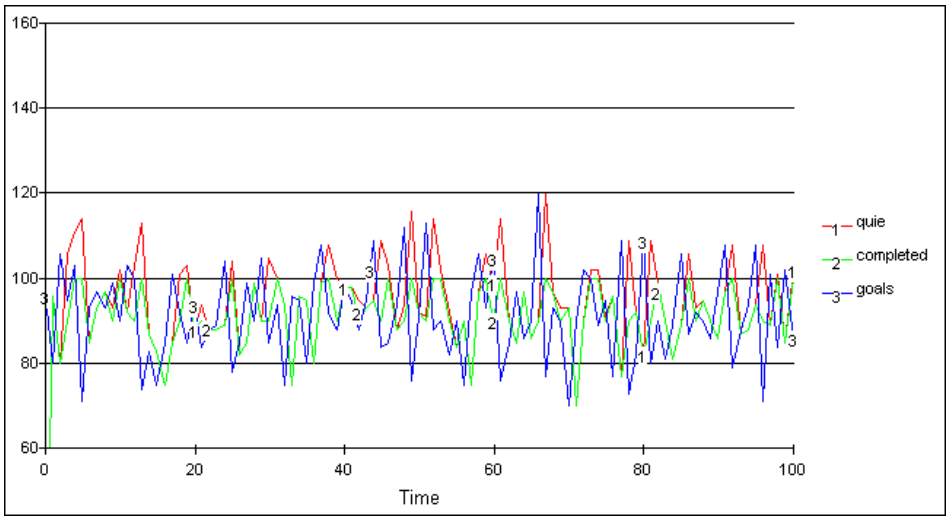

Figure 7. Simulation results in a feedback system with goals = NORMAL(95, 10)

As can be seen from the comparison of the graphs in Fig. 7 and Fig. 5, there has been a significant reduction in queue congestion and the associated delay in the execution of goals. The collection of experimental statistics and its analysis showed that under such conditions, on average, only in 29% of cases the number of applications in the queue exceeds 100, and for all 100 periods of model time, on average, only 243 applications were postponed, which corresponds to the postponement of 2% -3% of incoming goals.

Thus, simulation modeling of the processes of formation and achievement of goals made it possible to prove the feasibility of introducing feedback through the management of goals priorities between performers and their management. Let us now consider approaches to the implementation of digital mechanisms for managing priorities in the goal-setting system of an enterprise.

Obviously, the purpose of creating such mechanisms should be to provide the possibility of sorting goals according to a certain set of criteria that determine the relevance of its implementation by a given unit. When forming such a set of criteria, the following principles should be followed:

1) justice;

2) minimizing inter-target conflicts and other causes of target dispersion;

3) each given goal must be achieved sooner or later (if its cancellation is not initiated by an authorized person);

4) balanced use of resources;

5) minimum overhead costs;

6) improving the priorities of the goals of managers, which are characterized by better goal setting (taking into account errors in goal designations)

7) the ability to determine the signs of priority goals, depending on the situation;

8) the possibility of operational management;

9) ensuring the coherence of the tree of enterprise goals (strategic, tactical and operational);

10) the ability to integrate into existing HRM and ERP systems.

To implement these principles, planning mechanisms should take into account the following factors:

• whether the process of achieving the goal is limited by the work of other departments;

• the length of time each process waits;

• the total running time of each process and the estimated time required for each process to be completed.

When forming a digital priority control mechanism, we will be based on the fact that the goal structure *(g)* can be considered as a set $g=\{v,r,t,gr,l\}$ of parameters that specify:

- result *(v)*;
- resources *(r)*;
- time *(t)*;
- priority rank *(gr)*;
- connection with the goals and values of higher levels *(l)*.

Note that a similar goal structure has already been proposed in the scientific literature [18]. However, until now, studies in this direction were of a conceptual nature and did not explain how the goal priority rank is formed. Obviously, the priority rank assigned by the leader is subjective and must be supported by objective data. In other words, the overall goal priority can be viewed as a combination of subjective priorities (assigned by the will of enterprise managers) and objective priorities assigned within the goal management system.

Thus, when using only formal information about the target in the format of the set $g=\{v,r,t,gr,l\}$, it is not possible to obtain a satisfactory solution to the problem. Therefore, to increase the diversity of information about the goal, it is necessary to expand the list of components that determine the priority of the goal.

Within the framework of the problem under consideration, we can propose to classify the priority components into deserved and purchased parts. In addition, components can be static or dynamic. By default, they are assigned on a formal basis, but can also be adjusted in situations where it is necessary to increase the priority of certain goals. Thus, the overall goal priority should consist of static, dynamic, and purchased parts.

Static priorities are assigned initially and do not change. When setting them, a formal mechanism is used, based on the analysis of the structure of the goal, the conditions for its formation, and historical data. The setting of these priorities occurs when a target is entered into the system and is not associated with high costs. However, it should be borne in mind that such a mechanism is not flexible enough, since it does not respond to changes in the environment.

