BUSINESS PROCESS PRIORISATION WITH MULTICRITERIA METHODS

Case of Business Process Reengineering

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Abstract: Business process (BP) engineering is used nowadays in many methods, techniques and tools. In domains such as strategic management, reengineering, or security analysis, one particular concern is the identification of BPs that should be dealt primarily. In practice, the number of BPs is often very large and it justifies the creation of a priorisation mechanism. However, the number of approaches available to prioritise BPs specifically is very limited. This paper presents a comparison of multicriteria (MC) methods, and an approach to guide the selection and application of the MC method found as the most appropriate for BP priorisation. The approach is illustrated with the case of selecting and applying a BP priorisation in the view of BP reengineering.

1 INTRODUCTION

Many BP engineering methods, techniques and tools focus on “Key business processes” (Sachdeva and Joshy, 2005) (PegaRules, 2003). BPs priorisation is used by companies to define the most important development axes, to increase the reaction speed to environment changes, to optimize the expenditure, and consequently, to improve their competitiveness.

Dealing with Key BPs supposes that decision makers know business processes priorities or are able to define them, at least intuitively. The intuitive approach is viable when there is a limited number of BPs. However in most cases, managers face problems with a large number and large variability of BPs, and often different versions of BPs through time. The combination of these issues leads to a combinatory explosion of the number of artefacts to deal with, hence a better priorisation support is needed.

There is a limited number of researches dealing with BPs priorisation. In our point of view, BP priorisation can be considered as a multicriteria decision problem, and therefore we suggest integrating multicriteria (MC) methods into BP priorisation. Our aim is to propose a formal approach for BP priorisation in order to enhance decision-making (DM) in the field of BP management and related fields such as system engineering, or business security.

We develop our approach to achieve two main goals: (i) selecting an appropriate MC method and (ii) applying it to the considered BP priorisation case.

We suggest that a process allowing to guide the selection of a DM method should take into account the multiple aspects of the situation at hand. The presented approach copes with these different aspects using a structured benchmarking grid. The grid was adapted from (Papadacci et al., 2006) to the MC methods comparison issue and is applied to describe BP priorisation problem, which includes the description of alternative BPs and criteria typology for BP evaluation.

The rest of the paper is organised as follows: section 2 gives an overview of existing approaches of BP priorisation; section 3 presents MC approach for defining BP priorities and justifies the selection of one MC method; section 4 illustrates our approach with example of BPR. The section 5 discusses possible application domains and research's perspectives.

2 OVERVIEW OF EXISTING BP PRIORISATION APPROACHES

This section presents an overview of existing BPs priorisation approaches. After a brief description of these approaches, we compare them and give some conclusions.

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There is only a small number of approaches that propose to guide BP selection. Four approaches are particularly considered in our review: (i) Hammer and Champy's, (ii) Robson and Ullah's, (iii) PROSCI, and (iv) Mazur's et al. approaches.

Hammer and Champy (Hammer and Champy, 1993) propose to analyse BPs under three different perspectives in order to select those that need reengineering. These are "problems", "importance" and "feasibility". First, all processes for which a problem can be identified are chosen. Then, the importance of these BPs for the organization is analysed. Last, a feasibility control is carried out in order to verify if expected results will cover related expenses.

Robson and Ullah (Robson and Ullah, 1996) propose a methodology to sort BPs for reengineering. In this approach, BPs are analysed in relation with critical success factors (CSFs). First, relevant CSFs are listed, and then each BP is estimated along a five-grade scale according to all CSFs. A weighted sum is generated for each process; weights represent relative importance of CSF. It presents a complex value of each BP for organization. Besides, the authors suggest to analyse BP functioning (from very good to bad according to five-grade scale). Three levels of BP priorities are finally considered: reengineering, improvement and supervision. BPs that contribute to many CSFs and have bad functioning are considered as potential for BP reengineering.

PROSCI (Crowe et al., 1997) uses a BP taxonomy to identify reengineering opportunities. The authors suggest that relations exist between strategic goals and BPs. The first step of this approach consists in establishing the taxonomy of BPs. In the second step, the influence of each BP on every strategic goal is taken into account. To achieve this, an influence diagram is drawn using decision tree where every BP is embedded in a main decision node, strategic goals are drawn as chance nodes, and main decision nodes are linked to each chance node. Relationships are in the form of probability distributions, which reflect the stochastic nature of influences that BPs have on the strategic goals. The final BP evaluations are obtained using weighted sums of chance nodes in which weights are assigned to chance nodes depending on their order of importance.

