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STRUCTURAL ANALYSIS AND OPTIMIZATION OF IDEF0 FUNCTIONAL BUSINESS PROCESS MODELS

Godlevskyi M. D. – Dr. Sc., Professor, Head of the department of Software Engineering and Management Information Technologies, National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine.

Orlovskyi D. L. – PhD, Associate professor, Associate professor of the department of Software Engineering and Management Information Technologies, National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine.

Kopp A. M. – Post-graduate student of the Department of Software Engineering and Management Information Technologies, National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine.

ABSTRACT

Context. A relevant problem of an approach development used to reduce system or random errors which occur during business process models design is solved. The object of the research includes graphical and mathematical models which describe business process structure.

Objective. Minimization of systematic or random errors based on the development of an approach to formation and analysis of a business process structure in IDEF0 notation.

Method. The approach to formation and analysis of a business processes structure in IDEF0 notation is proposed. Balancing coefficient, which was modified and augmented, considering weight coefficients of arcs of various types, is used for IDEF0 diagrams analysis. Cohesion types defined in the ISO/IEC/IEEE 2476 standard, which weight coefficients are calculated using their values normalization, are used to define values of arc weight coefficients.

Results. The approach to IDEF0 diagrams analysis, which allows defining structural changes of diagrams to satisfy balancing requirements, has been developed. Recommendations obtained as a result of IDEF0 diagrams analysis, which describe product purchase and software release processes, and also recommendations of DevOps concept and SCOR supply chain reference model have been used to transform the source diagrams according to the balancing requirements. Further research may consider using of expert judgments for making decisions on recommendations development.

Conclusions. The proposed approach can be used to support activities of collecting, storing, and sharing organizational knowledge allowing to analyze and improve business process models before they are added into an enterprise repository for future reuse to design new solutions. Next studies will consider various approaches to business process models representation in an enterprise repository, corresponding to Archimate, ARIS, and other notations.

KEYWORDS: business process, modeling, IDEF0 diagram, business process model analysis, balancing, cohesion.

ABBREVIATIONS

ARIS is an Architecture of Integrated Information Systems;

DFD is a Data Flow Diagram;

RUP is a Rational Unified Process;

SCOR is a Supply Chain Operations Reference.

NOMENCLATURE

A_i is a number of arcs related to the i-th block of IDEF0 diagram, $i=\overline{1,n}$;

B is an optimization criterion that represents balancing coefficient that considers weights of arcs of various types, as well as tunneled arcs usage;

D is a matrix of $n \times m$ size, which elements d_{ij} represent a number of arcs of the j-th type related to the i-th block of diagram, $i=\overline{1,n}$, $j=\overline{1,m}$;

ΔD is a matrix of $n \times m$ size, which elements Δd_{ij} represent changes within a number of arcs of the j-th type related to the i-th block of diagram, $i=\overline{1,n}$, $j=\overline{1,m}$;

$\Delta D_{\min}$ is a matrix of $n \times m$ size, which elements represent lower boundaries of elements of the matrix ΔD;

$\Delta D_{\max}$ is a matrix of $n \times m$ size, which elements represent upper boundaries of elements of the matrix ΔD;

K_b is a balancing coefficient;

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m is a number of arc types (input, output, control, mechanism, and call), $m = 5$;

n is a number of blocks on the IDEF0 diagram;

T is a matrix of $n \times (m-1)$ size, which elements t_{ij} represent a number of tunneled arcs of the j-th type related to the i-th block of diagram, $i = \overline{1,n}$, $j = \overline{1,m-1}$;

w_{ij} is a weight coefficient of the arc of j-th type, which is related to the i-th block of diagram, $w_{ij} \in [0,1]$, $i = \overline{1,n}$, $j = \overline{1,m}$;

λ is a tunneling coefficient, $\lambda \in [0,1]$;

μ_l is a weight coefficient of the l-th cohesion type, $l = \overline{0,6}$.

INTRODUCTION

Today process approach is extremely popular management approach. It assumes considering an organization as a set of business processes that produce value for customers. Business process might be described as a set of activities that takes one or several types of resources at the "input" and produce a product that is valuable for a customer at the "output" [1].

Graphical models of business processes were widely disseminated in the modern practice of organizational management. There were developed and successfully used various notations and modeling tools intended to create business process models. This paper considers the methodology of functional modeling and graphical notation IDEF0 [2]. It is focused on the development, analysis, reengineering, and integration of information systems as well as supported business processes. Business modeling is one of the core processes of the RUP software development methodology [3, 4].

Business process modeling, including usage of the IDEF0 notation, is a subjective activity that might cause random or systematic errors related to the analyst's individual perception, the lack of domain research, etc. At the same time, modeling tools provide only formal validation of developed diagrams especially by checking only the syntax compliance according to the certain modeling notation.

The object of study includes graphical and mathematical models that describe business process structure.

The subject of study is development of an approach to decrease a number of random or systematic errors occurred during business process modeling.

The purpose of the work is minimization of a number of systematic or random errors which are based on the development of an approach to formation and analysis of a business process structure in IDEF0 notation.

1 PROBLEM STATEMENT

The considered problem assumes business process models described using IDEF0 diagrams as the input data. IDEF0 shows logical relations between functional blocks (business processes, sub-processes, tasks) which are represented by arcs of five types: input, output, control, mechanism, and call (fig. 1). Particularly, the call arc illustrates relations between blocks (or even between parts of models) across different models and provides connection between models or different parts of the same model.

