Product-Based Design of Business Processes Applied within the Financial Services

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ABSTRACT

Business Process Reengineering (BPR) is an important instrument to boost the performance of business processes. In this paper, the Product-Based Design method is presented that supports BPR. It is especially suitable to reengineer processes that support information-intensive products such as bonds, mortgages, and loans. Inspired by manufacturing principles, the structure of an information-intensive product is decomposed into a structure of informational elements which are used to derive the lay-out of an improved process design. Using this formal approach, many problems encountered with prevailing BPR practice are circumvented. This paper includes a description of the application of this method to credit processing within the ING Bank Nederland, a large Dutch bank. In this particular case, substantial savings in cost and flow time are achieved.

Keywords: Business Process Reengineering, Process Design, Case study, Financial Sector.

Classification: J.1, H.4

INTRODUCTION

One of the top challenges for banks and securities in the coming years is to "rethink" their businesses and align cost-cutting with revenue generation (Deloitte Research, 2002). Undoubtedly, this will revitalize the reengineering movement, which took off in the early 90s. Business Process Reengineering (BPR) aims at drastically changing the structure of a business process in combination with a wide-scale use of information technology (IT) (Hammer and Champy, 1993).

Despite the flood of BPR-related literature in the past years, it is interesting to note the relative methodological immaturity of the field (see e.g. Sharp and McDermott, 2001). An identification of the challenges involved with BPR may help to clarify this. A BPR initiative is commonly seen as a twofold challenge (e.g. Manganelli and Klein, 1994; Carr and Johansson, 1995) as follows:

- A *technical challenge*, which is due the difficulty of developing a business process design that is a radical improvement of the current design.
- A *sociocultural challenge*, resulting from the severe organizational effects on the involved people, which may lead them to react against those changes.

Apart from these challenges, the project management of a BPR initiative itself is also named as a BPR challenge (e.g. Grover, Jeong, Kettinger and Teng, 1995). Project management is concerned with managing both the technical and sociocultural challenge throughout the BPR initiative.

Most literature on the BPR subject is characterized by (Aalst, 2000) the following:

- A strong focus on the sociocultural and project management challenges instead of on the technical challenge.
- An anecdotal, qualitative, and descriptive point of view, rather than a universal, quantitative and prescriptive approach.

If one tries to find an answer to the question how to radically reengineer a specific business process, the results are disappointing.

The method of *Product-Based Design* (PBD) is one of the few approaches that aims to address the technical challenge of BPR in a rational and formal way (Aalst, Reijers and Limam, 2000; Reijers and Voorhoeve, 2000). Earlier applications of PBD have been described by Crom and Reijers (2001) and Reijers and Van der Toorn (2002). The essential idea behind PBD is the translation of a basic manufacturing concept: similar to the Bill-Of-Material (BOM) being used in manufacturing to organize assembly lines, the structure of an information-intensive product such as a loan or mortgage is used to derive a favorable business process design. This idea has first been put forward by Van der Aalst (1999). To our knowledge, only a few other methods provide a comparable degree of tangible BPR guidance (Orman, 1998; Aldowaisan and Gaafar, 1999; Hofacker and Vetschera, 2001). In contrast to these, however, PBD takes a clean-sheet approach, i.e. the structure of the existing process and its division into tasks are not the starting points for the redesign.

The purpose of this paper is to combine theory with practice by the presentation of the essential aspects of PBD on the one hand and its actual application in a real setting on the other. The latter is achieved by the presentation of a case description of a BPR project within the ING Bank Nederland, a large Dutch bank. The PBD method was applied to reengineer the bank's business process for handling credit applications of commercial parties.

The structure of the paper is as follows. First we will explain the essentials of PBD, and compare its characteristics with popular BPR approaches. Next, the case description is given. We end this paper with a general reflection on PBD and directions for further research.

PRODUCT-BASED DESIGN EXPLAINED

Prevailing BPR practice

Concerning the design of new business processes it is striking that there is a lack of *prescriptive* methods. Despite the abundance of handbooks that are advertised as "step-by-step guides to business transformation" (e.g. Manganelli and Klein, 1994), this kind of work seems to be primarily aimed at impressing a business audience. At best it gives some directions to manage organizational risk, but commonly lacks actual technical direction to design or redesign a business process. Even the classic work of Hammer and Champy (1993) devotes only 14 out of 250 pages to this issue, of which in fact 11 pages are used for the description of a case. Gerrits (1994) already commented: "In the literature on BPR, examples of successful BPR implementations are given. Unfortunately, the literature restricts itself to descriptions of the 'situation before' and the 'situation after', giving very little information on the redesign process itself." More recently by Sharp and McDermott (2001): "How to get from the as-is to the to-be [in a BPR project] isn't explained, so we conclude that during the break, the famous ATAMO procedure is invoked – And Then, A Miracle occurs".