Mazur et al. (Mazur et al., 2000) propose an approach for BP selection based on weighed sum. In this approach, the calculation is made according to the next criteria: influence on customer, variability, functioning, and importance for business. Each BP is measured towards all criteria with five-grade scale, and then the weighted sum is calculated.

The four selected approaches are compared along two dimensions: (i) the criteria used by the approaches for comparing BPs and (ii) the rules proposed to carry out BP selection. Several remarks can be made: (i) there is only a limited set of criteria to support BP comparison; (ii) most criteria are abstract (e.g. problems, or importance for customers and business), and the authors do not show how these criteria relate to actual BP performance indicators; and (iii) there are only two kinds of selection rules, weighted sum and two-dimensional space. The drawback of weighted sum is that it requires homogeneous criteria. On the other hand, two-dimensional space has the disadvantage of limiting maximal number of criteria.

In order to avoid these issues, we suggest integrating MC methods into BP priorisation.

3 MULTICRITERIA PRIORISATION OF BP

As indicated above, our proposal consists in using multicriteria methods in order to carry out BP priorisation. MC methods are very different from each other, and the result of priorisation highly depends on the selected method. We believe that a MC method must take into account the specific characteristics of problems situation to provide appropriate results. Therefore, we propose an approach that guides the selection of a MC method consistent with the situation at hand.

As Fig. 1 shows it, the guidance provided by our approach is based on a 5 phases process. The process results in applying a MC method specifically chosen to deal with the problem at hand.

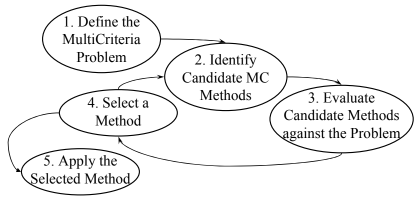

Figure 1: Overview of the proposed approach.

The goal of the initiation phase is to define the nature of the MC problem. Once the problem defined, it is necessary to identify candidate methods (phase 2), to evaluate their ability to cope with the MC problem (phase 3), and to select the most adequate method(s) (phase 4). Phases 2, 3 and 4 are iterative as several phases can match the problem at hand (in which case a more detailed analysis is required) or on the contrary none of the candidate methods matches the problem perfectly. In this case, another cycle of evaluation must be achieved. Several strategies are available: either other methods are considered, or some of the required characteristics are added or removed, or the characteristics are ranked by order of importance. For more details, see (Salinesi and Kornyshova, 2006).

3.1 Details of the Approach in the Context of BP Priorisation

Our approach provides different ways of working depending on the actual problem to deal with. The following sections develop the approach application in the specific context of BP priorisation.

3.1.1 Defining Multi-criteria Problem

Based on a state of the art research (Papadacci et al., 2006), we developed a benchmarking grid that helps defining a MC problem in detail. The grid is composed of 15 different facets organized into four orthogonal dimensions, namely: context, process, form, and object.

The *context* dimension gathers 5 characteristics of the situation of method use: (i) the problem is a choice (ii) ranking, (iii) or sorting, (iv) new alternatives can emerge, and (v) there are multiple viewpoints.

The *process* dimension gathers 4 characteristics of the expected way of method applying: (i) the approach for defining evaluations (either unique criterion of synthesis (UCS), or outranking), (ii) for defining the decision criteria (either without weighting, with weighting and interdependencies, or simple weighting), (iii) the ability to deal with different measure scales, and (iv) easiness of use (easy, medium or difficult).

The *form* dimension characterizes how the method is described. This dimension gathers two parameters: (i) notation (textual explanation, mathematical formula, function), and (ii) tool (to indicate if a software support is available).

The *object* dimension describes the alternatives to be prioritized using 4 characteristics: (i) type of data to consider (either quantitative or qualitative), (ii) number of alternatives that will be considered with the method (either large or small), (iii) ability to take into account incompatibilities and conflicts between alternatives, and (iv) hierarchicality (ability to deal with alternatives organized within a hierarchy tree).

