# A framework to evaluate methods' capacity to design flexible business processes

Feriel Daoudi, Selmin Nurcan

# A framework to evaluate methods' capacity to design flexible business processes

Feriel Daoudi [1]

Selmin Nurcan [1, 2]

[1] Centre de Recherche en Informatique
University Paris 1-Panthéon-Sorbonne
90, rue de Tolbiac
75634 Paris cedex 13 France
Feriel.Daoudi@malix.univ-paris1.fr

[2] IAE de Paris
(Sorbonne Graduate Business School)
University Paris 1-Panthéon-Sorbonne
21, rue Broca 75005 Paris France
nurcan@univ-paris1.fr

**Abstract.** The assumption done in this paper is that changing processes require specific methods for their design. The decision of adopting a method for modeling flexible processes depends on many criterions and situations. Accordingly, we propose a framework with a list of criterions. The user can use it as a decision support framework for the choice of a modeling method. We used two enterprise modeling approaches to illustrate the proposed framework.

## I. Introduction

The flexibility of business processes passes by the way of managing and/or modeling them. Indeed the monitoring of those business processes can be facilitated by the use of adequate modeling techniques. The best way, from our point of view, is to ensure the modeling of business processes from organizational objectives they allow to reach, to the software components included in the supporting systems in a complete way (being top-down, bottom-up or mixed). This way of thinking is partially adopted by software publishers providing panoply of tools to model enterprises in a global and coherent way. It also underlies EAI solutions that aim to integrate enterprise applications in order to avoid discontinuity in business processes those applications support.

Today, many enterprises tend to adopt "knowledge management" type of organizational targets and constitute business process warehouses to use them as a support of their reflection. It seems obvious that some changes can be anticipated making simulations on enterprise models stored in those business process warehouses. In order to achieve that, it is also imperative to choose appropriate enterprise modeling techniques and to be sure that those techniques meet users' needs. Several modeling techniques exist and the choice of the one(s) being able to support the required flexibility is not easy. On the other hand, benchmarking should not be

restricted only to IT products but extended to other enterprise modeling approaches. In this paper, we propose a framework that permits to evaluate methods' capacities to facilitate the design of changing business processes. We have chosen two approaches, EKD-CMM and ARIS, and used them to illustrate the proposed framework.

## II. Suggested framework

Process flexibility can be perceived differently. The meaning it takes determines (settle) the way to handle the flexibility topic. From our part, processes flexibility is the fast reactivity to internal and external changes that affects the enterprise and the easiness to modify business processes schemes and to set up the new enterprise activity. This flexibility is reflected by the ability that the information system (IS) has to take into account enterprise activity changes. This perception (vision) of process flexibility arises the need to get a structuring framework to explore the characteristics (behavior) of a method to cope with this issue.

In the information systems literature, a design method is generally viewed as a couple of a way of working (process model) and a way of modeling (product model) [2], [3]. This definition of a method was also applied to business process design and development methods [8]. The product is a set of diagrams or schemes describing the new system to be constructed and the organization in which it will operate [10], [11], [12]. The process keeps track of how the product has been constructed. A process and its related product are specific to an application, to a domain or to the whole enterprise. The Product Model defines the set of concepts, their properties and relationships that are needed to express the outcome of the process. A Process Model is a description of processes at the type level. It defines how to use the concepts defined within a Product Model and may serve two distinct purposes: descriptive or prescriptive [4], [5]. A descriptive Process Model aims at recording and providing a trace of what happens during the development process [6]. A prescriptive Process Model is used to describe "how things must/should/could be done". Prescriptive Process Models are often referred to as ways-of-working [7].

In this paper, the framework proposed is the one depicted in Figure 1. It is inspired from the Seligman's framework for the description of information system development methods presented in [7]. As shown in Figure 1, a business process design and development method is described according to four different aspects. Each of them is described using various criterions with explanations on their contributions for flexible business process management. The four aspects of the framework are:

- The way of thinking verbalizes the assumptions and viewpoints of the method on the kinds of problem domains, solutions and modelers.
- The way of working structures the way in which business process models are designed. It defines the possible tasks to be performed as part of the design and development process. It provides heuristics on how these tasks should be performed.