By absence of well-founded and proven design methods companies often turn to organizing workshops to design processes. In the *participative* approach that is followed, external consultants encourage internal specialists to critically assess an existing process. Each internal specialist is representing a stakeholder party for the process at hand: the department that is executing it, its management, the internal accountant, the marketing department, the financial department, etc. Problem areas are identified that are targeted for improvement. Using brain storm techniques, best practices, and design heuristics creativity among the participants is stimulated to think of new ways of organizing individual tasks within the process or the process structure as a whole.

This way of working aims at delivering process designs that appease all workshop members. In practice, this overall satisfaction is usually attained by abstracting from the details, because this is the most effective way to circumvent conflicts. Conflicts on a substantial level are unavoidable as, for example, a marketing manager's view on what is necessary and what is superfluous within a process will be different from a financial specialist's. Another effect of this approach is that designs resulting from this approach are often incomplete, because they only reflect the expertise present at a workshop. In particular, the IT discipline is not always represented as they are seen as responsible for the implementation – not the design.

The resulting design is subsequently handed over to the implementation team, which typically consists of system developers and integrators. The IT-orientation of the implementation team is partly understandable, as BPR is nowadays hardly ever executed without exploiting the benefits of new information technology such as business process management systems or knowledge management systems (Sharp and McDermott, 2001).

Also, existing organizations always utilize technology of all sorts onto which the new process design should integrate. (Note that the integration of a new process with existing information systems is an issue rather of system *integration* and not strictly of system *development*.) However, because the process design is incomplete and superficial it puts an incredible burden on such an implementation team. All kinds of additional analyses are required to find out how the existing process is affected, which systems are involved, which information is required for people to do their work in this new way, what the procedures will be, etc. Understandably this takes time – which aggravates the rest of the organization – and it requires the implementation team to fill in the gaps of the design – which is not budgeted for and may even annul the expected improvements.

Essentials of PBD

Product Based Design (PBD) is basically a translation of a manufacturing concept to the world of administrative processes, such as found in banking, insurance, governmental agencies, etc. Material Requirements Planning, often referred to as MRP-I, determines the production schedule based on the ordered quantifies, current stock, and the composition of a product as specified in a so-called *Bill-of-Material* (Orlicky, 1972). In other words, production is driven by the structure of the product. With PBD the structure of an informational product, such as a mortgage loan or a social insurance permit, is decomposed into a structure of informational elements which are used to derive a process design. This idea is visualized in Figure 1, which shows how the information can be decomposed that is required for handling applications for a credit facility.

Figure 1: A credit facility example

Actual information elements of an administrative product may be related to each other in several ways. Consider the credit facility example of Figure 1. One of the essential pieces of information that is to be delivered in handling an application for such a facility is the credit proposal (6). The figure expresses that creating such a proposal requires a credit id (8), signed product conditions (9), a specified credit limit (10), a specified credit compensation scheme (11), a satisfactory outcome of the creditability check (12), an automatic collection specification (13), an indication of the type of credit (22), an account on which salary payments are received (26), and customer information (29). If all these required pieces of information are both available *and* acceptable, a credit proposal can be made. Note that for the sake of readability, some information elements in Figure 1 are depicted twice – indicated by their gray coloring.

PBD prescribes the explicit representation of the involved logic in the form of *production rules*. The production rule for the credit proposal may specify that the creditability check score should yield a value of at least 3 on a scoring scale of 1 to 5. Production rules are derived from explicit product specifications, such as banking regulations, product descriptions, administrative organizational procedures, etc.

The information elements that are required to produce others may themselves be decomposed in a comparable way. At the lowest level, information elements are found that are elementary and non-decomposable, for example: the interest base used within the bank (23). These information elements typically represent information that should be derived from the customer, the process owner, or even a third party.

Note that the relations between information elements in the form of production rules may be rather complex. For example, the age of an applicant for a life insurance may be used to estimate *both* the involved health risks *and* the risks of work-related accidents. Secondly, there are typically multiple ways to derive the value of an information element, i.e. there may be more production rules available for the same information element. For example, health risks may be estimated using either a questionnaire or a full medical examination. All these types of dependencies can be taken account in a formal *product-data model*, which completely specifies all information elements and their production rules (Aalst et al., 2000).