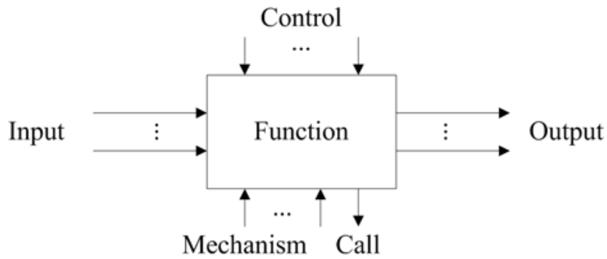

Figure 1 – Connection of arcs to blocks on IDEF0 diagrams

The earlier known balancing coefficient is used to analyze structure of IDEF0 diagrams [5, 6]:

$$K_b = \left| \frac{1}{n} \sum_{i=1}^{n} A_i - \max_{i=\overline{1,n}} \{A_i\} \right|.$$

However using of the balancing coefficient provides only common estimation of IDEF0 diagrams but does not allow analyzing their balancing in terms of various impacts (input, output, control, mechanism, and call) on diagram's blocks. This might be considered as the significant shortcoming of the approach.

Hence, it's important to develop criterion and restrictions that allow forming recommendations in order to design optimal structure of business process models using the IDEF0 notation.

2 REVIEW OF THE LITERATURE

Besides graphical business process models widely used in the modern practice of the organizational management, the well-known and powerful analytical tool has existed for a long time. Petri nets are used in the area of discrete systems research. Since business processes belong to this class of systems, it is possible to analyze those using Petri nets [7].

In order to apply modeling features of Petri nets, business process models should be trans-formed into the corresponding nets [8]. Earlier Petri nets were used to analyze business process models in the IDEF0 notation [9]. But analysis of business process models in the IDEF0 notation requires transformation of these models into Petri nets which causes difficulties related to the various types of IDEF0 diagrams arcs related to the diagrams blocks according to the certain rules (fig. 1).

Proper design of IDEF0 diagrams requires achieving the value of balancing coefficient which is close to 0 and decreasing when the decomposition level is increasing [5]. IDEF0 diagrams should be balanced which means that situations when numbers of arcs connected to various blocks are significantly different are not allowed [6]. These situations usually indicate errors related to the design and execution of business process [5].

Thus, balancing analysis of IDEF0 diagram should consider cohesion types of functional blocks [10, 11]. The

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cohesion types defined in the ISO/IEC/IEEE 2476 standard (table 1) are used to analyze IDEF0 diagrams and data flow diagrams DFD for the functional and data cohesion respectively [10]. Earlier the balancing coefficient that considers various cohesion types was used to analyze data flow diagrams [12].

Hierarchical relations within the units of business system called "silos" are typical for the functional management approach. Such functional areas cause isolation of processes and, therefore, resources involved in the process executions [13]. Cohesion types with levels 4–6 are the most important to obtain diagrams of good quality (table 1). Developers should achieve a maximum number of relations of these types [10, 11]. Cohesion types with levels 0-3 indicate that relations between blocks are weak or do not exist at all (table 1) [11]. In this case direct relations between organizational units (departments, manufactories, branches, etc.) almost do not exist which means that "silos" exist in an organization. These shortcomings might be eliminated by implementing process management features that assumes creation of the direct relations between business processes [13].

IDEF0 notation assumes domain modeling as the hierarchical system of diagrams. This hierarchy could be obtained as the result of decomposition of the functional block and, therefore, the so called child diagram is obtained. In case when several arcs don't need to be considered on the parent and/or child diagram, IDEF0 diagram feature called tunneling might be used [2]. There might be situations when some interface arcs do not need to be considered in child diagrams lower or upper than certain decomposition level within a hierarchy. On the other hand, it might be necessary to hide detailing of some "conceptual" interface arcs below certain threshold. The arrow marked as the tunnel near the block means that data associated with this arc are not necessary to be considered on the next level of decomposition. The arrow marked as the tunnel near the borderline means that data associated with this arc does not exist on the parent diagram (fig. 2) [14].

Arcs I2 and C2 of the parent diagram A1 do not exist on the child diagram A12. An output O2 of the child diagram A12 is not related to the parent block and does not exist on the diagram A1 (fig. 2). Analysis of IDEF0 diagrams requires considering various types of impacts on the diagram blocks, as well as considering presence of the tunneled arcs.

Table 1 – Cohesion types of IDEF0 diagrams blocks

Cohesion type	Level, l	Description
Coincidental	0	Blocks aren't related at all
Logical	1	Blocks of diagrams of various decomposition levels
Temporal	2	Blocks of diagrams of the same decomposition level
Procedural	3	Blocks of the same diagram
Communicational	4	Blocks have common inputs, outputs or mechanisms
Sequential	5	Output of the preceding block is the input of the subsequent
Functional	6	Output of the preceding block is the control of the subsequent