- The way of modeling provides information on the modeling concepts, on their properties and on their relationships. It gives a *formalism* and notation to express business process models.
- The way of supporting refers to the tools that support the design and development of business process models and offers a repository to store and to exploit them. To be efficient, a business process design and development method has to be supported by a tool because the results are exploited daily and have to be produced rapidly.
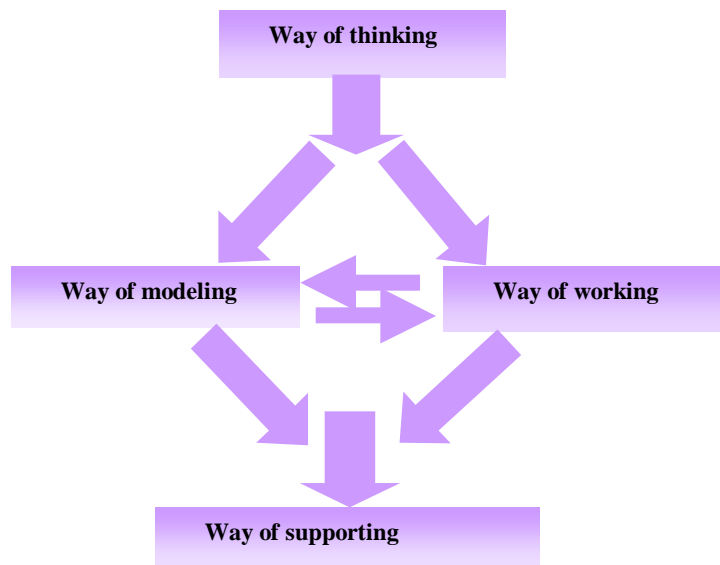
**Fig. 1.** Various aspects of a business process design and development method

## II. 1. Way of thinking

- **Completeness:** it describes the various views covered by a method. Obviously, any modeling formalism has its own modeling views. Their number can determine the possible adoption of the method for a project. There are three main views. The objective (purpose) view is related to goals and strategies that the enterprise implements in its business processes. The dynamic view is related to events, activities and business processes describing the way of functioning of the enterprise. Finally the static view concerns the data, outputs and inputs

produced/handled during the execution of business processes. All modeling formalisms don't necessarily offer concepts to describe the three views. Although to model flexible processes, a method must provide the necessary tool kit to model all the enterprise facets that are impacted by process changes. If it is not the case, the information modeled contains gaps and there is a risk of omitting important details in this design step. It means also that there is a risk of misalignment between new processes and the organization, staff, IS when those processes will be deployed.

- **Targeted users**: Usually a method is intended for a specific kind of users. Users' typology is a deterministic factor for multiple parameters such as formalism, development process, etc. As far as business process design is concerned, the method must be intended at the same time for IT engineers and business actors. Processes flexibility is ensured when the enterprise updates rapidly its processes and the IS supporting them. Indeed the processes flexibility gives arise to the IS/processes alignment topic. Actually to handle this problem, the business staff and the IT staff should work together to design the new way of working of the enterprise. The method should address the two kinds of users offering then the autonomy to each team to design the diagrams concerning it with the possibility to communicate and/or validate its results with other teams.

## II. 2. Way of working

- **Arbitrariness/freedom**: processes flexibility is synonymous to fast reactivity and the easiness to model changes in processes diagrams and in setting up the new enterprise's activity. The purpose of this characteristic is to not make diagrams too time consuming or requiring a large team. In this context, method's arbitrariness contributes in decreasing time and staff number. In fact, each design method offers a certain number of steps and a sequence of them. The degree of freedom offered to the designer concerning the execution of these steps varies (from one method to another). A high arbitrariness means possible parallelism of the steps so time decreasing. This means also the possibility to use some of the proposed modeling formalisms and to omit some others, according to the situation which is synonymous to time reduction and/or staff number restriction. This shows how the random side could be advantageous for a fast reactivity. However, an excess in the arbitrariness slows down the results or leads to a certain anarchy. It is essential to find the equilibrium between freedom and framing.

- **Guidance:** in the application of a method, the ideal is to have activities to be performed and guidelines relative to each situation. In the literature, various design methods offer only explanations related to the underlying modeling formalisms and the diagrams they allow to construct. However guidance concerning the steps to follow is seldom provided by them and it is deplorable. In fact, to easily design flexible business processes the enterprise needs guidelines specific to the context that it undergoes. In this case, guidance can be characterized by orientations

relative to the changes (internal, external…) that are involved. Guidelines can refer also to the methodology that each kind of designer (business staff, IT staff …) should adopt. Guidelines should offer clear choices to the designer according to the modeling situations and his aims. The purpose of guidance is to optimize the designer time-split. Providing guidelines, increases designer's productivity by giving him strategies to follow for each situation or problem he faces. It's supposed to be a way to store situations of change and the way to handling them.