A new process design with PBD can then be derived on the basis of all of the following:

(a) The product-data model.

(b) Optimization goals.

(c) Empirical data.

Optimization goals are often formulated in the reduction of cost and flow time. The empirical data typically addresses aspects that influence these optimization criteria, such as the time and cost that is involved with determining values of information elements.

Each process step in the newly derived process involves the gathering of information (of values of elementary information elements) or the processing of information (to derive the value of an information element on the basis of the values of information elements it can be decomposed into). Process steps are performed by human experts if it involves expertise that cannot be formalized and by computer programs otherwise. The precedence relations in the process design must respect the relations in the product-data model (conformance) (Aalst et al., 2000), i.e. information cannot be used in a processing step if it is not created earlier.

Aalst et al. (2000) describe two types of strategies for the derivation of a process design on the basis of a product-data model: *breadth-first* and *depth-first*. The breadth-first strategy optimizes the process design with respect to flow time, but possibly at high costs. It does so by pursuing maximal parallelism in the processing of information. In this way, its is possible that superfluous information is determined.

The depth-first strategy minimizes the average costs of process execution, but with substantial longer flow times. The main issue in applying a depth-first strategy is to identify *knock-outs*: processing steps that, once completed, may stop the process. An example is the failure of an applicant to identify him- or herself. To achieve optimality, knock-outs should be ordered in a decreasing effort to produce the desired information and in an increasing order of termination probability (Aalst, 2000). Mixed strategies are also possible. The characteristic form of breadth-first and depth-first processes are visualized in Figure 2.

Figure 2: Breadth-first and depth-first processes

The former description is not intended to give the impression that the derivation of the process design from the product-data model is a completely mechanical procedure. Although the contours of the design are easily obtained as described, as well as the logic constraints that must be satisfied by it, a considerable effort must be spent in detailing the design in such a way that it conforms with the optimization goals. The measures of freedom for ordering (or not ordering) information elements are generally so large that not all process lay-outs can be generated, let alone considered. A certain amount of creativity is still required to select the most hopeful scenario's, which can be further validated and evaluated. The case study that is to follow supports this point.

Note that an important difference between PBD and traditional approaches is that PBD does not take the existing process as the starting point of the BPR initiative. Rather, it focuses on the very legitimization of the process: the products it should deliver. Although empirical data on the execution of an existing process may come in use for arguing the quality of a new design, PBD can be characterized as a relatively clean-sheet approach. PBD does not question the products to be delivered by a company. It puts them at the forefront to guide the design of a new process. It does require the company to have a clear view on their products. In this way, it can also be used to detect holes in product specifications. In short, PBD can deliver the fastest or least costly way of producing an information-intensive product by considering its essential ingredients.

Earlier applications of PBD resulted in process designs that were radically different from the existing processes they replaced. Typically, flow time reductions of up to 35 % and reductions of operational cost of up to 75 % were achieved (Crom and Reijers, 2001). Note that the PBD method is explicitly focused on the so-called technical challenge of BPR. The success of any BPR initiative strongly depends on addressing sociocultural, organizational, and project management issues *as well*. Preferably, PBD should be incorporated in a comprehensive approach covering all these issues. We also believe that well-founded participative design approaches certainly have their merits (e.g. Sherwood-Smith, 1994; Hermann and Walter, 1998). In fact, in an earlier application of PBD we have used prototyping that heavily involved end-users to validate the new process design (Crom and Reijers, 2001). What we do object to is the marginal importance of quantitative and analytic methods in the prevailing practice of process design.

Having stressed these important issues above, we will focus in this paper on the phases a PBD project goes through from a technical perspective. The phases are as follows:

- *Scope*: In this initial phase the process that will be subject to the redesign (or design) is selected. The redesign objectives for this business process are identified, as well as the limitations to be taken into consideration for the final design.
- *Analysis*: A study of the product specification leads to its decomposition into data elements and their logical dependencies. The existing business process – if any – is studied to retrieve data that is both significant for designing the new business process and for the sake of evaluation.
- *Design*: Based on the redesign (or design) objectives, the product specification decomposition and some estimated performance figures, one or several alternative business process structures are derived. A business process structure consists of tasks that retrieve or process data elements.
- *Evaluation*: The alternative business process structures are verified, validated with end-users, and their estimated performance is analyzed in more detail. The most promising designs are presented to the commissioning management to assess the degree in which objectives can be realized and to select the design to be implemented.

