RESEARCH ON RULES-BASED BUSINESS PROCESS MODELLING AND SIMULATION

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Abstract. Googling the term "Business Process Simulation" in April 2013 yielded only 42.1 thousand hits. It is not much compared with googling the term such as "Business Process Modelling" in the same time, which yielded approx. 1.470 million hits. That is 35 times more compared to the previous search. The difference between modelling and simulation is arguable. In fact, the terms 'simulation' and 'modelling' are often used synonymously, but the authors prefer to distinguish between the terms and look at modelling as an act of building a model while simulation is considered an act or even a process of using that model for a specific purpose or study. If simulation is a manipulation process of one or more variables, which can be changed and observed, then this kind of process is best managed and controlled by business rules that can also be manipulated in the simulation process.

Keywords: business process modelling, business process simulation, business rules.

Introduction

These days, most organisations focus on business processes – the key for improvement of business. Whenever an organisation engages in modelling of business processes, different questions arise, such as exiting processes, the start and the end of a process, the level of detail of a process, etc. (Dijkman *et al.* 2011). Modelling real world business processes is not easy. It is necessary to choose the right and effective architecture of business process modelling, which is one of the keys to success in creating a model. In the view of the authors, a finished business process model, which represents business processes of a real organisation, can change with a changing business environment. For this reason, the model constantly needs to be rechecked and updated. It is an ongoing process, which depending on the model and changes it requires is quite a costly and painful path. That is why the authors suggest implementing business rules in business processes to control the business environment. In the research conducted by the authors, this way is suggested for simplification of this problem. Furthermore, integration of business rules into business processes makes the organisation more flexible and more effective.

The authors regard business process modelling and business process simulation as two distinct terms, but focus more on the field of business process simulation. The difference between modelling and simulation is arguable as these terms are often used synonymously. According to the authors, modelling is an act of building a model while simulation is an act or even a process of using that model for a specific purpose or study. Annual scientific conferences, books, scientific papers in the field of business process simulation and business rules confirm the importance of this research field. In fact, T. Debevoise (2007) and M. Dumas *et al.* (2005) stated that business processes and business rules modelling, simulation and implementation measures are considered to be one of the most effective ways to increase the efficiency of business processes and productivity. This is of utmost importance to many modern organisations.

To make an even greater distinction between simulation and modelling, a business process simulation can be regarded as a process of manipulation involving one or more variables, which can be changed and observed. The authors do not consider a business model with different variables as a different variant of a business process. Simulation of a business process can eventually set variables to values that can never exist in a real world model, which explains why it cannot be another variant of that business model. Furthermore, there can be an agreement that business rules should be used or those variables to change. For a long

time, business rules and business process simulation were developed separately. Due to these circumstances, it is not yet obvious how business rules should be integrated into business process simulation. There are some tools that integrate business rules into business process simulation and they all have their advantages. Nevertheless, integration of business rules into business process simulation is a good subject for further research.

The paper focuses on the research field and perspectives of rule-based business process modelling and simulation.

The aim of this paper is to present rule-based business process modelling and simulation as two distinct terms that can complement each other for better efficiency.

The following are objectives of the paper aimed at achieving the aforementioned result:

1. Analyse the existing concepts of business processes and business rules.
2. Analyse the current mostly used business process modelling notations.
3. Evaluate the capabilities of integrated business rules into business process simulation.

The remainder of this paper is structured as follows: Section 2 presents a precise description of a possible business process definition; Section 3 presents and compares business process modelling languages, as identified through the literature study; Section 4 presents the evaluation of the use and usefulness of business rules integration into business process simulation; and Section 5 concludes this paper.

Business process definition

To improve the understanding of processes and to enable their analysis, business processes are represented by models. T. Davenport (1993) defines a business process as "a structured, measured set of activities designed to produce a specific output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to a product focus's emphasis on what. A process is thus a specific ordering of work activities across time and space, with a beginning and an end, and clearly defined inputs and outputs: a structure for action. Taking a process approach implies adopting the customer's point of view. Processes are the structure by which an organization does what is necessary to produce value for its customers".

This definition suggests that a business process has to have resources, input and output, a clearly defined scope, activities, time and space and one or more effectors. The definition offered by M. Hammer and J. Champy (1994)

can be presumed as a subset of Davenport's business process definition: "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer". This definition clearly suggests that a business process is nothing more than a mere transformation of activities.