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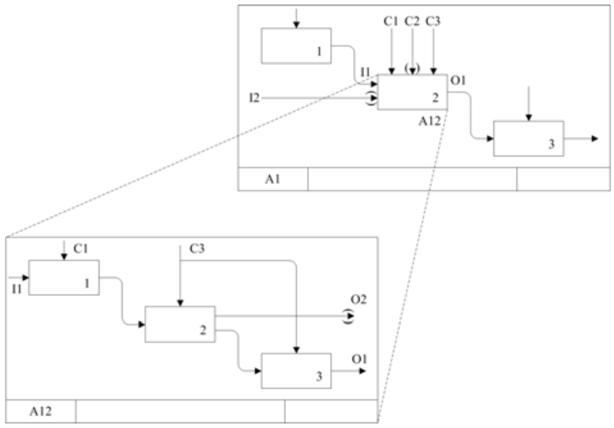

Figure 2 – Example of tunnel arcs on IDEF0 diagrams

As the result of the literature review we summarized that existing formal approaches [5, 6–9] does not provide solutions of the considered problem. Therefore, this study should be focused on the development of the approach to formation and analysis of a business process structure in IDEF0 notation.

3 MATERIALS AND METHODS

Some diagrams might not fit the recommendation of the minimum value achievement of balancing coefficient because of features of business processes these diagrams describe (e.g., manufacturing process consumes a lot of components and produces one product) [5]. The weight coefficient of arcs related to the diagram blocks should be considered in order to resolve this problem. This allows considering roles of each arc within the described business process execution.

The weight coefficients of arcs w_{ij} are proposed to be defined using cohesion types (tab. 1). The weights of cohesion types μ_l should be calculated using normalization of their levels that in-crease from the coincidental (0) to functional type (1) according to the ISO/IEC/IEEE 24765 standard [10]:

$$\mu_l = \frac{l}{\max\limits_{l=0,6}\{l\}},\ l = \overline{0,6}.$$

Hence, the weight coefficients of arcs w_{ij} of the IDEF0 diagram will take various values μ_l according to the chosen cohesion type (tab. 1). This study does not consider problems related to selection and explanation of expert judgment methods (e.g., Saaty's pairwise comparison) used to de-fine weights of cohesion types. This might be a subject of future research.

The integer matrix D represents the number of arcs of various types, which are related to the IDEF0 diagram blocks. The matrix ΔD represents structural changes that allow obtaining the IDEF0 diagram suitable for balancing requirements. The elements Δd_{ij} of this matrix are also integer values. The upper and lower boundaries of values that represent changes within numbers of arcs of various types, which related to the IDEF0 diagram blocks, are represented using matrices $\Delta D_{\min}$ and $\Delta D_{\max}$. Moreover, there are restrictions that each IDEF0 diagram block might be connected to at least one arc of each type except call.

The following optimization problem allows obtaining required structural changes ΔD that will provide the minimum value of balancing coefficient:

$$B = \left| \frac{1}{n} \cdot \sum_{i=1}^{n} \sum_{j=1}^{m-1} w_{ij} \cdot \left(d_{ij} + \Delta d_{ij} - \lambda \cdot t_{ij} \right) + \right.$$

$$+ w_{im} \cdot \left(d_{im} + \Delta d_{im} \right) -$$

$$- \max_{i=1,n} \left\{ \sum_{j=1}^{m-1} w_{ij} \cdot \left(d_{ij} + \Delta d_{ij} - \lambda \cdot t_{ij} \right) + \right.$$

$$\left. \left. + w_{im} \cdot \left(d_{im} + \Delta d_{im} \right) \right\} \right| \to \min_{\{\Delta d_{ij}\}},$$

$$d_{ij} + \Delta d_{ij} > 0, \; i = \overline{1,n}, \; j = \overline{1,m},$$

$$\Delta D_{\min} \le \Delta D \le \Delta D_{\max}.$$

The optimization criterion B represents the balancing coefficient that considers weight coefficients of arcs of various types, which are related to the IDEF0 diagram blocks, as well as possibility of tunneled arcs usage.

The tunneling coefficient λ might be defined using the following equation:

$$\lambda = 1 - \frac{\sum_{i=1}^{n} \sum_{j=1}^{m-1} t_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{m-1} \left(d_{ij} + \Delta d_{ij} \right)}.$$

The value $\lambda = 1$ indicates that the IDEF0 diagram does not contain tunneled arcs, while value $\lambda = 0$ indicates that the IDEF0 diagram contains only tunneled arcs.

4 EXPERIMENTS

IDEF0 notation might be used for business process modeling in various areas. Further design and analysis of IDEF0 diagrams is outlined as an example. The example includes a sample pair of business processes related to the software release and product purchase respectively.

The following IDEF0 diagram (fig. 3) describes business processes of the software release.

The number of blocks on this diagram is $n^1 = 5$. The matrix of the numbers of arcs related to the IDEF0 diagram blocks as well as restrictions matrices are following:

$$D^1 = \begin{pmatrix} 2 & 1 & 1 & 3 & 0 \\ 4 & 1 & 2 & 1 & 0 \\ 2 & 2 & 2 & 1 & 0 \\ 1 & 2 & 2 & 1 & 0 \\ 2 & 2 & 2 & 1 & 0 \end{pmatrix}, \Delta D^1_{\min} = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \end{pmatrix},$$

$$\Delta D^1_{\max} = \begin{pmatrix} 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 1 & 1 & 0 \end{pmatrix}.$$

Since the IDEF0 diagram (fig. 3) does not contain tunneled arcs, matrix of tunneled arcs T^1 is zero-matrix.