These phases are proposed to be executed in a sequential order, but in practice it is very plausible and sometimes desirable that iterations will take place. For example, the evaluation phase explicitly aims at identifying design errors, which may result in rework on the design.

We will use the presented phases of the PBD methodology as a structure for the case description in the following section.

AN APPLICATION OF PBD

Context

The application of PBD we will describe in this section took place for the ING Bank. The ING Bank is part of the ING Group, which is a global financial institution of Dutch origin. The group is active in the field of banking, insurance, and asset management in 65 countries with more than 100,000 employees. The project in which we participated took place during the years 2000 and 2001. Its primary aim was to redesign the ING bank's business process for handling credit applications of commercial parties. This process is executed at all the 350 Dutch offices the ING Bank, handling about 35,000 applications for loans and credit facilities on a yearly basis. The project also involved the development of new applications, systems integration with existing applications, and the introduction of a Workflow Management System (see e.g. Jablonski and Bussler, 1996) to support the process execution. Overall, the size of the project team consisted of some 40 full-time equivalents. The project is still underway in 2002, rolling out the redesigned processes and new applications throughout the Dutch offices. Because of the size of the project, it is only possible to give the highlights on our experiences with the application of PBD.

Scoping

The credit application business process was selected for reengineering, because of the ING Bank's top management suspicions that considerable cost reduction could be achieved within this business process. Earlier projects indicated large inefficiencies in current working practice.

The initial boundaries of the redesign project were subsequently determined by selecting two products out of a range of six similar credit products: the current account credit (CAC) and the loan with fixed interest (LFI). At the time of selection, the two products generated 70 % of the total credit facility turnover of the ING Bank. After the initial business process design would be completed for these two products, the redesign of the other four products would follow.

Initially, considerable effort had to be paid to further specify the scope of the redesign project. Illustrative for the involved issues is the specification of the redesign scope, which is as follows:

- *Increases* of credit limits on existing CAC and LFI contracts were included in the redesign scope.
- Within the redesign project the business processes would be considered for handling applications for CAC and LFI products *up till the moment* that the (first parcel of the) credit would be available to the client; processes to support the use of the credit facility were excluded.
- The *client segments* considered within the redesign scope were all commercial parties, excluding the top multinational accounts and the private banking accounts.
- The primary *channel* to be considered for the application of credit were those that stream in through the standing offices; all other channels (e.g. Internet) were initially excluded from the scope of the project.

Considering this scope, the redesign objective for the project was formulated as follows:

Realize a substantial efficiency increase of the processes within the offices and operations for handling applications of LFI and CAC credit and shorten the throughput time of those processes by redesigning them from client to client using automation, outplacement, or rendering superfluous.

The "substantial efficiency increase" was not formally made operational, but among the project members and project management a figure of 30 % was considered as a minimal requirement. With respect to the throughput time, an average of 2 working days was thought to be a good result.

A short feasibility study was performed to assess the applicability of the PBD methodology. This study focused on the two following issues :

1. The adequateness of the material to base the PBD analysis upon.
2. The adequateness of the expected gains of applying PBD in this particular project.

With respect to the first issue the information specified in the form of formal procedures, circulars, commercial objectives, etc. seemed in general adequate to describe most of the involved product specifics. One notable exception pertained to the authorization part of the business process: under what conditions would an account manager's tender for a credit loan be authorized for disclosure to a client? As it turned out, this part of the business process was governed rather by custom than by formal procedure. A special workgroup was established to formulate the company's policy in this area.

The second issue was addressed with the outcomes of a previous project that identified as a primary source of inefficiency the multiple data-entry of similar information during the business process execution. It was expected that a business process design based upon a non-redundant product-data model would elevate this inefficiency for the greatest part. The previous project also indicated that considerable time and effort was spent on writing an explanatory memorandum that accompanied the credit proposal. From a preliminary study of the product specification, the need for the memorandum did not become clear.

As a final step of the first phase, a considerable number of information systems were identified that were not allowed to be subject to system development efforts. In other words, these systems should be left unchanged. The primary reason for these systems being treated as *black boxes* was: that a system was in use to support business processes delivering other products, that it did not belong to the ING Bank, or that its content was used by other systems. A prominent example was the involved financial information system, which was also intensively used by the ING's general ledger system.