Dynamic priorities increase the flexibility of the system, as they provide an opportunity to provide an adequate response to changes in the situation, as a result of which the initial value of the process priority can be changed to a new, more appropriate value. The dynamic component of the target priority is constantly changing due to automatic recalculation.

Purchased priorities allow concerned leaders to increase the priority of certain goals and achieve them faster for an "extra fee". Each leader can raise the priorities of the goals, to the extent of his competence. At the same time, in order to exclude abuse of this opportunity, a limit on raising priorities should be introduced. The value of such a limit should be determined individually for each manager based on the analysis of his activities.

Thus, the priority of the target (parameter *gr*) can be defined as

$$gr = f(\{u_s\},\{u_d\},\{u_p\}) \quad (1)$$

where $\{u_s\}$ – set of static priorities,
$\{u_d\}$ – set of dynamic priorities,
$\{u_p\}$ – multiplicity of purchased priorities.

In this case, the greater the value of the *gr* parameter, the higher the target is in the execution queue.

Consider the composition of the components that form the priority of the goal (Table 2).

Table 2. Components that form the priority of the goal

№	Name of the component	Designation	Type	Limits of change
1.	Start priority	u_1	Static	0..200
2.	Source bonus	u_2	Static	0..50
3.	Bonus for the quality of goal formation	u_3	Static	0..20
4.	Parent Goal Priority Bonus	u_4	Static	0..100
5.	Bonus for time in line	u_5	Dynamic	0..∞
6.	Situational bonus	u_6	Dynamic	-100..100
7.	Penalty for conflict	u_7	Dynamic	–∞..0
8.	Similar task bonus	u_8	Dynamic	0..50
9.	Penalty for correction	u_9	Dynamic	-50..0
10.	Purchase bonus	u_{10}	Purchased	0..∞

The starting priority *(u1)* is set when the goal is formulated and entered into the goal setting management system. At the same time, the maximum priority value that can be set depends on the relative position of the target source and target recipient within the organizational structure of the enterprise. This value will be the highest for units connected by a direct hierarchical relationship. The manager setting the goal can choose a starting priority value ranging from 0 to the allowed maximum value. It is possible to have both a direct numerical assignment and the use of fuzzy terms: “very important”, “important”, “medium significance” and the like.

The source bonus *(u2)* is set automatically and reflects the internal rating of the manager who sets the goal. The higher this rating, the faster the goals set by this leader will be fulfilled. The rating, in turn, depends on the quality of his goal-setting, in particular, on the assessments that his actions received post factum, on how fully the goals are formulated, what specific weight is occupied by α-goals, and the like. The initial determination of the value of this bonus is made by experts. In the future, its value is reassessed 1-2 times a year.

The bonus for the quality of target formation *(u3)* is set automatically depending on how complete the target parameters are. The purpose of introducing such a bonus is to improve the quality of goal setting in the enterprise. Managers of all ranks should be informed that the completeness of setting a goal is directly related to the speed of its implementation. In addition, statistics on this bonus is used when revaluing the source bonus.

The bonus for the priority of the parent target *(u4)* is set depending on whether the parameter l is set in the target structure and what priority the parent target (GI) had at the time the current target was queued. The introduction of this bonus stimulates the decision

maker to accurately set the parameters of goals, and also makes it possible to ensure the coherence of the tree of enterprise goals. In particular, goals related to ensuring the economic security of the enterprise have an increased priority.

The bonus for time in queue *(u5)* changes dynamically, increasing from 0 for the time the target is in the queue for execution. The presence of this component as part of the priority ensures that the target in the queue will be completed. Indeed, since this bonus does not have a limit value, sooner or later it will reach a value that allows the target to reach the top of the execution queue. If during the waiting time the goal has lost its relevance, it can be removed from the queue.

The situational bonus *(u6)* is set by the top management of the enterprise or authorized persons and allows group management of priorities by increasing or decreasing priorities along the branches of the goal tree. When setting this bonus for a certain goal, the system looks for sub-goals associated with it and automatically changes their situational bonuses.

The penalty for conflict *(u7)* is set automatically or manually by a higher manager if the combination of information flow values excludes the full execution of some incoming (GI) or single-level (GL) goals of the goal-setting subject, that is, in the event of a conflict. In this case, the execution of one or more conflicting goals can be forcibly delayed for an indefinite period until the conflict situation is resolved.

The similar task bonus *(u8)* allows you to improve the performance of the process of executing goals (mostly single-level ones) through the use of pipeline processing principles. As is known and scientifically proven, labor productivity in the simultaneous performance of similar tasks is significantly higher than when they are performed separately [19-20]. This bonus can be set both manually and automatically if the data available in the system are sufficient to identify such tasks.