G. Rummler and A. Brache (1995) define a business process with the focus on external customers of an organisation: "a business process is a series of steps designed to produce a product or service. Most processes are cross-functional, spanning the 'white-space' between the boxes on the organization chart. Some processes result in a product or service that is received by an organization's external customer. We call these primary processes. Other processes produce products that are invisible to the external customer but essential to the effective management of the business. We call these support processes". This definition distinguishes between two types of processes: primary and support processes, depending on whether a business process is internal or external. If it is internal, it is a support process. If it is external for a customer, then it is the primary process. Business process modelling is decisive when it comes to design of how organisations provide products and services to customers or how they organise internal operational processes. However, creativity plays a big role in creation of business processes.

Fig. 1 indicates that a business process has to have an input and an output. A business process can be automated, semi-automated and non-automated. Nonetheless, a business process has to be called by an event. The kind of event is irrelevant as any of them can be simulated in all circumstances. Every business process must have a goal, if it does not have one. It is especially important once a real world modeller considers the existence of a business process in an organisation. In reality, a business process can be made of smaller business processes, but it still needs to have all the features and structure of a business process as indicated in Fig. 1. To conclude on the definition of business processes, more definitions are available from different authors; however, most of them cite these original authors.
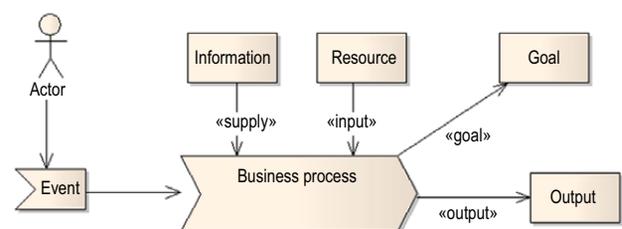
Fig. 1. Example of a business process example

Business process modelling languages

The use of standard methods for organisations and academic people can make calibration for customers and shareholders much easier. Business process modelling languages is not an exception. A problem occurs when scientific papers start using custom modelling notations, which cannot be understood by other academics or it requires extra time to understand a notation. This is the reason why the authors of the article are trying to use standard methods themselves and encourage others to do the same when representing the real world in a computer model.

In 2004, the Business Process Modelling Notation (BPMN) was presented as a standard business process modelling language. Since then, BPMN has been found in different ways by the academic community and has become widely supported by the industry. The primary goal of BPMN was to provide a notation that is readily understandable by all business users from business analysts to technical developers and, finally, business people (Aagesen, Krogstie 2010). In the year 2011, Object Management Group (OMG) released BPMN 2.0. It should be noted that BPMN 2.0 is harder to learn than the previous version; it has become much more difficult to understand. Most business modelling tools finished or are implementing the new version for graphical business representation, especially – the big players in this industry.

Fig. 2 presents a simple business process diagram that is created using BPMN 2.0 notation. Enterprise Architect modelling tool was used to create this model. This simple business process has starting and ending positions and some activities.
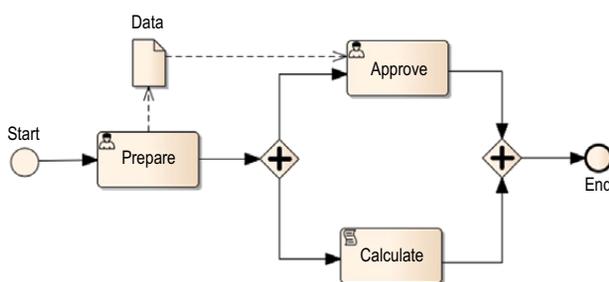
Fig. 2. Example of BPMN 2.0

Analysis of such big players as IBM, ORACLE, Sparx, Tibco, Cordys and recently – SAP shows that BPMN is successfully adopted into their tools, leaving other notations behind. In the opinion of the authors, it is a smart move as business process diagrams are really important for creating real time computer models while the use of a language that is understood by all interested parties simplifies the task. The same analysis of business process diagrams reveals that flowcharts of Event-driven Process Chains (EPC) are also widely used for business process modelling, especially by ARIS and SAP, even though SAP seems to be moving to BPMN 2.0. Possibly, it is only a matter of time before the leading business process notation becomes clear. Nonetheless, both EPC and BPMN, have their advantages and disadvantages. For example, BPMN supports far more workflow patterns than EPC. But EPC has elements that are unavailable in BPMN. For instance, BPMN does not have elements to express a process outcome and model risks cannot be modelled. Although it is not the original intention for BPMN to model that, it seems to focus on executable processes. Engineers prefer to see their work modelled in BPMN because they can track tasks against application (lane) and domain (pool). Project managers prefer EPC as it is easier for them to identify a task or a function against responsible individuals. In conclusion, currently used business process modelling languages are strongly influenced by software products and their prevalence in the market.