## II. 3. Way of modeling

- **Notation:** it is the mean of expressing concepts via the formalism chosen. Notation can be formal, semi formal or informal. This criterion is an important mean to ensure flexibility. First, it is the guaranty of homogeneity of diagrams such as all concepts and all ways of connecting them are well known. Secondly, it may allow the designer to express all needed concepts without difficulty. If a design method does not offer those two conditions, flexibility seems difficult to ensure.

- **Simplicity:** this element appears in this list because we believe that it is a way to reach flexibility. Simple business process models are easier to design, to understand and to update. Thus simplicity can be characterized by a moderate number of modeling formalisms. It can be characterized also by very significant symbols that have high expressiveness making models manageable. It will be then easy to introduce changes, to remove chunks, to detect inconsistencies, accelerating then new processes' design. Obviously, the principle of simplicity is often in opposition with the principle of richness, so the balance must be attempted.

- **Richness:** a Product Model includes the set of concepts intended to represent the enterprise knowledge. The richness of the formalism lies in the number and the power of expression of the underlying concepts. A representation language is considered as rich if it also offers possibilities of extension as it is the case of the stereotypes in UML. Despite the improvement in modeling techniques by representing several new concepts, some notions are still not represented. For this reason, it seems better to use an open formalism to ensure flexibility. Thus richness is an asset because it allows representing accurately enterprise knowledge. A judicious level of richness is required to represent easily changing processes. This level must permit the integration of specific enterprises' concepts and especially those related to its environment by adding them if they are not available in the product meta-model. Finally as said previously, richness must be controlled because too many concepts are a brake on straightforward comprehension of diagrams by all enterprise concerned staff.

- **Granularity:** it represents the level of decomposition of the designer's vision. All views of the enterprise are concerned by this principle. The granularity can be considered via the number of necessary diagrams to reflect a complete vision of the

business. It can also be reflected by the levels of description of an enterprise diagram. For instance, an abstract diagram can be progressively detailed in more operational ones according to the modeling need. We argue that granularity affects process flexibility because it can facilitate or compromises the reader's comprehension. In fact, abstract diagrams (the first level) are the means to get a rapid and general idea of the enterprise's functioning. The detailed ones must permit the reflection of all the crucial details of the enterprise's ways of working and help managers take decisions and introduce desires and interesting changes. The granularity must be controlled because a large usage of decomposition is not always an ally of flexibility. Thus the designer must make the enterprise diagrams readable dice the first level, to facilitate the comprehension of the readers and their decision-making.

### II. 4. Way of supporting

- **Tool support:** In our opinion, a method is more powerful when it has tool support. The level of tool support may vary from generic drawing and modeling tools (diagram editors) to integrated tool suites that even guide the developers through design and development processes. In the case of business flexibility, designers need processes warehouses to ameliorate continuously their activities. Without tool supporting, those changes are difficult to introduce because they are time and staff consuming which is in contradiction with the definition cited above. Tools also permit simulations and staff initiation which are essential to increase enterprise reactivity to change by implying its organization and whole staff.

- **Connectivity:** activities of business processes are supported by software components developed as parts of the enterprise information system. Those software components should match the requirements of the business process models. EAI technologies tend to ensure communication between them in tight (smooth) way. The aim is to keep the transversal integration from the design until the implementation. To ensure that a method should offer mechanisms to rock from business process modeling to IS development. Thus business processes will be translated accurately and at the same time can ensure efficient reverse engineering permitting then connection with software applications such as EAI and ERP.

## III. Illustration

The list of criterions listed above was applied on two business modeling approaches: EKD-CMM [1], [9] and ARIS [11]. The following list shows how each approach tackles with business process change. This board summarizes this evaluation and reflects advantages and inconveniences that users can meet.

A framework to evaluate methods' capacity to design flexible business processes

| Criterions/Methods | EKD-CMM | ARIS |
|---|---|---|
| **Completeness** | Dynamic+static+intentional | Dynamic+static+objectives |
| **Targeted users** | Business staff, IT staff | Business staff, IT staff |
| **Arbitrariness** | Moderate | Moderate |
| **Guidance** | Supported by MAP | No |
| **Notation** | Semi formal | Semi formal |
| **Simplicity** | High level | Moderate (many concepts and connectors difficult to use) |
| **Richness** | Moderate degree of richness, adding new concepts is not possible | High degree of richness, adding new concepts is not possible |
| **Granularity** | Different levels of abstraction | Different levels of abstraction |
| **Tool** | No | Aris HOBE |
| **Connectivity** | No | SAP R/3, #EAI |