The next considered IDEF0 diagram describes product purchase processes (fig. 4).

The number of blocks on this diagram is $n^2 = 4$. The matrix of the numbers of arcs related to the IDEF0 diagram blocks, as well as restrictions matrices, and matrix of the number of tunneled arcs are following:

$$D^2 = \begin{pmatrix} 4 & 1 & 1 & 2 & 1 \\ 1 & 2 & 1 & 2 & 1 \\ 1 & 2 & 1 & 2 & 0 \\ 1 & 2 & 1 & 2 & 0 \end{pmatrix}, \Delta D^2_{\min} = \begin{pmatrix} -1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix},$$

$$\Delta D^2_{\max} = \begin{pmatrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \end{pmatrix}, T^2 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}.$$

5 RESULTS

Calculated for the considered IDEF0 diagrams values $K_b^1 = 1$ and $K_b^2 = 2$ do not correspond to balancing requirements. It is necessary to define structural changes that will provide minimum values of the balancing coefficient K_b and optimization criterion B based on the solution of proposed optimization problem.

The weights μ_l that were calculated using the cohesion types levels (tab. 1) [10] are shown in table 2.

Table 2 – Weights of cohesion types

l	0	1	2	3	4	5	6
μ_l	0	0,17	0,33	0,5	0,67	0,83	1

The weight coefficients of arcs w_{ij}^1, w_{ij}^2 related to blocks of the considered IDEF0 diagrams were selected from the set of the obtained weights μ_l based on the considered cohesion types (tab. 1):

1) input and output arcs correspond to the sequential cohesion (they connect output of the preceding block with the input of the subsequent):

$$w_{i1}^1 = w_{i2}^1 = \mu_5 = 0{,}83, \; i = \overline{1,n^1},$$

$$w_{j1}^2 = w_{j2}^2 = \mu_5 = 0{,}83, \; j = \overline{1,n^2};$$

2) control arcs correspond to the procedural cohesion (they impact on the blocks of the same diagram):

$$w_{i3}^1 = \mu_3 = 0{,}5, \; i = \overline{1,n^1}, \; w_{j3}^2 = \mu_3 = 0{,}5, \; j = \overline{1,n^2};$$

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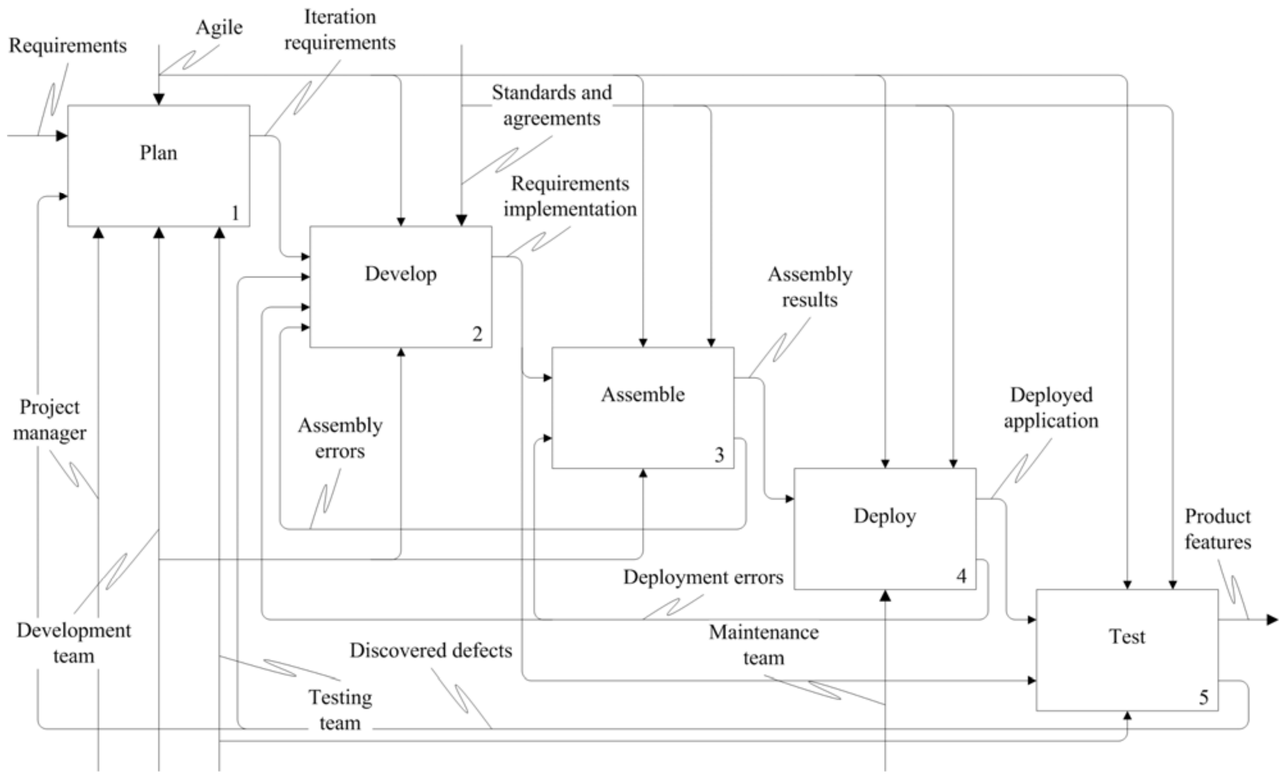