In the context of BP priorisation, the problem can be a choice (application example is BPR), a ranking (for example, the BPs must be ranked in order to establish priorities for business security improvement), and sorting (e.g. BPs are positioned according to the Capability Maturity Model).

In our case, the potential actions to be considered are the BPs of an organisation. Their number may vary from little (if only “macroprocesses” are taken into account) to very large (if all detailed BPs of the BP hierarchy are considered). It is very important to take into account the hierarchical nature of BPs. Indeed (i) only BP of the same hierarchical level should be compared, and (ii) BP analysis must taken into account the nature of the hierarchical links between BPs. Besides, the BP collection is dynamic. New BPs emerge, some disappear, and some change their properties. Alternative BPs have various nature and may be evaluated according to multiple criteria.

We suggest the 9 following criteria drawn from literature (Voyer, 1999), (PegaRules, 2003), (Shadrin, 2002), (Sachdeva and Joshy, 2005) and (Crowe et al., 1997):

- BP duration,
- BP quality,
- BP cost,
- BP size,
- BP customers satisfaction,
- BP efficiency,
- BP productivity,
- BP contribution to strategic goals,
- BP problems,

and, the 4 following criteria, developed based on our experience with BP priorisation:

- BP contribution to problems resolution (the number of problems that can be solved by improving the given BP),
- BP lifecycle steps: creation, development, stable functioning, regress, and destruction,
- BP influence on stakeholders,
- BP customer: internal or external.

These criteria have different scales: cost and value are absolute numerical data, efficiency and productivity are ratio, contribution to strategic objectives, life cycle steps have nominal scales etc. In addition, data type takes two values: quantitative and qualitative.

Besides, the analysis involves multiple stakeholders with different, and sometimes contradictory, viewpoints.

This analysis allows characterizing the situation in which BP priorisation shall be undertaken and shall help selecting an appropriate multicriteria method.

3.1.2 Identifying Candidate MC Methods

The analysis grid was applied to the four general-purpose MC methods: Multiattribute Utility Theory

(MAUT) (Keeney and Raiffa, 1993), Analytical Hierarchy Process (AHP) (Saaty, 1980), Outranking methods (Roy and Bouyssous, 1993), and Weighting methods (Keeney, 1999). For the sake of space, these methods are not detailed here. However, table 1 shows an overview using the benchmarking grid.

Table 1: Overview of considered MC methods.

Dimension / Facets	MAUT	AHP	Outran-king	Weigh-ting
Context				
Problematic, choice	Yes	Yes	Yes	Yes
Problematic, ranking	Yes	Yes	Yes	Yes
Problematic, sorting	No	No	Yes	No
Treatment of a new alternative	Yes	No	Yes	Yes
Taking into account multiple viewpoints	No	No	Yes	No
Process				
Approach for defining evaluations	UCS	UCS	Out-ranking	UCS
Approach for decision criteria weighting	Yes, no interd	Yes, interd	Yes, interd	Yes, no interd
Taking into account various scales of criteria	Yes	No	Yes	No
Easiness of use	Difficult	Easy	Medium	Easy
Form				
Notation	Utility func-tion	Weigh-ted sum	Textual	Weigh-ted sum
Tools	No	Yes	Yes	Yes
Object				
Data type	quan, qual	quan, qual	quan, qual	quan
Number of alternatives to be treated	Great	Small	Great	Great
Treatment of incompatibility, alternatives conflicts	Yes	No	Yes	No
Hierarchicality	No	Yes	No	No

3.1.3 Evaluating Candidate Methods

The goal of this step is to identify which candidate method satisfies all the characteristics which are at step 1.

In our example: (i) all the considered methods deal with the choice and ranking problems, and only outranking methods allow alternatives sorting; (ii) two methods (MAUT and outranking) supports various scales of criteria and deal with a great alternatives number; (iii) AHP is not able to treat the apparition of new alternatives, and (iv) only Outranking is able to deal with multiple viewpoints.

