Evaluation and comparison of business process modeling methodologies for small and midsized enterprises
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INTELLIGENT DECISION MAKING SYSTEMS - EVALUATION AND COMPARISON OF BUSINESS PROCESS MODELING METHODOLOGIES FOR SMALL AND MIDSIZED ENTERPRISES

FIRST AUTHOR
FATMA AKSU

Applied Economics-Business Informatics, University Hasselt, Campus Diepenbeek
Agoralaan – Gebouw D, 3590 Diepenbeek, Belgium

SECOND AUTHOR[†]

KOEN VANHOOF

Transportation Research Institute (IMOB) , University Hasselt, Campus Diepenbeek
Wetenschapspark, 3590 Diepenbeek, Belgium

THIRD AUTHOR[†]

LIESBET DE MUNCK

Research Institute LOG-IC, Provinciale Hogeschool Limburg (PHL), Elfde
Liniestraat 24, 3500 Hasselt, Belgium

ABSTRACT. This paper focuses on small and midsized enterprises (SME's) and investigates which business process modeling (BPM) methodology is the most adequate and appropriate for these type of companies. Therefore, it selects and applies a general framework, by which BPM-methodologies are evaluated and compared, instead of isolated frameworks. More specific, this paper emphasize the intention towards a foundation of such a framework based on a method ranking approach combined with a case based approach.

1. Research problem

Business process modeling faces considerable complexities. One of these complexities is the problem of selection of an adequate modeling methodology. In the process of choosing business process modeling methodology (BPM-

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methodology) most suited for the particular task the responsible decision maker has to act under such conditions as incomplete knowledge, insufficient resources, compatibility requirements, and lack of time. In this situation, responsible persons are often tempted to reduce risk by choosing from the set of familiar methodologies. The selection problem is further complicated because there are too many methodologies to choose from. [1]

Considering the fact that this research is integrated into the Tetra-project 2008-2009 which objective is to optimize information flows and interfaces in the logistic chain of small and midsized enterprises (SME's) there is a necessity for a BPM-methodology in the stage of analysis of this project. This paper focuses on SME's and investigates which BPM-methodology is the most adequate and appropriate considering these type of companies which have narrow or zero knowledge about the broad range of BPM-methodologies. Furthermore, in order to provide the SME's with knowledge concerning this topic on an effective and comprehensible level this paper selects and applies a general framework for selecting adequate BPM-methodologies instead of isolated and difficult selection frameworks.

2. Selection of BPM-method(s) by means of generic framework

2.1. *Description of the generic framework*

Luo and Tung developed a general framework for selecting BPM-methodologies [2]. Assuming that there are objectives for using process modeling, this framework suggests that such objectives should determine the perspectives from which the process is modeled and that they require the modeling methodologies to possess certain modeling characteristics. At the same time, each method can be categorized in terms of its perspectives and characteristics. Luo and Tung derived a general procedure for evaluating and selecting BPM-methodologies from the proposed framework. This research uses the ideas of this procedure in a slightly different way. The adapted procedure includes the following steps:

1. Identification of modeling objectives;
2. Identification of BPM-methodologies;
3. Description of the identified BPM-methodologies, perspectives and characteristics;
4. Evaluation, comparison and pre-selection of the identified BPM-methodologies through expert experiences;
5. Case studies: application at two SME's;

6. Evaluation and comparison of the pre-selected BPM-methodologies through user experiences;
7. Selection of the most adequate and appropriate method(s).

This paper emphasize the intention towards a foundation of such a framework based on a method ranking approach combined with a case based approach for SME's as the target group.

The rest of the paper is organized as follows: in the next section, the modeling objectives and the BPM-methodologies related to those objectives are identified. In section 2.3, the pre-selection through expert experiences are held. In section 2.4, two groups of user experiences support the procedure concerning the comparison and evaluation of BPM-methodologies. Section 3 describes the research conclusions.