Rule-based business process simulation

Our field of research is rule-based business process simulation. Terms 'modelling' and 'simulation' are often used synonymously; however, the authors of the article regard that modelling is an act of building a model while simulation is an act or even a process of using that model for a specific purpose or study. Business process simulation can be used for different purposes. Simulation can be a part of modelling to optimize the model while it is developed or updated. Simulation can be used: to compare different versions of the same model; to check the model for bottlenecks, overlaps and gaps; to determine how the model acts under different circumstances; to find the right decision if the environment of the model changes. Finally, simulation can be used as a forecasting mechanism of the model. Therefore, simulation is considered especially important to many modern organisations and enterprises, which are looking forward to implementing it in their business.

Without a doubt, simulation of a process is a hard task. The business processes need to be much more flexible; for this reason, the authors of the article propose to use rule-based business processes. Business rules and their integration into business process simulation is a somewhat new and interesting approach that can still be developed as none of the big players have managed to offer something that would really suit everyone in the field. Business rules are intended to assert business structure or control or influence the behaviour of the business.

Despite of tools for business process modelling and management lack simulation capabilities, another problem – the behaviour of resources – is modelled in a rather naive manner, which makes the simulation differ from reality without the expected results (Aalst *et al.* 2010).

M. H. Jansen-Vullers described three different categories of software tools that may be applicable for business process simulation:

- Business process modelling tools;
- Business process management tools;
- General purpose simulation tools.

These different types of tools can work together to create a business process simulation (Jansen-Vullers, Netjes 2006). Some tools for business process simulation integrate these tool categories into one package, but different tools have different principles evaluating this process.

Conclusions

1. Business processes are influenced by creativity and: defining how business processes are modeled; what a business process is; what it is capable of doing; what components it is made of; and other. This is the core of modelling the real world environment. It is relevant to look into existing business processes and business rules modelling techniques and use best practices to avoid as much creativity as possible. Even though a comprehensive approach on managing creativity does not seem to be available.

2. Business process modelling languages are strongly influenced by software products that use the notations and also depend on their prevalence in the industry. In fact, the spread of a business process modelling language depends on such big players as IBM, ORACLE, ARIS, SAP and others and their decision to use a specific language. Nonetheless, the big players consider opinions of the academic community and customers.

3. Business process management tools lack simulation capabilities or have rather different principles. Moreover, with current tools, business rules and business process simulation is somewhat difficult to manage as usually it is a separate task. In practice, relevance of a business process simulation is limited due to the current approach, tools and training: it is time-consuming, differs from the reality and requires a lot of resources.

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TAISYKLĖMIS GRINDŽIAMŲ VERSLO PROCESŲ MODELIAVIMO IR SIMULIAVIMO TYRIMAS

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Santrauka

„Google" paieškoje įvestas terminas „Business Process Simulation" 2013 metų balandžio mėn. duoda tik 42,1 tūkst. paieškos rezultatų. Tai nėra daug, palyginti su kitu paieškos terminu „Business Process Modelling". Tuo pačiu metu reikšminiai paieškos žodžiai duoda apie 1,470 milijono paieškos rezultatų. Tai 35 kartus daugiau, palyginti su prieš tai daryta paieška. Galima ginčytis, ar yra skirtumas tarp modeliavimo ir simuliavimo? Iš tiesų žodžiai „modeliavimas" ir „simuliavimas" dažnai vartojami kaip sinonimai, tačiau straipsnyje siūloma į modeliavimą ir simuliavimą žiūrėti skirtingai, t. y. į modeliavimą kaip į veiksmą, kuris sukuria modelį, į simuliavimą – kaip į veiksmą arba procesą, kuris sudaro sąlygas taikyti šį modelį konkrečiam tikslui arba tyrimui atlikti. Jeigu apibrėžiama, kad simuliavimas yra vieno ar daugiau kintamųjų manipuliacijos procesas, kurį galima pakeisti ir stebėti, tada taip pat galima susitarti, kad šis procesas geriausiai grindžiamas verslo taisyklėmis, kurios gali būti papildomos arba keičiamos simuliavimo proceso metu.

Reikšminiai žodžiai: verslo procesų modeliavimas, verslo procesų simuliavimas, verslo taisyklės.