# Applying Some Fact Oriented Modelling Principles to Business Process Modelling

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**Abstract.** In the context of a business process modelling task within a government department, an adapted version of the first two steps of fact oriented modelling has been proposed as an alternative strategy in the initial stage of business processes knowledge elicitation activities. As expertise and knowledge on organisational processes and procedures are in many cases implicit and embodied by support staff – rather than by highly skilled knowledge workers – it is extremely important to adopt an more accessible method to facilitate the elicitation and validation steps. This paper presents how a small scale experiment has been set up, its results and lessons learnt. Even if a thorough evaluation was out of scope, the experiment sufficiently demonstrated the strength of the analysis by natural language as included in the fact oriented modelling methodology.

## 1 Context and Motivation

One of the targets of the Flemish government, in particular in times of budgetary restrictions, is to have its administration function more efficiently, cut costs and become a leaner organisation. At the Flemish department of Economy, Science and Innovation (EWI) it was decided to analyse and re-engineer the most important business processes and lay out a roadmap from the "as is" situation to the "to be" ideal. An external consultant was contracted to facilitate and support this effort. A task group of civil servants received a first business process modelling assignment. It was striking to see that a majority had started to identify mainly activities and some choice points (or gateways), but without any connecting logic (see section 4.1). Hardly any connection between the process states was established. Also during subsequent discussion it became clear that many civil servants were much more at ease *talking* about the process flow (with the consultant as a Socratic knowledge elicitator) rather than drawing gateways and adding the connecting logic to it (see Fig. 2).

As fact oriented modelling distinguishes itself from other data modelling methodologies by its emphasis on the use of natural language as part of the methodology, it seemed natural to try to re-use and apply principles of fact oriented modelling [4:p. 64 f.f. section 3.3] to business processes or workflow modelling. After all, Natural-language Information Analysis Method (NIAM) [15] (by *Nijssen*) was the basis of fact oriented modelling: statements of domain experts are subsumed into sentence patterns (comparable with templates) to create an information model. The fact that the second

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edition of the Object Role Modeling (ORM) reference work [4] includes a chapter on "process and state modelling" confirms our intuition that fact oriented modelling is not exclusively disjoint from process modelling. A limited literature review (see section 2) revealed that this topic, even if not entirely innovative anymore (cf. e.g. [10]), still leaves room for further thoughts and discussion. In addition, a case study emerged [11] that reported about a positive experience in this respect.

Hence, the major topic of this paper is to present an alternative to the initial stage in the workflow or process modelling method proposed by the external consultant. The alternative consists of a combination of analysis through natural language, typical of fact oriented modelling methodologies, and some knowledge breakdown steps, as included in the DOGMA modelling methodology [14]. Even if based on earlier acquired scientific insights, the experiment presented here does not make scientific claims, but rather is a report on how process modelling on the work floor by lay persons can be improved. The text is structured as follows. After having discussed some related work (section 2), we present the method and material (section 3) and explain in section 4 how the process modelling exercise has been set up. Results and experiences of the experiment are amply discussed in section 5. The paper ends with some ideas for future work (section 6) as well as with a concluding section (7).

## 2 Related Work

Seen our context (governmental organisation, no scientific ambitions, report on practical experience), we focused on the combination of business process modelling with fact oriented modelling. To our – albeit probably limited – knowledge, only a few authors mention this combination. Even if the ORM2 handbook [4: chapter 15 pp. 773 - 833] includes a chapter on business process modelling, *Halpin and Morgan* rather provide an introduction to workflow modelling (and popular graphical notations) in general. The structure of a process, represented by several ORM2 meta-models of process constructs is their main focus [4: p.780, 7].

*Bollen* models processes by starting from a data model that is the result of fact oriented modelling steps (the inside-out approach) [2]. His basic idea is that the relevant static domain description is represented by the data model so that the knowledge engineers have to additionally model the dynamic aspects, and map these into Business Process Modelling Notation (BPMN) constructs [1]. In his view this can to a very large extent be done by including derivation rules – see [1] for an overview on the matter – in the data model. The process flow is considered as a set of (approved) transitions from one stage of the knowledge grammar to another. He has created an ORM meta-model for palette 1 BPMN constructs using the fact oriented modelling methodology [3]. As far as we know, he has not (yet ?) applied his model to real-life business process modelling cases.