2.2. *BPM-methodologies related to modeling objectives*

Luo and Tung classify process modeling objectives into the following three categories: communication, analysis and control [2]. Since SME's, particularly in a growing phase, the growth might be blocked due to weak business processes. Those SME's can enhance the growth rate through investments in business information systems. Though, it's recommended to optimize and improve business processes before implementing information systems. This issue requires communication and analysis of current business processes to re-engineer afterwards. Preferable, the re-engineered business processes must be often controlled and monitored.

Aguilar Saven proposes a framework to classify the BPM-methodologies according to their purpose [3]. Figure 1 shows this framework, where by the BPM-methodologies applicable to the identified modeling objectives are clearly defined with a rectangle. Moreover the category 'active' on the x-axis is left out of consideration due to the high level of complexity of the BPM-methodologies regarding SME's. The conclusion is that the following methods fits well with the three modeling objectives (communication, analysis and control): Gantt chart, SSM-Rich Pictures, IDEF0, IDEF3, RID, DFD, RAD and Flow chart.
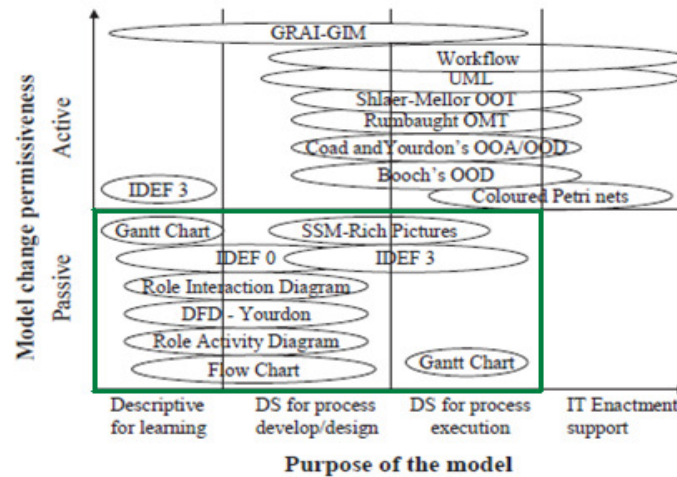
Figure 1. Classification framework for BPM-methodologies

2.3. *Pre-selection of BPM-methodologies*

The knowledge and opinions of four experts, particularly methodology, business and ICT experts, are blended. According to these experts:

- IDEF0 en IDEF3 are too complex and target engineers or system designers as modeling stakeholders. Thus, IDEF0 and IDEF3 aren't adequate for SME's.
- Gantt charts are meant for planning purposes and not for process modeling.
- SSM-Rich picture is not an adequate BPM-methodology since stakeholders just simply draw pictures to get their individual intuitive insights.
- Role interaction diagram shows the sequence of process activities related to different roles, but this methodology doesn't provide any structure which has consequences, like very complex models.
- Role activity diagram, flow chart and data flow diagram are the most adequate and applicable BPM-methodologies for SME's. The following paragraph summarizes the reasons for this choice.

    The RAD en flow chart focus on the workflow of business processes with indication of relations between roles. Please note that not the linear flow chart is taking into account but the cross-functional flowchart which uses swim lanes to define the roles. The RAD and flow chart belongs mainly to the functional, behavioral, organizational perspectives whereas the DFD mainly has an informational perspective. Therefore, all experts

agree that processes needs to be modeled with the DFD after the workflow has been modeled with the RAD or flow chart. The latter BPM-methodologies conflict each other since they provide the same insights of business processes though on an other way. Notice that the difference in presenting models may influence the level of user-friendliness. This issue is handled in next section.

2.4. *Evaluation and comparison of the pre-selected BPM-methodologies through user experiences*

The research contains two case studies which provide the models of specific business processes of two SME's. These business processes are modeled with the RAD, flow chart and DFD. The objective is to compare and evaluate the three BPM-methodologies by using the business process models during surveys for user experiences. Two different user groups are surveyed. One group consists of persons working for the two SME's. The other group consists of students who haven't any knowledge about the business processes of these two SME's.

