Conference Paper

Identification of Information System Functional Problems Using the Model of Requirements and Cause-effect Relationships

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Abstract

The paper defines the models of the objective tree and the current reality tree. Such models allow to define problems on the basis of cause-effect relations. The paper provides general recommendations for the application of these models. It describes their application on the example of an information system, a compound program complex. The information is accompanied by visual images in the form of diagrams. The information system is used in the field of retail to solve many different problems. The paper explains the need to identify problems. Within the framework of the example, the system's stakeholders are defined and their interaction with the objective tree is given. After that, a certain objective is considered and the reason for that is given. As a result of using the current reality tree, the paper compiles a list of root problems. At the end, it proves the connection between the solution of low-level problems and the implementation of high-level objectives. Finally, it provides recommendations for further work related to the selected list of problems.

Keywords: current reality tree, system, stakeholders, objective tree, retail, problems definition

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1. Introduction to the Subject Area

Retail is the subject area of this study. Retail is a field of retail sales. This field involves a lot of human resources and all of them are aimed at making profit. Obviously, in the case of retail sales, the work performed by employees usually depends on the number of these sales. Such a simple conclusion, on the one hand, leads to complex problems, on the other hand.

One of the most common problems is the scheduling of retail employees, which is based on the prediction of customer traffic [1]. It is not always a matter of saving human resources, but of increasing net profit [2]. A special mention should be made of the problem of human factor control, the solution of which, in the real world, is taken over by HR managers, since making a schedule and following it are two different things [3].

Many business processes in retail, although complex, can be automated. Many large retailers are interested in such automation because it can be a serious competitive advantage [4].

The system [5] which will be considered in the paper is a complex software package including a large set of different tools. These tools provide management of various processes on HR management in retail.

The system is operated and implemented in large retail chains. Therefore, high demands are placed on its quality and the quality of the result. Each problem is a potentially high cost, namely reputation risks and the cost of quick fixing. It is necessary to identify existing problems before they are detected by the customer at the stage of industrial operation.

2. Purpose of the Paper

The purpose of the paper is to create a list of problems [6] with the help of tools for modeling requirements and cause-effect relationships.

This formalized list of problems can be used by the decision-maker for further strategic planning of the system development. Also, the obtained list of problems can be used at different stages of the life cycle of the system related to the definition of requirements, verification, validation, etc. [7].

Another purpose of the paper is to show that there is a connection between solving low-level problems and achieving high-level objectives.

3. Formalization of the Objective Tree Model

Objective tree model is a hierarchical data structure, a model within which the objective-means ratio is established [8]. In other words, the interrelationship between the higher and lower objectives is understood as follows: it is necessary to achieve all the lower objectives related to it in order to achieve the higher objective. The objective tree model can be presented in a visual form of a hierarchical diagram or a set of diagrams. According to the author of the paper, in case of a large volume of structured information, the model should be presented in a tabular form.

Building an objective tree begins with the identification of stakeholders, because the main objective is a successful system, i.e. one that meets the requirements of

stakeholders [7]. The next step is to define their objectives or problems. After that, the objectives of the stakeholders are decomposed to the needs and requirements [9].

In the author's view, it should be considered that both objectives aimed at generating and increasing profits and objectives related to long-term support and infrastructure provision are strategically important. In terms of the life cycle of systems, this means that one should not forget about the operational phase of the system.

When compiling the objective tree model, it is necessary to structure and classify the objectives in such a way that they are understood by the Decision Maker [10]. The modeling by means of objective identification is performed using various analytical procedures, as well as coordination and approval procedures.

At the lower level of specification, a methodology of defining objectives and setting tasks should be applied, for example SMART (Specific Measurable Achievable Realistic Timed) [11].

4. Description of Objective Tree Building

One of the main objectives of any commercial organization is to obtain and increase its profits. The difference between organizations is in the ways and methods of achieving this objective.

For stakeholders of the considered system the construction of an objective tree was performed with the use of interviewing process with owners of subsystems, and also with managers of the organization.

Based on the information obtained, the objective tree was created. A simplified version containing only high-level objectives of the organization can be observed in the figure below. In the simplified version, the stakeholders are developer, sales manager, customer. Below is an example that deserves attention, which was identified during the creation.

The analysis revealed a conflict of interest of some subsystem owners responsible for the development of their subsystems with the managers, whose work is the sale and implementation of the system. The conflict of interests of these stakeholders is the following: developers, as high level technical specialists, are interested in long-term support and consider the objectives of reliability improvement to be more important, while sales managers are interested in short-term creation of new functionality, in other words, here and now, in order to meet the needs of new clients as soon as possible.