Analysis

The analysis phase involved a thorough study of the product specification of the CAS and LFI products. This analysis was carried out in three months by a mixed team of seven consultants and banking professionals. Considerable effort was required (and spent) on training all team members with the PBD way of information analysis and reporting. It proved to be hard for people familiar with the existing business process to release the existing conceptions on the ordering and content of work. Moreover, business people tended to find the information-driven analysis not always that appealing. Also, some attention had to be paid in maintaining a comparable level of detail in the description of information elements delivered by different project team members. Finally, periodic meetings and inspections were required to ensure that information elements were specified only once.

The initial, complete product-data model comprised 580 information elements. Somewhat over 120 information elements were linked to the initial application for credit and the characteristics of the client. Almost half of all the information elements were associated with the tender sent to a client in response to a credit application, which specified the conditions under which the loan could be granted. Other information elements were the result of e.g. checks, intermediate credit calculations, and internal communications.

After the initial analysis and design phase, the decision was taken to determine the overlap of product-data models of the CAC and LFI products on the one hand, and the remaining four credit loan products on the other. This was to determine whether the business process design on the basis of the initial product-data model could be used for handling other credit products. Large similarities were found, which resulted in so-called *generic* product-data models. In a generic product-data model, information elements are included that may be used by a single product or by more products.

A specific part of the analysis phase concentrated on the information exchange with the black box systems. As we explained in the previous section, these systems were to be left unchanged. However, these systems provided relevant information for credit loans, e.g. current credit rates, creditworthiness scores, etc. So, in order to obtain this information to handle actual loan applications it was vital to obtain the information that was required to operate these systems. Context graphs were used to depict exchange relations, including the number and names of the exchanged information elements.

When the analysis phase was concluded, a comparison was made between the found information elements and the information being processed in the current business process. It showed that *almost 30 % of the originally obtained pieces of information were superfluous*, i.e. they could not be justified on the basis of the credit product specification. Likely reasons for this part of information were historic system migrations, temporary (marketing) needs, additions of cross-checks, etc.

Design

The design of the first business process version took place during the next two months of the project. On the basis of the product-data model, an initial business process design was derived. First, a set of workable tasks was determined that each incorporated one or more production rules. At the highest level, the design pursued a depth-first strategy, ordering the existing knock-out tasks in a sequential and optimal way. A certain knock-out within the process was, for example, the applicant's appearance on a black list. In between the knock-out tasks of the business process, tasks that were not causally related were structured sequentially when there were strong ergonomic reasons for this and put in parallel otherwise. For example, the respective tasks of entering general proposal data and entering data for the proposal on the specific credit products offered were sequentially ordered, because account managers thought this to be a natural order. However, on the basis of the product-data model there were no reasons to order them. An example of tasks that were put in parallel are the issuing of the order for the credit availability, the actual release, and the reporting to the Dutch National Bank Authority (DNB). So, at a low level, a breadth-first strategy was pursued when this did not interfere with logical wishes of the business process executors. A simplified version of the designed business process is depicted in Figure 3. The business process is represented as a Petri net, where rectangles represent active parts of the process (tasks) and circles the passive parts (milestone) (Aalst, 1998). Specific production rules are not depicted.

Figure 3: Business process design for credit applications

One important additional measure was made that had an impact on the design. This decision involved the authorization procedure and the memorandum we mentioned earlier. Empirical study showed that the memorandum was in many cases not used by people authorizing credit proposals. Only for the really difficult 30 % of credit applications, the memorandum was seen by the people authorizing the proposals as adding value. As a result, the formal policy proposed by the special workgroup included a so-called *triage* for simple and difficult applications. Difficult applications would require an accompanying memorandum, where simple ones would not. This distinction resulted in a similar distinction within the business process design with a so-called *Fast Track* for simple applications and a *Regular track* for complex ones (see the task "Determine track" in Figure 3). The development of a new application supporting the process actually simplified the enforcement of this new policy, as account managers writing the proposals did not get the opportunity to specify this kind of information anymore: the user-interface simply did not include space for it when it was determined that the credit application was simple. Note that the distinction of the two tracks is not given in by PBD, but made by the designers on the basis of an evaluation of empirical data. This stresses the point we made earlier about the additional creativity that is required to deliver good designs.

The next stage of the design phase of the project involved the extension of the derived business process model with the other credit products, which we will not discuss here.

Evaluation

The evaluation of the business process design took place on several levels. In the first place, the business process model was checked with the tool Woflan (Verbeek, Basten and Aalst, 2000) to detect logical errors, such as dead-locks and improper completion options. Manual inspections on the ordering of the production rules were performed to check their consistency with the product-data model. The latter activity was rather laborious, which gave rise to the need for automated support.