Figure 3 – Original diagram that describes software release processes

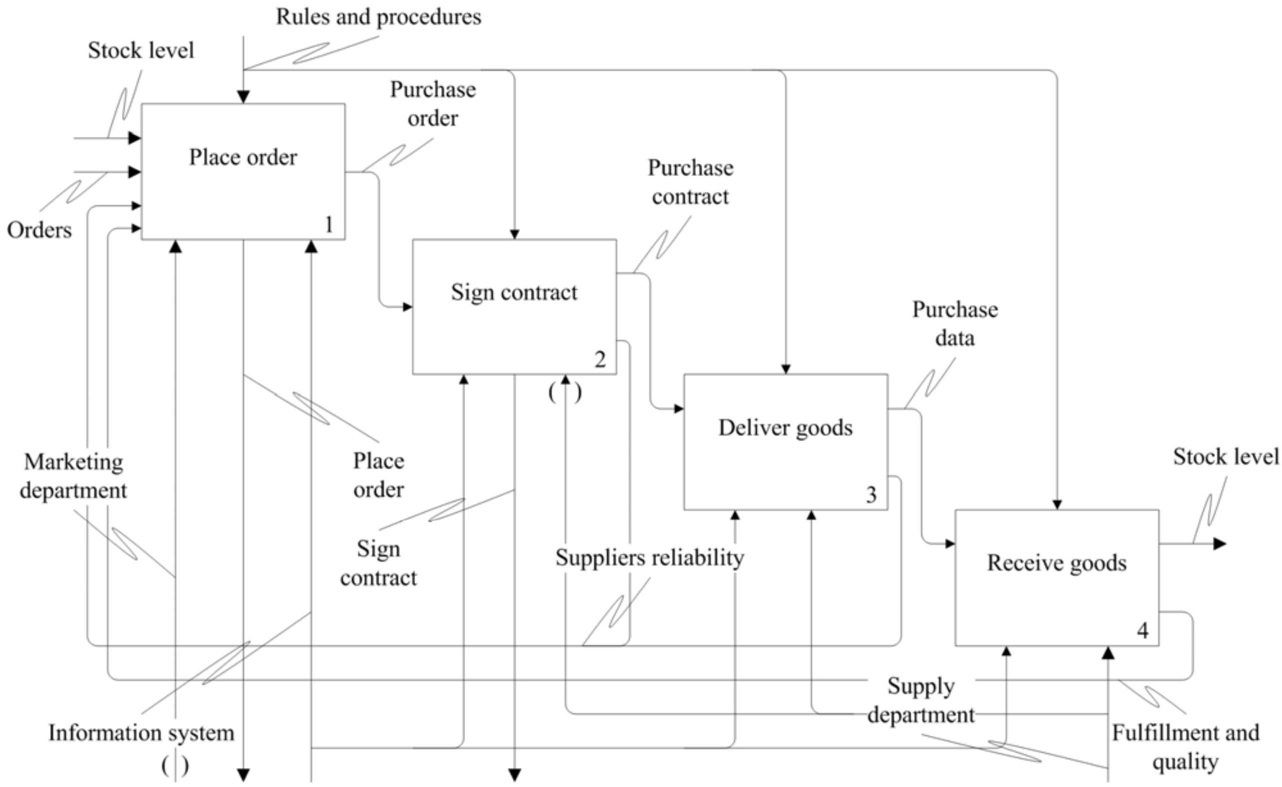

Figure 4 – Original diagram that describes product purchase processes

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3) mechanism arcs correspond to the communicational cohesion (they are common for the blocks):

$$w_{i4}^1 = \mu_4 = 0{,}67 \,,\; i = \overline{1, n^1} \,,\; w_{j4}^2 = \mu_4 = 0{,}67 \,,\; j = \overline{1, n^2} \;;$$

4) call arcs correspond to the logical cohesion (they are related to the blocks of different model):

$$w_{j5}^2 = \mu_1 = 0{,}17 \,,\; j = \overline{1, n^2} \;.$$

As the result of optimization problem solution, the following values of balancing coefficients of the considered IDEF0 diagrams were obtained (tabl. 3).

Table 3 – Balancing coefficients values

Coefficient	Description	Diagram 1	Diagram 2
Balancing coefficient K_b	Before transformation	1	2
	After transformation	0	0,5
Optimization criterion B	Before transformation	0,83	1,03
	After transformation	0,17	0,15

Calculations were performed using Microsoft Excel tool "Solver". Since a number of blocks on the diagrams according to the IDEF0 standard might be from 3 to 6, the size of proposed optimization problem allows performing calculations using Microsoft Excel.