Less directly related, but nevertheless still relevant for our purposes, work concerns the story telling based (or narratological) ontology modelling technique by *Zhao* [16] integrated in the DOGMA approach [14]. A story seems to be a natural "vehicle" to describe a workflow in an almost casual way. Reducing stories into episodes,

which are further to be segmented into elementary sentences, is a crucial step to distil lexons (i.e. the DOGMA denomination defined by *Meersman* for a more formal – but still linguistic form of – plausible binary fact types about a universe of discourse [5,12]). A subsequent step is to semantically ground the constituents of a lexon [13].

Another not so remotely related modelling standard is SBVR (Semantics of Business Vocabulary and Business Rules) [9] by the OMG Group (Object Management Group). Although the immediate aim of the EWI business process modelling exercise was not to define precise semantics or to create an ontology, it will in the long run be advantageous if the business process vocabulary is grounded by precise semantics.

## 3 Material and Method

Just as in any important knowledge engineering project, some preparatory actions were executed before the experiment at hand started. The preparation stage mainly concerned defining the scope of the overall project, the identification (and prioritisation) of major processes in the EWI department, and the selection of a method and tools. We will not elaborate on these aspects as most of them do not present any general (scientific) interest.

The EWI department subsequently set up an internal enterprise architecture project team. The team members hold different functions, have various backgrounds[1] and different levels of initial expertise with knowledge modelling and enterprise architecture. An external consultant, PriceWaterhouseCoopers Belgium (PWC), was contracted to facilitate and support the modelling exercises. One can reasonably expect the PWC team members to be professional experts in business process engineering. In order to familiarise the EWI project team involved in the process (re-)engineering effort, the consultant gave an introductory course on workflow and enterprise architecture modelling. Eventually the EWI project team members were supposed to model and (re-) engineer themselves the EWI business processes and enterprise architecture. After the introductory course, three subgroups of the project team each had to model an important process within the department as an exercise.

In this paper, we discuss the process of handling incoming requests for information.[2] At the end of a modelling session, the external consultant should have gathered enough information to draw a process model. The external consultant used MS Visio as complementary tool (with a specific

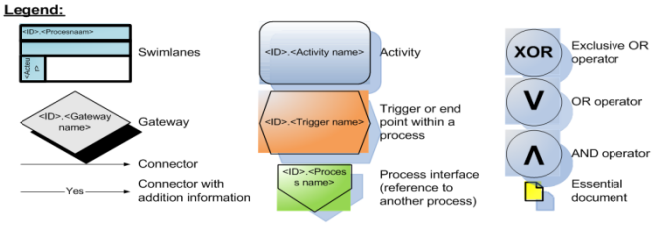


**Fig. 1.** Some BP modelling constructs

[1] Such as economy, library science, chemistry, bio-engineer, public administration.
[2] We have selected this particular process for this paper as it is quite universal.

cil) to draw the workflows (see Fig. 1 for the constructs used[3]). For subsequent modelling steps, the consultant developed some specific Excel forms to capture additional textual information, e.g., to describe information objects and applications used.

The experiment took place during two sessions: a so-called naive process modelling session (see section 4.1) and a fact oriented session (section 4.2). The former consisted of the steps and activities following the methods of the consultant as foreseen in his contract with EWI. The author, who is part of the EWI project team, participated in both sessions. At the same time, he observed his colleagues and the consultants. Afterwards, he analysed their results and interactions in order to formulate an alternative method. During the latter, the author applied this alternative method to another major administrative (and formally constraint) process as well: providing a reply by the minister to a question by a member of the Flemish Parliament. Nevertheless, for the easy of reading of this paper and due to space restrictions, the "request for information" process is elaborated in the following sections.

# 4 Two Ways of Modelling Business Processes

## 4.1 "Naive" Business Process Engineering

The (few) EWI civil servants quite familiar with (or interested in) formal information modelling and/or MS Visio managed to structure their conceptualisation of the process resulting in a nicely drawn flow. Fig. 2 however displays a model prepared by a less "knowledge engineering savvy" group. What immediately strikes the eye is the (almost complete) absence of connecting edges, logical operators, swim lanes and end point. One can summarise safely that these civil servants were well able to distinguish the main activities, decision points and certain activity sequences (although represented implicitly by the position of the activity boxes), but did not master the (graphical) modelling language and principles well enough.[4] This initial model has been discussed and enriched in subsequent discussions by the entire EWI project team. The consultant facilitated the discussions by reconciling various points of view, noting down the intermediate conclusions and using post-its to lay out the process flow on the wall.