With respect to the validation of the derived business process model, the first validation step took place within the project group. Halfway through the project, the project group was extended with business professionals from office branches that worked on handling credit applications and had deep knowledge of the existing process and common work practice. On the basis of their comments, stricter orderings were made within the business process to enhance its usability. A second validation step took place by designing Graphical User Interfaces (GUI) windows of the process support system to be designed. For each task of the business process, one or more GUI windows were designed. A GUI window displayed all the information elements that were available for carrying out the corresponding task and also displayed the information elements of which the values should be determined within this task. Although the windows were "dumb", i.e. no production rules were involved, this way of validation indicated a number of information elements (+/- 20) that were not completely well-defined, and a smaller number of missing information elements. The design was corrected in response to these findings.

A thorough performance evaluation of the designed business process with respect to the work capacity took place with the Petri-net based simulation tool ExSpect (Hee, Somers and Voorhoeve, 1989). The structure of the process design as a Petri-net was extended in ExSpect with a stochastic arrival pattern of new loan applications, stochastic timing of the separate tasks, stochastic routing behavior at splitting points, dependencies between non-automatic tasks and their required human operators, and the availability patterns of the various resources. All this information was derived from actual information on the existing process if possible and on expert estimates otherwise. The ExSpect capabilities of simulation subruns and reliability intervals were used to determine whether effects on the various indicators were significant.

The simulation study indicated an expected decrease of labor hours of 40 %. Alternative business process designs with e.g. different orderings of tasks were also studied, but did not yield significantly higher expected savings. The single entry of each piece of information, the identification of the "Fast Track" and the automated, integrated support to the workforces by the new process support system were identified as the major sources of efficiency gains. On a minor scale, a more-focused definition of tasks contributed to the efficiency gains. A simultaneous independent evaluation of the Human Resources task group of the BPR project group on the basis of the new task descriptions rendered almost the same expected gain.

The final step in the evaluation phase was a pilot project for two of the twenty districts the ING operates during the last months of 2000. The pilot projects were conducted when the process support system was being developed, so only the new *procedure* – including the single recording of information and the different tracks – was used in handling some 140 new applications. The pilot evaluation indicated an efficiency increase of 15 % and a reduction of the flow time to an average of less than 1 working day. On a more qualitative level, the business process design was evaluated by the business professionals as both workable and agreeable. The throughput time and the qualitative evaluation were highly satisfactory given the project goals, but the efficiency increase was slightly disappointing – despite the lack of automated support of the new business process. Closer inspection indicated that the ratio of simple and complex applications during the pilot project was 41:59 instead of the 70:30 assumed during the design and performance evaluation. Not only was there a coincidental increase of difficult applications, it was also found that people were rather reluctant to decide that an application was simple, even when the formal definition was satisfied. Also, a considerable learning effect had taken place. This could be established on the basis of the number of calls to the support desk, which steeply declined when the pilot project continued. Overall, the results of the pilot project were thought to be convincing enough to decide on a roll-out of the new business process design throughout the Dutch ING branches and further development of the new process support system. These activities have continued throughout 2001 and 2002.

CONCLUSION

In this paper, both the theory and practice of designing a business process in a product-based way have been presented. By taking the product as a starting point many of the problems related to participative approaches can be avoided. By now, the Dutch consultancy branch of Deloitte & Touche have applied the method presented in this paper in three other client engagements. The advantages of PBD can be summarized as follows:

- It enables a *rational* decision making process on the parts to include in a new process design, as it explicitly builds on product characteristics.
- Its design process is *formal* and *explicit* which greatly helps the justification of the final design.
- Its deliverables are *formal* and *explicit* which diminishes the risks on misunderstanding between involved parties.

These factors are very different from the traditional BPR approach we sketched. On the other hand, a PBD effort is *very labor-intensive*, as product specifications are to be analyzed thoroughly. The cost involved should be related to the expected gains of the BPR effort. PBD seems to be cost-effective in information-intensive settings with relatively high volumes of cases (e.g. banks, insurance companies, government agencies). We also experienced that traditional IT departments had difficulties in accepting a practice different from developing new systems first and then molding the business process to using them. Creating awareness as well as training of the project members seems to be a prerequisite for successfully applying PBD.