Target Adjustment Penalty *(u9)*. When implementing a priority management system, it is important to minimize the system's vulnerability to misuse. In particular, the possibility of adjusting the target parameters should be limited in order to avoid cases of complete reworking of tasks that are close to the exit from the queue. To do this, you can either completely prohibit the adjustment of the main parameters of the target, or introduce a "penalty" for each adjustment.

The purchased bonus *(u10)* allows each manager to exercise his right to choose his primary goals. To do this, each manager, depending on his position in the organizational structure of the enterprise, is awarded a certain number of bonuses, which he, at his discretion, can use to increase the priorities of the selected goals. The frequency of bonus accrual can be a calendar month, a week, or another period, if this is due to the peculiarities of the production process. It should be noted that the purchase bonus can be set by managers either for the goals set by them, or for the goals of subordinate managers located lower in the tree of goals.

Goal priority is defined as the arithmetic sum of all the listed components:

$$gr = u_1 + u_2 + \ldots + u_{10}. \quad (2)$$

The mechanism for managing the priorities of goals can thus be represented as follows (Fig. 8).

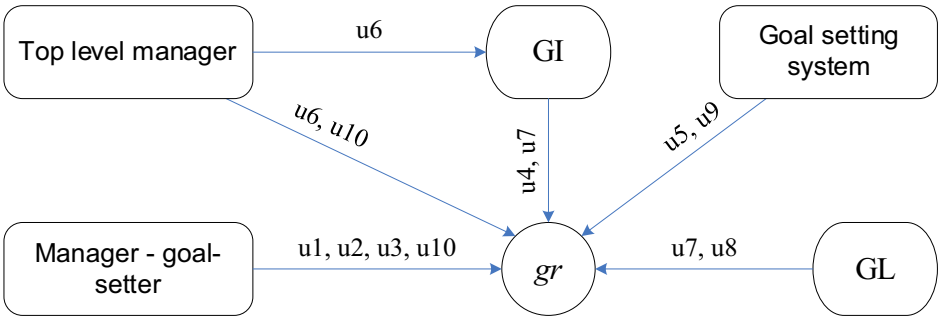

Figure 8. Digital mechanism for managing priorities in the enterprise goal-setting system

The considered mechanism for the formation and management of goal priorities is quite flexible and can be implemented gradually, as the process of enterprise management is digitalized and the possibilities of goal-setting management are expanded. Thus, the automatic setting of bonuses u2, u4, u6, u7, u8 is possible only after the accumulation of a sufficient amount of information in the system and the implementation of methods for processing it, allowing to assess the quality of goal-setting of individual managers, the coherence of goals, their impact on the economic security of the enterprise and other characteristics.

Priority management allows you to ensure better connectivity of the tree of enterprise goals, that is, it provides a link between the strategic, tactical and operational goals of the enterprise, as well as group management of the priorities of individual branches of this tree.

It should be noted that the considered goal priority management mechanism, although it is quite universal, is primarily focused on enterprises with a hierarchical management system. In addition, the enterprise must be large enough to afford the costs of implementing the goal-setting system and training to work with it. Therefore, for other types of organizational structures, or for relatively small enterprises, the described mechanism should be modernized taking into account their features. In particular, the following simplified options can be proposed:

1. A system based on source priorities. In such a system, for each unit, the priorities of the sources of goals are determined, that is, the principle of determining the sequence of fulfillment of goals obtained simultaneously from different sources is set. In fact, this corresponds to the “source bonus” u2 (see Table 2). Execution is carried out starting from the goals received from the highest priority source. After they are exhausted, they move to a source with a lower priority, and so on. The disadvantage of such a system is that the goals of sources with low priorities may remain unfulfilled.
2. Using the principle of queuing "Last in, first out" (Last In First Out - LIFO). In this case, the most relevant target of each source is the target sent for execution the last. The fulfillment of the goals is carried out in accordance with the priorities of the sources, similarly to paragraph 1.
3. Manual control mode. In this case, at the beginning of each working day, each manager chooses the most relevant ones from the list of goals set by him. The fulfillment of the goals is carried out in accordance with the priorities of the sources, similarly to paragraph 1.

Based on simulation experiments, the article substantiates the need to use digital mechanisms for managing priorities in the goal-setting system of large enterprises. It is

shown that the absence of such mechanisms leads to a large delay in the fulfillment of goals, which negatively affects the economic security of the enterprise. An increase in the effectiveness of goal setting after the introduction of feedback on the priorities of goals is shown.

The structure of the digital mechanism for managing the priorities of goals is proposed, as well as its main components that form the information base of the goal-setting system are described.

The implementation of the proposed digital mechanisms for managing the priorities of goals will increase the efficiency of the enterprise management system and their economic security. Subsequent research in this direction should provide for a detailed integration of the proposed mechanisms into the enterprise management system and bringing them to the stage of practical implementation.

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Sources of funding for research presented in a scientific article or scientific article itself: *This research is/was funded by the European Social Fund under the No 09.3.3-LMT-K-712-23-0211 "Transformation of the economic security system of enterprises in the process of digitalization" measure.*