The matrix of structural changes and the matrix of numbers of arcs connected to the blocks of IDEF0 diagram that describes software release processes are the following:

$$\Delta D^1 = \begin{pmatrix} 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 1 & 1 & 0 \end{pmatrix}, D^1 + \Delta D^1 = \begin{pmatrix} 2 & 1 & 2 & 4 & 0 \\ 4 & 1 & 3 & 1 & 0 \\ 2 & 2 & 3 & 2 & 0 \\ 1 & 2 & 3 & 3 & 0 \\ 2 & 2 & 3 & 2 & 0 \end{pmatrix}.$$

The matrix of structural changes and matrix of numbers of arcs connected to the blocks of IDEF0 diagram that describes product purchase processes are the following:

$$\Delta D^2 = \begin{pmatrix} -1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 \end{pmatrix}, D^2 + \Delta D^2 = \begin{pmatrix} 3 & 1 & 2 & 2 & 1 \\ 1 & 2 & 3 & 2 & 1 \\ 1 & 2 & 3 & 2 & 0 \\ 1 & 2 & 3 & 2 & 0 \end{pmatrix}.$$

6 DISCUSSION

The DevOps concept allows development, testing, and maintenance units to implement cur-rent business requirements of the continuous software release by organizing interaction of these groups [15]. The implementation of the process management features according to the DevOps concept and obtained recommendations related to the structural changes ΔD^1 allowed obtaining the following IDEF0 diagram (fig. 5).

For example, the original IDEF0 diagram (fig. 3) contains planning, development, and assembly processes that were related to the deployment process only because they were executed during the same software release iteration which corresponds to the procedural cohesion. Now the transformed diagram (fig. 5) contains these processes related because they are executed by the same resources (DevOps team) which corresponds to the communicational cohesion. This improvement eliminates functional areas called "silos" that are typical for the functional management approach.

The obtained recommendations related to the structural changes ΔD^2, as well as the recommendations of the supply-chain reference model SCOR (processes, best practices, metrics, etc.) allowed obtaining the following IDEF0 diagram (fig. 6) [16].

The sample calculations required to check the validity of the proposed approach were per-formed for the IDEF0 diagrams that describe business processes of various domains – software release and product purchase. The considered IDEF0 diagrams were developed using the trial-version of Erwin Process Modeler.

Unlike the reviewed formal approaches [5, 6-9], the proposed approach allows analyzing balancing of IDEF0 diagrams in terms of various types of impacts and presence of tunneled arcs as well as defining structural changes that provide IDEF0 diagrams suitable for the balancing requirements [10, 11].

The shortcomings of the proposed approach are complexity of the considered optimization problem at big size (for hierarchical system of diagrams) and high requirements for business analyst's skills (deep knowledge of the IDEF0 methodology).

CONCLUSIONS

In this paper we proposed an approach to formation and analysis of a business process structure in IDEF0 notation.

The scientific novelty of the obtained results is that the earlier known approach based on the use of the balancing coefficient of IDEF0 diagrams was modified and augmented with considering the weights coefficients of arcs of various types. In order to calculate the values of these coefficients the cohesion types defined in the ISO/IEC/IEEE 24765 standard are used. The weights of these types are calculated using normalization of theirs levels. The approach to analysis of IDEF0 diagrams allows defining structural changes in which diagrams will fulfill balancing requirements.

The practical significance of the achieved outcomes is that the recommendations obtained as the result of analysis of IDEF0 diagrams, which describe product purchase and software release processes, as well as the recommendations of the DevOps concept and supply-chain operations reference model SCOR, allowed transforming original IDEF0 diagrams according to the balancing requirements.

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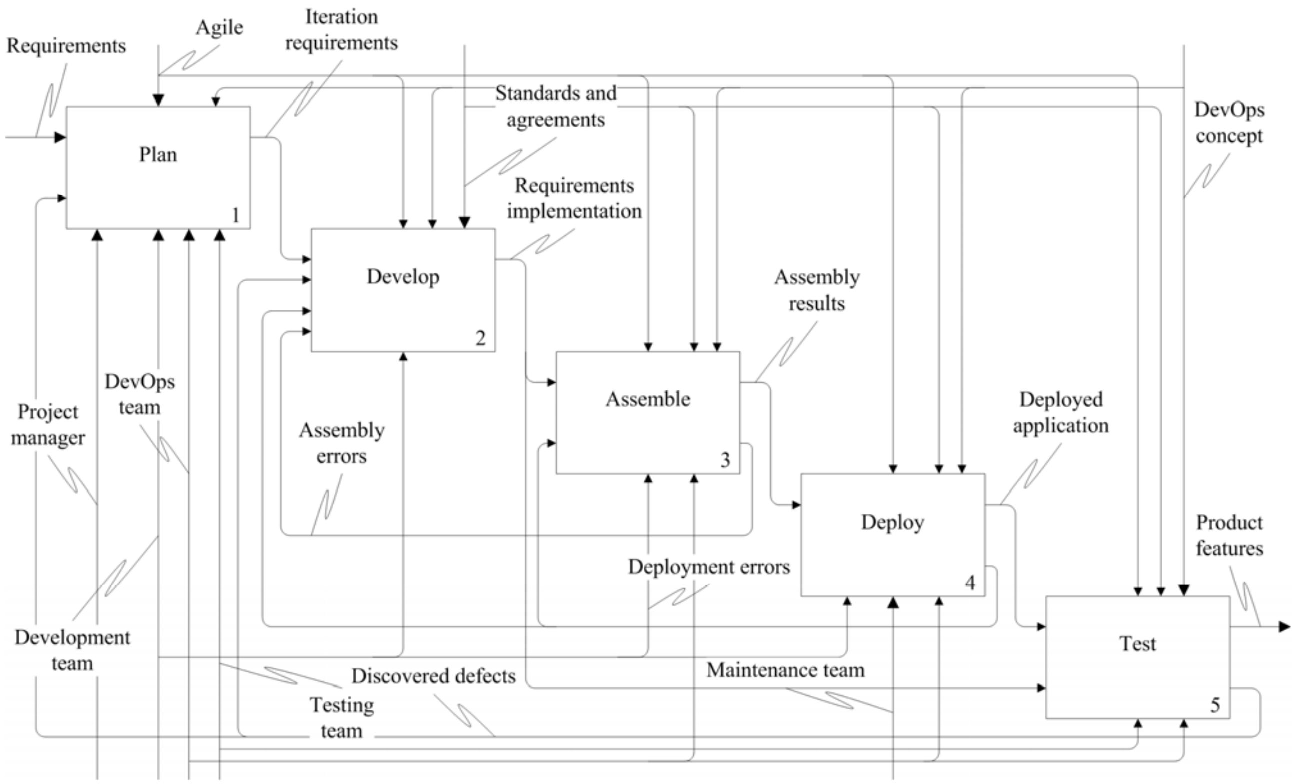