After reading those values, we notice that the gap between the two frameworks is due firstly to the lack of EKD-CMM to provide a tool support and to ensure connectivity with other kinds of applications. The second difference is materialized by the guidance offered by EKD-CMM and that is missing in ARIS. Finally, we observe that the richness of formalism offered by ARIS is caught up on formalism simplicity provided by EKD-CMM. This permits us to recommend EKD-CMM when users are not familiar with rich modeling paradigms and when a tool is not required to share out business process models. On the other hand, ARIS is better for modeling flexible business processes when business staff knows well logic connectors and when tool support is needed to store the produced business process models.

## VI. Conclusion

By making a clear distinction between the different aspects of a method, we were able to find criterions for evaluating its capacity to contribute in business process flexibility. As suggested earlier, method evaluation is imperative before its selection for designing enterprise solutions. Benchmarking must be extended to design and development methods to help the enterprise in creating or maintaining flexible business processes. To attempt this target, users need a mean to position methods in the existing context and also to structure their problem.

The framework proposed in this paper permits that by decomposing a method in two layers. In the first layer, a method is dissected in four aspects: way of thinking, way of modelling, way of working and way of supporting. This layer is supposed to give a structure in order to position the method. Secondly, each aspect is detailed using several criterions in order to reflect situations or questions to which users are

exposed in business process management projects. Thus, we offer a structured evaluation framework to study, in a detailed way, modelling capacities of business processes design and development methods. This was illustrated by EKD-CMM and ARIS to evaluate their adequacy to design flexible business processes. This framework is dedicated to be a decision support for the benchmarking of design and development methods. An extension can be considered by associating metrics to the criterions that can be exploited in simulations.

## References

[1] Barrios, J. and Nurcan, S. (2004) "Model Driven Architectures for Enterprise Information Systems" CAISE'04, Springer Verlag (pub), 2004.

[2] Harmsen, A.F., Brinkkemper, S. and Oei, H. (1994) Situational Method Engineering for Information System Projects. In Olle T. W. and A. A. Verrijn Stuart (Eds.), Methods and Associated Tools for the Information Systems Life Cycle, pp. 169-194, Proceedings of the IFIP WG8.1 Working Conference CRIS'94, North-Holland, Amsterdam, 1994.

[3] Prakash, N. (1999) "On Method Statics and Dynamics", Information Systems, Vol 24, No 8, p. 613-637, 1999.

[4] Curtis, B., Kellner, M. and Over, J. (1992) Process Modeling. *Communications of ACM*, 35, 9, 75-90.

[5] Lonchamp, J. (1993) A structured conceptual and terminological framework for software process engineering. International Conference on Software Process.

[6] Gotel, O. and Finkelstein, A. USA (1996) An Analysis of the Requirements Traceability Problem. First IEEE International Conference ICRE'94, Colorado Springs.

[7] Seligmann, P.S., Wijers, G.M. and Sol, H.G. (1989) Analyzing the structure of IS methodologies, an alternative approach, Proceedings of the First Dutch Conference on Information Systems, Amersfoort, the Netherlands, 1989.

[8] Hommes, B.J. and Van Reijswoud, V. (2000) Assessing the quality of business process modelling techniques, Proceedings of the 33rd HICSS 2000.

[9] Nurcan, S. and Barrios, J. (2003) Enterprise Knowledge and Information System Modelling in an Evolving Environment. The EMSISE workshop in the OOIS Conference, Geneva, Switzerland, September 2003.

[10] Loucopoulos, P., Kavakli, V., Prekas, N., Dimitromanolaki, I. Yilmazturk, N., Rolland, C., Grosz, G., Nurcan, S., Beis, D., and Vgontzas, G. (1998) The ELEKTRA project: Enterprise Knowledge Modeling for change in the distribution unit of Public Power Corporation. 2nd IMACS International Conference on Circuits, Systems and Computers (IMACS-CSC'98), Athens, Greece, 352-357.

[11] Scheer, A.-W., and Nüttgens, M. (2000) ARIS architecture and reference models for business process management, Business Process Management, Van de Aast W, Desel J., Oberweis A. (eds), Springer.

[12] Papazoglou, M.P. and van den Heuvel W.-J. (2000) Configurable business objects for building evolving enterprise models and applications, Business Process Management, Van de Aast W, Desel J., Oberweis A. (eds), Springer.