3.1.4 Selecting and Applying a Method

Both MAUT and outranking methods satisfy majority of characteristics. Nevertheless, outranking methods exceed MAUT regarding to two criteria: sorting problematic and ability to take into account the multiple viewpoints. If the last criteria are not significant, then two methods are equivalent. In such a case, we must extend analysis to other criteria. Besides characteristics elicited on step 1, these methods differ according to approach for defining evaluations, easiness of use and tool presence. The approach by outranking gives a more exact result then unique criterion synthesis. Moreover, outranking methods are more easy to use and are supported by tools.

Thus, our recommendation is to use outranking methods for defining BP priorities.

4 CASE STUDY WITH ELECTRE

This section presents a case study undertaken at a company in the electronics industry. The purpose of the experiment was to choose BP to be reengineered. As a result of this experience, the enterprise expected to identify one or two processes which reengineering would bring maximal value with minimal drawbacks.

As shown in the former section, an outranking method should be considered to deal with this issue. The family of ELECTRE methods was found particularly interesting by the enterprise. The ELECTRE I method intended for choice problems (Roy and Bouyssous, 1993) was finally chosen. In order to apply ELECTRE I, one must (i) define the problem (potential BP and criteria) and evaluate BP according to selected criteria, and (ii) apply the method.

4.1 Problem Definition

The problem definition includes specifying (i) a list of BP, (ii) a list of criteria, (iii) criteria construction and preference rules, and (iv) criteria weights.

The *set of BPs* was developed based on the "Process classification framework" proposed by APQC (Process Classification Framework, 1996). It included:

- ***BP1.***Understand Markets and Customers,
- ***BP2.***Design Products,
- ***BP3.***Market and Sell,
- ***BP4.***Produce and Deliver,
- ***BP5.***Invoice and Service Customers,
- ***BP6.***Develop and Manage Human Resources,

- ***BP7.***Manage Information Resources,
- ***BP8.***Manage Financial and Physical Resources.

The collection of *criteria* to be considered while applying ELECTRE I was defined based on the enterprise requirements:

Cr.1. *BP contribution to strategic goals* presents the degree of influence of BPs on organizational performance. Within the framework of Balanced Scorecard, strategic goals are divided into two categories: "results" that concern financial performance and customers, and "leverages" that concern internal processes, learning and growth. Weights were distributed within these categories: 2 – "results" and 1 – "leverages". The final evaluation was based on weighted sum. The preference rule was maximum.

Cr.2. *BP contribution to problems resolution* means that BPR should help to resolve some decision problems. The problem at hand was to select a BP which improvement would bring the greatest result. We defined improvement by the contribution of processes to problems that could be solved by process reengineering. To make the analysis closer to reality the frequency of occurrence and threat degree were used as weights. For frequency, the scale was: 0 – never, 1 – sometimes, 2 – often, 3 – regular. For threat degree, the scale was estimated on a three-level grade: 1 – low, 2 – medium, 3 – high. This function was maximum.

Cr.3. *BP costs* were defined as the number of persons, working on the BP. Preference rule was minimum.

Cr.4. *BP sizes* were defined by the quantity of sub-processes, which we believed would reflect their importance in the company. The preference function was aimed at a maximum.

Cr.5. The purpose of *BP life cycle steps* was to define the administrative influences required for process reforming. Indeed, it was found that process reengineering was needed or at least acceptable for processes in the state of development, regression or stable functioning. Reengineering was felt less preferable for BPs in state of creation, destruction and stable functioning. Therefore, the preference rule was defined as: (development = regress) ≥ stable functioning > (creation = destruction).

Cr.6. *BP customers* could be external or internal. External processes add value for organization's customers, therefore they were considered as more important. The preference rule is: external ≥ internal.

To define criteria weights, we used the SWING method (Keeney, 1999). The decision maker (DM) chose the most important criterion and affected a value of 100 to it. Then, the DM chose the most important criterion and affected a lower value to it. The same principle was applied recursively until a value was affected to all criteria. Normalisation produced weights as shown in Table 2.

Table 2: Criteria Weighting.

Criteria	Cr.1	Cr.2	Cr.3	Cr.4	Cr.5	Cr.6
Value	80	100	20	20	60	50
Weight	0.24	0.30	0.06	0.06	0.19	0.15

The two first criteria were general; that is they included "sub-criteria". In order to define the partial evaluations we attributed "1" to BPs, which affected either strategic goals (in our case, the data on strategic goals were taken from Balanced Scorecard (BSC)) or problems to be solved. The final evaluations are the weighted sums of the partial ones (the weights are described above).