Figure 5 – Transformed diagram that describes software release processes

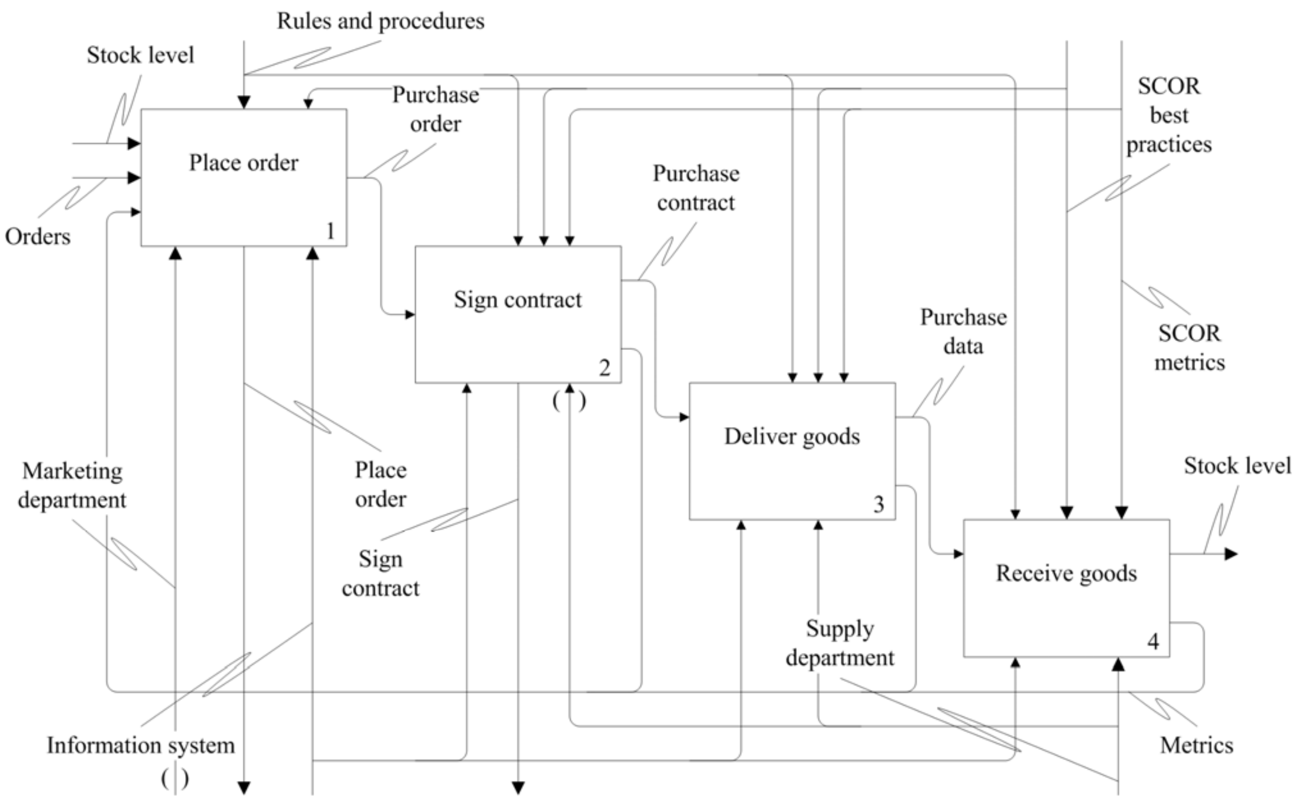

Figure 6 – Transformed diagram that describes product purchase processes

The proposed approach might be used to support activities related to storing and sharing of the organizational knowledge by supporting analysis and enhancement of business process models before they are stored into the enterprise repository for their future reusing to create new solutions.

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Prospects for further research include considering the use of expert judgments related to the selection and explanation of the cohesion types scale, as well as to definition of arcs weight coefficients for making decisions on recommendations development. Various approaches to presentation of business process models within the enterprise repository using Archimate, ARIS, and other notations will be also considered in future work.

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СТРУКТУРНИЙ АНАЛІЗ ТА ОПТИМІЗАЦІЯ ФУНКЦІОНАЛЬНИХ IDEF0-МОДЕЛЕЙ БІЗНЕС-ПРОЦЕСІВ

Годлевський М. Д. – д-р техн. наук, професор, завідувач кафедри програмної інженерії та інформаційних технологій управління Національного технічного університету «Харківський політехнічний інститут», Харків, Україна.