The method of product-based process design is a promising new way of executing BPR initiatives. A practical boost would come from the development of tools to specify product-data models and derive business processes from it. Also, a tighter integration with (component-based) system development methodologies seems possible. Production rules offer a good basis for specifying the functionality of information systems that are to be developed. Already, we had some good experiences with prototyping on the basis of the PBD deliverables (Crom and Reijers, 2001). A direction for integrating PBD with a component-based system development methodology is given by Reijers and Van der Toorn (2002). We hope that the spirit of PBD – a rational and formal approach of BPR – will positively contribute to the BPR projects that will be executed in the next coming years.

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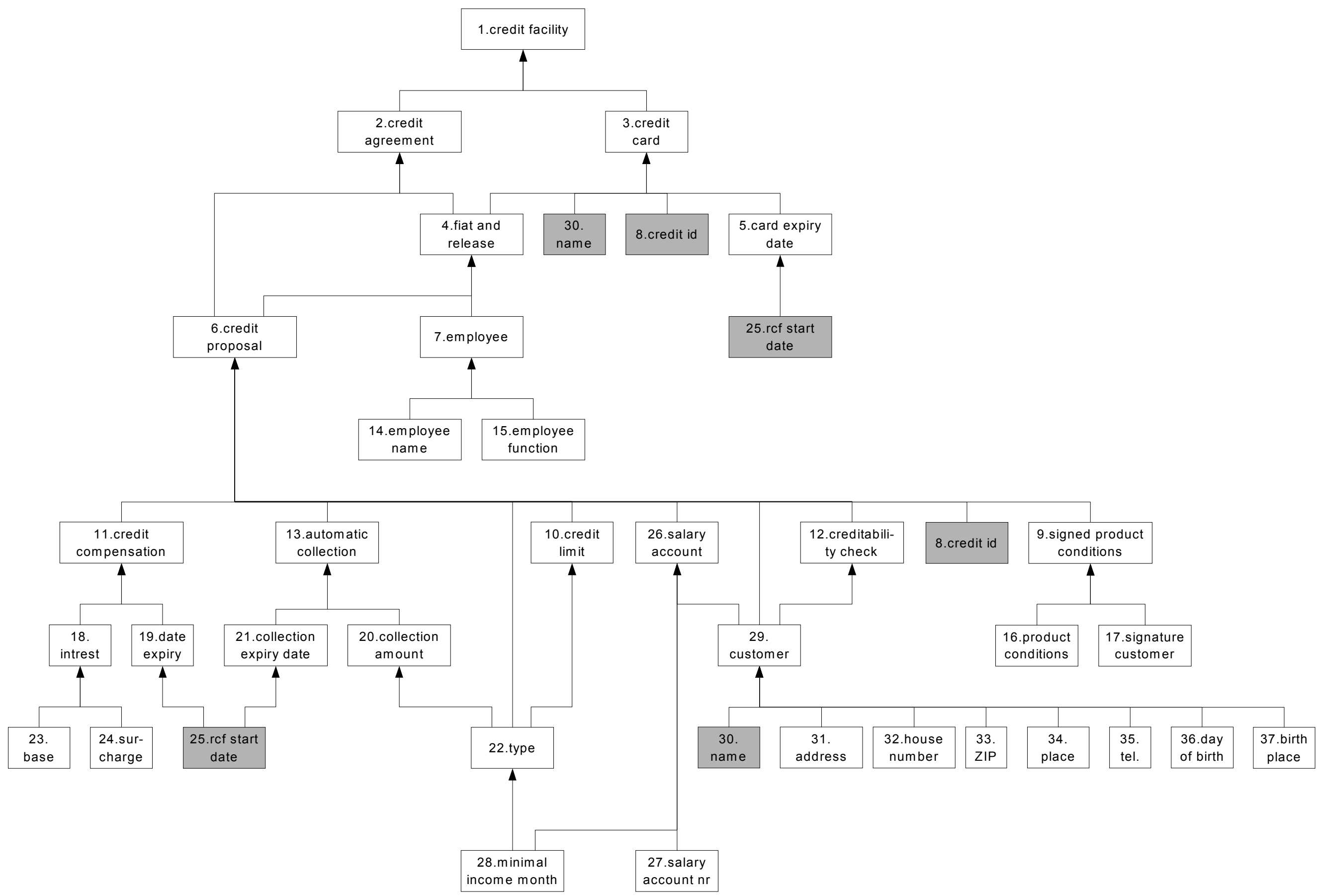

