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AN APPROACH AND TOOLS FOR BUSINESS PROCESS MAPPING DIAGRAMS ANALYSIS

***A.M. KOPP*[1*]*, D.L. ORLOVSKYI*[2]

[1] *postgraduate student of SEMIT Department, NTU «KhPI», Kharkiv, UKRAINE*
[2] *associate professor of SEMIT Department, PhD, NTU «KhPI», Kharkiv, UKRAINE*
[*]*email: kopp93@gmail.com*

Business process mapping is an approach to documenting of organizational activities, and how inputs and outputs flow through a business system. At the same time, business process modeling provides a visual way to represent process maps created by organizations. Business process maps are also called diagrams and use defined symbols depending on used modeling notation. Data flow diagrams (DFD) are one of techniques used for mapping of organization's business processes and their interaction. Business process maps, including DFD diagrams, are used for collecting, storing and sharing knowledge about organizational activities. However, business process mapping is a subjective activity, which may cause accidental or systematic errors related to a business analyst competence, lack of detailed domain description etc. Hence, the problem of business process diagrams analysis, including data flow diagrams, becomes relevant and should be considered in further researches [1].

The goal of the research was to develop an approach to DFD diagrams analysis and enhancement, which allows defining DFD diagram shortcomings and provide recommendations for a further diagram enhancement. Since DFD diagrams represent a system as a network of related activities, we've proposed to use the link analysis in order to evaluate relationships (data flows in DFD notation) among network nodes (elements in DFD notation – external entities, data storages and processes) [1, 2].

Hence, the matrix of interaction among DFD diagram elements may be defined in a following manner [1]:

$$X = \begin{bmatrix} X^{1}_{m,m} & X^{2}_{m,r} & X^{3}_{m,n} \\ X^{4}_{r,m} & X^{5}_{r,r} & X^{6}_{r,n} \\ X^{7}_{n,m} & X^{8}_{n,r} & X^{9}_{n,n} \end{bmatrix} = \left(x_{ij}\right) \in \mathrm{R}^{g \times g},$$

where x_{ij} – a number of data flows, connecting i-th and j-th elements; m – a number of external entities; r – a number of data storages; n – a number of processes; g – a total number of data flow diagram elements, $g = n + m + r$.

Since the DFD notation considers elements of different domains (external entities, data storages and processes), we've proposed a modified network centrality coefficient, which may be calculated using the following equation [1]:

$$C''_D = \frac{\sum_{i=1}^{g}\left[w_i \cdot \left(\max_{j \in 1,g} \left\{ C_D(v_i) \right\} - C_D(v_i) \right) \right]}{(g-1)\cdot(g-2)},$$

where $C_D(v_i)$ – a centrality coefficient of a DFD diagram's element v_i defined as an out degree of the corresponding node; w_i – a weight coefficient, which represents a type of the DFD diagram's element v_i, defined using connectivity types according to the ISO/IEC/IEEE 24765 standard.

The larger centrality coefficient is the more likely is it, that a single key element affects the remaining elements of business system described using DFD diagram. Thus, any changes on this key element could affect the remaining elements or even a whole business system. According to the DFD notation, uneven distribution of data flows may indicate process "bottlenecks" and errors related to validation rules violations such as "spontaneous generations", "black holes" and "gray holes" [1].

The following equation may be used to compare centrality coefficients among various diagram elements and get insights on uneven distribution of data flows [1]:

$$C'_D(v_i) = \frac{\deg^+(v_i)}{g-1} = \frac{\sum_{j=1}^{g} x_{ij}}{g-1}.$$

According to the described approach, tools used to support data flow diagrams analysis process (fig. 1) under the business process management (BPM) system Bizagi have been developed. These tools include the following process automated using Bizagi, web application integrated with the Bizagi database, and Bizagi widget used to interact with the web application and display analysis results [2].

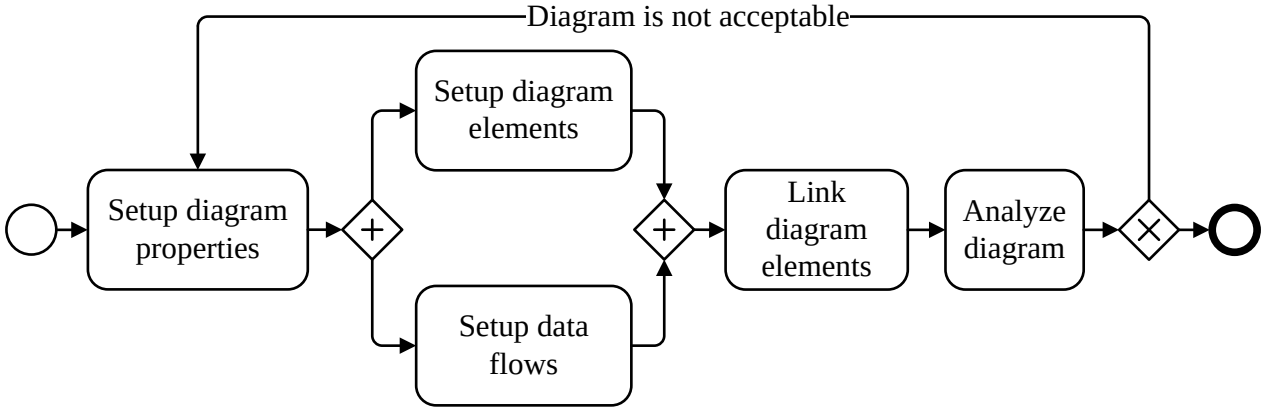

Fig. 1 – The DFD diagram analysis process modeled using Bizagi BPM system

Proposed approach and tools allow to extending BPM system Bizagi features in order to perform the analysis and enhancement of DFD diagrams, which represent knowledge about organizational activities. Using of BPM system allows avoiding issues related to interaction with legacy systems [2]. Future research will be focused on another business process mapping techniques such as IDEF0, BPMN (Business Process Model and Notation) and EPC (Event-driven Process Chain).

References:

1. *Kopp, A.* Разработка подхода к анализу и оптимизации диаграмм потоков данных / *A. Kopp, D. Orlovskyi* // ScienceRise. – 2017. – Vol. 7 – P. 33 – 42.

2. *Kopp, A.* Розробка інструментальних засобів для підтримки процесу аналізу діаграм потоків даних / *A. Kopp, D. Orlovskyi* // ScienceRise. – 2017. – Vol. 12 – P. 48 – 53.