2.4.1 First group of users – internal stakeholders

Two persons, manager and planner, of both SME's are asked to define their expectations towards business process models and evaluate the RAD, flow chart and DFD using the models and based on a set of criteria. The criteria are divided along perspectives and characteristics. The BPM-methodology which has the best match between the expectations and evaluations should be the best one for a SME. Table 1 shows the results of the surveys.

Table 1. Results of the surveys at user group 1[a]

	Perspective	Expecta-tions	Evaluation		
			Flowchart	RAD	DFD
	Perspective	Activity, roles, information, systems	Idem	Idem	Infor-mation
c	Ease to understand (user friendliness)	4 4	4 4	4 3	2 2
h a	Ease of use (User friendliness)	4 2	4 3	2 1	2 2
r a c t	Scale	3 3	2 2	4 4	2 3
e r	Flexibility	2 3	3 2	3 4	2 2
i s	Formality	2 3	2 3	4 3	2 3
t i c	Time	3 4	4 4	4 2	2 2

Table 1 concludes that the flow chart has the best match between the expectations and evaluations. More specific, the flow chart has great marks for criteria like time, ease of use and comprehensibility.

2.4.2 Second group of users – external stakeholders

This group consists of 42 students and their task was to fill in questionnaires regarding to the business processes of the two SME's. They have done this by using the models designed with the RAD, flow chart and DFD. 14 students have been allocated to each BPM-methodology.

Different criteria are measured. The first four criteria in table 2 are measured by asking questions about the process models and, of course, which are related to those criteria. Students who answered the questions right got a mark of 1 point, those who answered on a moderate level 0,5 point and a wrong answer is equal

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[a] Point scale for expectations: 1: not important, 2: less important, 3: important, 4:very important
Point scale for evaluations: 1: bad, 2: moderate, 3: good, 4: perfect

to 0 point. The criteria 'Analysis' and 'Ease of use' are measured in a different way. At the end of the exercise students gave their opinion about these criteria. The following question concerning 'Analysis' was asked to the students: 'to what extent have the models helped you to answer the questions?'. The question concerning 'Ease of use' was: 'To what extent were the models comprehensible?'. Next, the time which each student used for answering the questions was also taken into account. The criterion 'total score' defines the total points each student gained.

All the measurements for each criterion are collected for each BPM-methodology. In this way it's possible to rank each BPM-methodology according to each criterion. Table 2 shows the rankings.

Table 2. Rankings of each BPM-methodology[b]

	RAD	Flow chart	DFD
Insights into structures	1	3	2
Insights into coherence	1	3	2
Roles	1	2	3
Information	1	3	2
Analysis	1	2	3
Ease of use	1	2	2
Time	1	2	3
Total score	1	3	2

Table 2 concludes that the RAD is the number one for all the criteria and generally the flow chart and DFD have the same ranking.

3. Conclusion

The most adequate and appropriate BPM-methodology for a SME depends on the targeted stakeholder. Modelers who are internals of the SME and have experience with a particular BPM-methodology will prefer that specific methodology. This research shows that the majority of the internals often uses flow charts and prefer to keep that choice. That choice is also influenced by the flow charts' simplicity and flexibility in the syntax.

However, external stakeholders, who probably haven't any knowledge about an SME's business processes, prefer the RAD due to the ease of use and high level of comprehensibility. These criteria are optimal due to the RAD's

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[b] Point of scale: 1: perfect, 2: moderate, 3: bad.

interpretable symbols, decomposition and clearly defined roles. Thus, if SME's needs to communicate among externals and internals it's preferable to use the RAD.

Since the DFD differs from the RAD and flow chart due it's different perspective, namely the information perspective. This BPM-methodology should be used after modeling the workflow. However, external stakeholders find this method not optimal, it should be used by ICT experts.

References

1. Abramowicz, W. & Mayr, H.C. (2007) 'Technologies for Business Information Systems', Springer.
2. Luo, W. & Tung Alex Y. (1999) 'A framework for selecting business process modeling methods', Industrial Management & Data Systems, Vol. 99/7, Issue 312-319.
3. Aguilar-Savén R.S. (2004) 'Business process modeling: review and framework', International journal of production economics, Vol. 90, Issue 129-149.