We proceeded by simply assigning values to BP evaluation according to next four criteria. The summary of BP evaluation is presented in Table 3.

Table 3: BP evaluation summary.

Criteria	weights	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8
Cr.1 (in points)	0,24	18	5	12	18	2	2	1	9
Cr.2 (in points)	0,30	3	4	13	13	4	4	4	26
Cr.3 (in persons)	0,06	4	8	5	29	2	1	3	2
Cr.4 (sub-processes number)	0,06	6	1	1	5	2	2	3	4
Cr.5 (nominal)	0,19	st. fun.	st. fun.	st. fun.	reg.	reg.	st. fun.	cre-at.	reg.
Cr.6 (nominal)	0,15	ext.	int.	ext.	ext.	ext.	int.	int.	int.

4.2 ELECTRE Application

ELECTRE I is based on the principles of concordance and discordance (see Roy and Bouyssous, 1993).

The method starts by a calculation of concordance and discordance indices. These indices define concordance and discordance with the assumption that alternative A is preferred to alternative B. Concordance and discordance were established using the following principle: if a DM declared that alternative A is at least as good as B for the majority of attributes then a concordance was defined. Discordance was defined based on the other attributes according to which A was not strong enough compared with B. All calculations are not shown here for the sake of space. The concordance and discordance matrices developed in our case study are shown in Table 4 and Table 4.

Using a threshold of 0,55 to highlight BPs in the concordance and discordance tables revealed that BP8

(Manage Financial and Physical Resources) dominated the others on average without any particular shortcoming in terms of discordance. A qualitative analysis of this choice revealed that the enterprise agreed with it. A reengineering of the financial and physical resources management processes was thus undertaken.

Table 4: Concordance matrix.

	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8
BP1		0,70	0,70	0,51	0,45	0,64	0,64	0,45
BP2	0,49		0,25	0,06	0,54	0,88	0,88	0,15
BP3	0,64	1,00		0,51	0,69	0,88	0,88	0,39
BP4	0,88	0,94	0,94		0,94	0,94	0,94	0,64
BP5	0,70	0,76	0,46	0,40		1,00	0,94	0,40
BP6	0,55	0,76	0,31	0,06	0,66		0,94	0,21
BP7	0,36	0,57	0,12	0,06	0,36	0,51		0,15
BP8	0,55	1,00	0,61	0,55	0,79	0,94	1,00	

Table 5: Discordance matrix.

	BP1	BP2	BP3	BP4	BP5	BP6	BP7	BP8
BP1		0,04	0,43	0,43	0,14	0,14	0,04	1,00
BP2	0,76		0,39	0,76	0,25	0,25	0,14	0,96
BP3	0,35	0,00		0,35	0,18	0,18	0,07	0,57
BP4	0,86	0,75	0,82		1,00	1,00	0,89	0,93
BP5	0,94	0,18	0,59	0,94		0,00	0,20	0,96
BP6	0,94	0,18	0,59	0,94	0,50		0,20	0,96
BP7	1,00	0,24	0,65	1,00	0,11	0,11		0,96
BP8	0,53	0,00	0,18	0,53	0,07	0,07	0,00	

5 CONCLUSIONS

This paper shows how to choose and to apply a MCDM method. In the particular domain of BP priorisation, it shows that outranking methods should be used. Based on an analytical comparison, this claim is confirmed by a case study of BP priorisation for the purpose of reengineering in an electronic company.

Besides BPR, BP priorisation could be achieved in others contexts such as: ERP implementation, business continuity plan elaboration, or improvement of Information System strategic alignment. We believe that other case studies in these domains and comparative analyses should be undertaken to fully validate our approach.

Defining BP priorities with a structured MC method has advantages: (i) time for decision-making and implementing decreases thanks to less analysis mistakes in the BP, (ii) expenses decrease, (iii) degree of goals achievement grows by targeting the most important BPs, and (iv) stakeholders confidence in results and in the overall project grows owing to their participation in the definition of priorities.

We intend to proceed this research in two directions: improving our approach to multicriteria methods selection and developing new practical cases to obtain more precise evaluations.

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