A coordinated and detailed objective tree helps to identify priorities. Identifying priorities is usually the responsibility of the decision-maker.

The order of achievement of the objectives can influence the result, as variability determines not only the objectives to be achieved, but also the resources to be spent on these objectives. And, because stakeholders' reactions to the implementation, nonfulfillment or ignorance of their objectives will be different, it is obvious that the consequences of the decisions made may be different.

Based on the data that it is usually impossible to fulfill all the requirements of all the system's stakeholders [8, 12], the author of the paper really supposes a high dependence of the result on the chosen strategy of objective fulfillment.
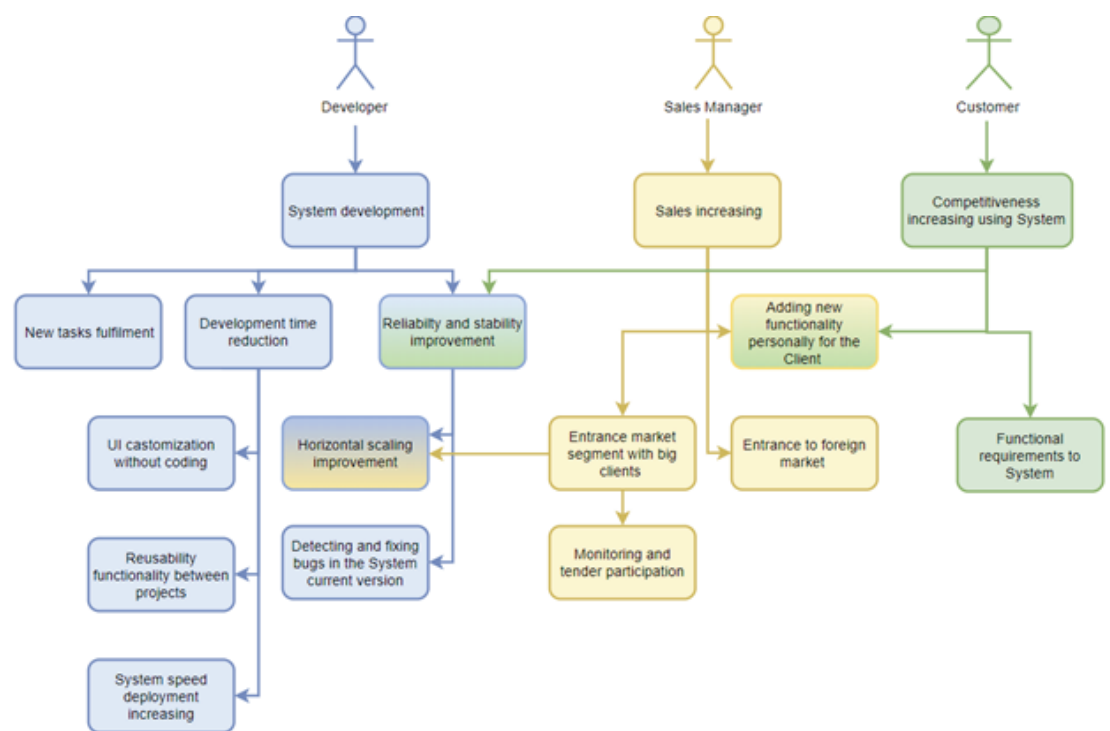

Figure 1: Simplified model of objective tree with stakeholders.

5. Explanation of the Move to the Considered Area

The above example is interesting not only because of the conflict of interest, but also because the two stakeholders, the owners of the subsystems responsible for the development of their subsystems and the managers whose job it is to sell and implement the system, have common interests. So, in the course of the research the author of the article revealed that not only developers, but also sales managers are interested in achieving and fulfilling such objective as improvement of horizontal scaling

of the system. Because the achievement of this objective for sales managers will lead to the possibility of fulfilling the objective " Entrance to the market segment with big clients", and for developers to increase the reliability and stability of the system. The customer is also interested in increasing the reliability of the system.

As improvement of horizontal scaling is one of the intersection areas of interests of two involved parties and, indirectly, the third one, we shall consider this objective in more detail.

The performance of functions is a criterion of success. The main function of the system is the scheduling of employees, which is executed in the module of scheduling. Therefore, in order to improve the quality of the whole system by improving the quality of the main function, we will consider this module.

6. Formalization of the Current Reality Tree

The current reality tree is a diagram showing the cause-effect relationships that exist between the root (key) problem and the majority of undesirable events (or all undesirable events) [13].