Орловський Д. Л. – канд. техн. наук, доцент, доцент кафедри програмної інженерії та інформаційних технологій управління Національного технічного університету «Харківський політехнічний інститут», Харків, Україна.

Копп А. М. – аспірант кафедри програмної інженерії та інформаційних технологій управління Національного технічного університету «Харківський політехнічний інститут», Харків, Україна.

АНОТАЦІЯ

Актуальність. Вирішено актуальну задачу розробки методу, який дозволяє знизити кількість системних або випадкових помилок, що виникають під час побудови моделей бізнес-процесів. Об'єктом дослідження є графічні та математичні моделі, які відображають структуру бізнес-процесів. Мета роботи – мінімізація системних або випадкових помилок на основі розробки методу формування та аналізу структури бізнес-процесів в нотації IDEF0.

Метод. Запропоновано метод формування та аналізу структури бізнес-процесів в нотації IDEF0. Для аналізу діаграм IDEF0 використовується коефіцієнт збалансованості, який було модифіковано та доповнено з урахуванням вагових коефіцієнтів дуг різних видів. Для визначення значень даних коефіцієнтів використовуються типи зв'язності, визначені у стандарті ISO/IEC/IEEE 24765, вагові коефіцієнти яких розраховуються за допомогою нормування їх значущості.

Результати. Розроблено метод аналізу діаграм IDEF0, який дозволяє визначати структурні зміни, за яких діаграми будуть задовольняти вимогам збалансованості та функціональної зв'язності. Рекомендації, отримані в результаті аналізу діаграм IDEF0, що описують процеси закупки продукції та випуску ПЗ, а також рекомендації концепції DevOps та референтної моделі операцій у ланцюгах поставок SCOR, дозволили перетворити вихідні діаграми відповідно до вимог збалансованості. У подальшому при прийнятті рішень про виробітку рекомендацій можуть бути використані експертні судження.

Висновки. Запропонований метод може бути використаний для підтримки діяльності по накопиченню та розповсюдженню організаційних знань, дозволяючи аналізувати та вдосконалювати моделі бізнес-процесів, перш ніж вони будуть додані до корпоративного репозиторію для їх повторного використання при створенні нових рішень. У подальшому будуть розглянуті різні способи представлення моделей бізнес-процесів у корпоративному репозиторії, що відповідають нотаціям Archimate, ARIS та ін.

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КЛЮЧОВІ СЛОВА: бізнес-процес, моделювання, діаграма IDEF0, аналіз моделі бізнес-процесів, збалансованість, зв'язність.

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СТРУКТУРНЫЙ АНАЛИЗ И ОПТИМИЗАЦИЯ ФУНКЦИОНАЛЬНЫХ IDEF0-МОДЕЛЕЙ БИЗНЕС-ПРОЦЕССОВ

Годлевский М. Д. – д-р техн. наук, профессор, заведующий кафедрой программной инженерии и информационных технологий управления Национального технического университета «Харьковский политехнический институт», Харьков, Украина.

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Копп А. М. – аспирант кафедры программной инженерии и информационных технологий управления Национального технического университета «Харьковский политехнический институт», Харьков, Украина.

АННОТАЦИЯ

Актуальность. Решена актуальная задача разработки метода, позволяющего снизить количество системных или случайных ошибок, возникающих при построении моделей бизнес-процессов. Объектом исследования являются графические и математические модели, отображающие структуру бизнес-процессов. Цель работы – минимизация системных или случайных ошибок на основе разработки метода формирования и анализа структуры бизнес-процессов в нотации IDEF0.

Метод. Предложен метод формирования и анализа структуры бизнес-процессов в нотации IDEF0. Для анализа диаграмм IDEF0 используется коэффициент сбалансированности, который был модифицирован и дополнен с учетом весовых коэффициентов дуг различных видов. Для определения значений данных коэффициентов используются типы связности, определенные в стандарте ISO/IEC/IEEE 24765, весовые коэффициенты которых рассчитываются путем нормировки их значимости.

Результаты. Разработан метод анализа диаграмм IDEF0, позволяющий определять структурные изменения, при которых диаграммы будут удовлетворять требованиям сбалансированности. Рекомендации, полученные в результате анализа диаграмм IDEF0, описывающих процессы закупки продукции и выпуска ПО, а также рекомендации концепции DevOps и референтной модели операций в цепях поставок SCOR, позволили преобразовать исходные диаграммы в соответствии с требованиями сбалансированности. В дальнейшем при принятии решений о выработке рекомендаций могут быть использованы экспертные суждения.

Выводы. Предложенный метод может быть использован для поддержки деятельности по накоплению и распространению организационных знаний, позволяя анализировать и совершенствовать модели бизнес-процессов, прежде чем они будут добавлены в корпоративный репозиторий для их повторного использования при создании новых решений. В дальнейшем будут рассмотрены различные способы представления моделей бизнес-процессов в корпоративном репозитории, соответствующие нотациям Archimate, ARIS и др.

КЛЮЧЕВЫЕ СЛОВА: бизнес-процесс, моделирование, диаграмма IDEF0, анализ модели бизнес-процессов, сбалансированность, связность.

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