Figure 1: A credit facility example

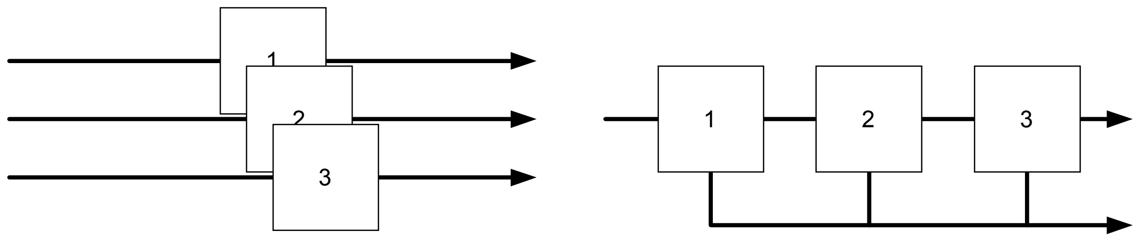

Figure 2: Breadth-first and depth-first processes

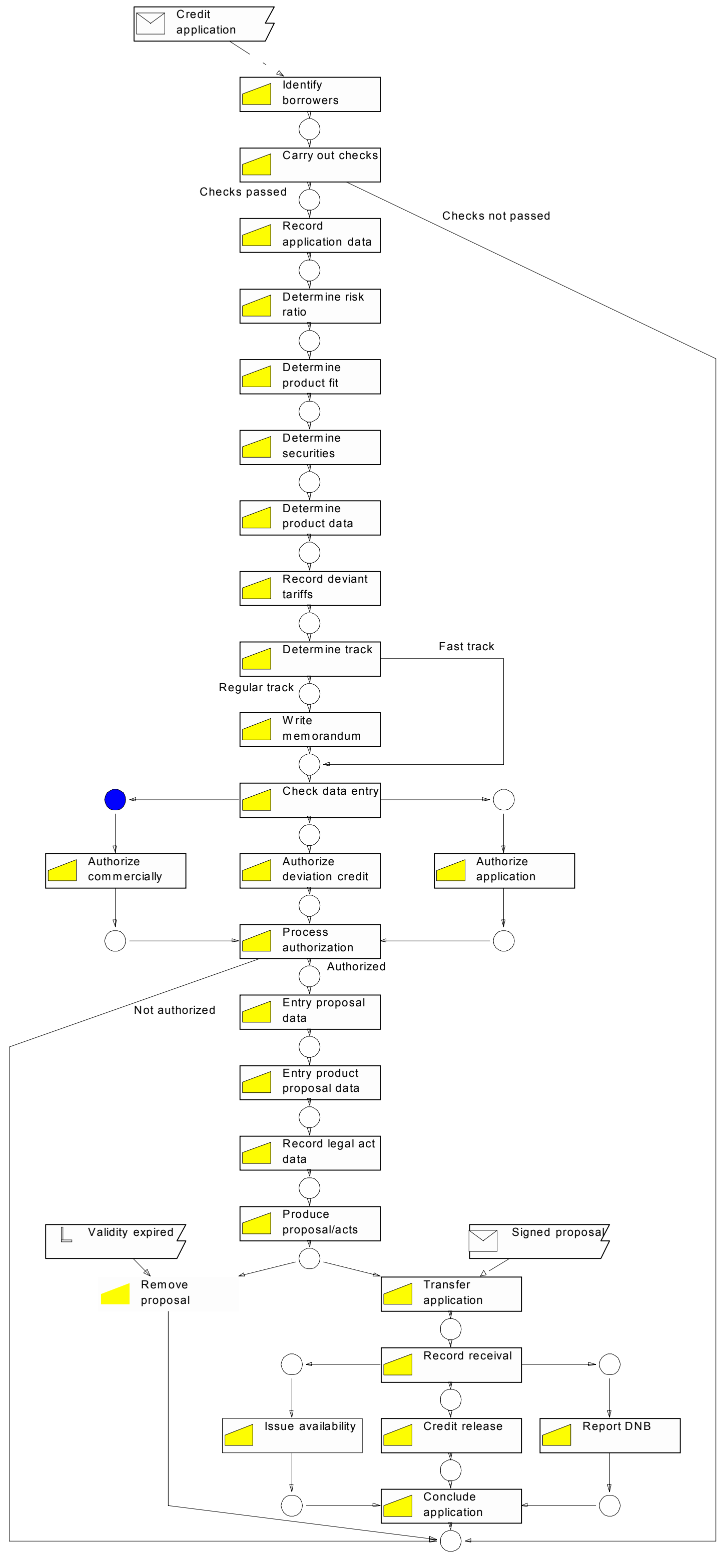

Figure 3: Business process design for credit applications