The general approach to building the current reality tree consists of several consecutive stages. The first stage reveals undesirable effects or phenomena that have a negative impact on one or more of the system's stakeholders. Afterwards, at the second stage, the upward branches of the tree are determined, i.e. the consequences of the undesirable phenomena or, otherwise, problems selected at the first stage. Finally, at the third stage, the downward branches of the tree are defined.

Specificity of modelling with the use of cause-effect relationships tool is largely determined by relative limits. Within the framework of the current reality tree model, this can be interpreted as a control over the growth of the number of elements and interrelations, as well as the use of abstractions, based on the purposes of modelling.

As a result, using the current reality tree, we can make a complete list of all problems, get a clear cause-effect relationship of all undesirable phenomena in the system, and identify root problems. Subsequently, by analyzing the obtained information, we can determine the influence of each of the elements and make decisions about those undesirable phenomena, which, from the point of view of the decision-maker, will have the greatest influence.

It is worth noting that, although the use of the current reality tree model allows us to identify the root problem, it does not mean the possibility and, accordingly, the need to solve it [the root problem].

7. Description of the Current Reality Tree Building

Scheduling is a single computer solution to a single task that requires 1 CPU resource and a relatively small amount of RAM. Tasks that need to be performed fall into the FIFO (first in first out) queue. The solution of such a task is based on the solution of systems with a large number of equations and inequalities with a large number of variables.

Model building was performed from two problems: the task is not executed, and the task is executed slowly.

As a result of modelling the current reality tree for the calculation module of the schedule, we have identified several root problems:

1. A large number of calculations that are in the queue for calculation. Perhaps, due to the appearance of a large number of tasks at once.

2. Service (calculation module) is not available. This means the situation when the system otherwise works normally, and only the calculations module is unavailable.

3. A large number of employees within the scope of one task.

4. No optimization of the calculation module operation. This means optimization at the program level.

5. High complexity of the real world. This means a large number of business rules, the implementation of which is mandatory when drawing up the schedule.

Further work related to the direct analysis and solution of any problems is beyond the scope of the current paper.

8. Conclusions and Plans

The created current reality tree allowed to reveal the list of root problems of the investigated system in the context of the specified subject area. The proof of this is the connection of the high level with stakeholders, which determines the success of the system, the low level (specification of requirements) with the implementation of the system itself, the internal decomposition and tracing of levels between them.

Further work may consist in creating a formalized list of problems and working on this list. The formalized problem, as the author believes, is the problem described by the following pattern:
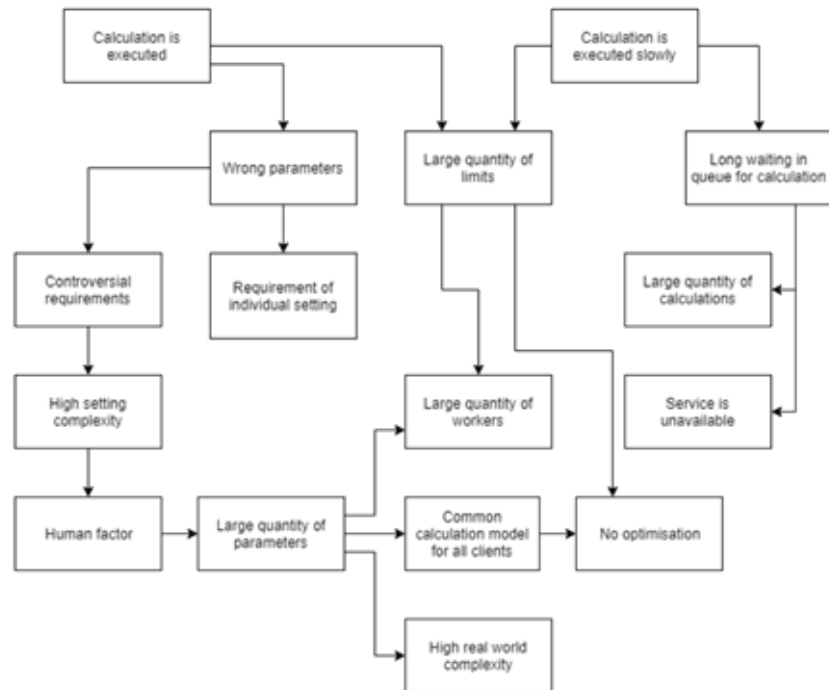
Figure 2: Model of current reality tree in module of scheduling.

The problem (of)	Problem description
Affects	Stakeholders
The impact (of which is)	Impact description
A successful solution (would)	Key benefits of the solution

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