With this material the consultant subsequently created an "as-is" workflow model (after a final validation by the project team). The consultant was, as expected, at some points unfamiliar with the terminology used by the civil servants. Some semantic assumptions, being important for a correct "as-is" flow, remained implicit and led the consultant on the wrong track. Some misunderstandings were clarified during the first

[3] This stencil has been made by the consultant without any further explanation. The number of BP modelling constructs is very limited and basic – e.g., no timing or event primitives – maybe to reduce the learning curve for the EWI team members. Its idiosyncratic notation seems to be only remotely inspired by BPMN.

[4] Some actually stated that they did not have enough time (or interest ?) to invest into using Microsoft Visio and the modelling stencil prepared by the consultant – see Fig. 1. Another explanation could be that they didn't master MS Visio enough.

group discussion; others were only detected during the final validation phase. And as with any group discussion, group dynamics sometimes may lead to adopting the position expressed by the loudest voice, which is not necessarily the most correct voice. In short, the primary means to convey domain or process information during these modelling sessions was natural language (spoken and written), which echoes findings of another recent real life fact oriented modelling case study [8: p. 751]. Hence, improving the knowledge elicitation steps implies applying and improving techniques focusing on the use of natural language.

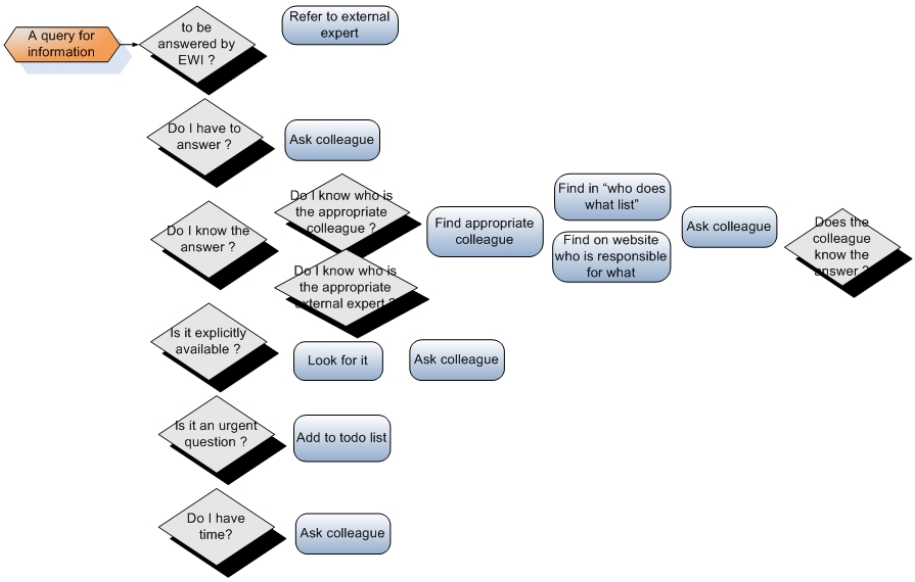


**Fig. 2.** Initial model for the EWI business process "finding information"

### 4.2 Fact Oriented Inspired Business Process Engineering

The idea, as explained in [14,16], is to firstly compose a story (from scratch by an individual, as a summary of existing documents or as a result from an initial group discussion) – see Fig. 3. Available documents describing official procedures already contain important parts of such a story, or even the entire story in "disguise".

Depending on the complexity of the domain, the skills of the domain expert with fact oriented analysis through natural language, the volume of available text, (s)he can immediately produce elementary sentences (see Table 2) starting from the story itself or proceed via an intermediate stage first. In the latter case, one first decomposes a story into several episodes (see Table 1).

*External persons send requests for information to the EWI info email address from where the EWI communication manager routes the question to the most appropriate head of division, who in turn forwards the question to his most appropriate collaborator. Or the head of division returns the question, possibly on behalf of his/her collaborator, as not relevant/related to his/her division – maybe suggesting another, more appropriate division or civil servant.*

*The collaborator who accepted the question composes an answer after having browsed through his/her (physical) sources of information and/or having consulted other (external) parties responsible for a part of the answer. If the collaborator is not the most appropriate person (s)he explains why not.*

*The head of division might perform some quality control on the proposed answer and sends the final answer to the EWI contact-point who archives the answers and eventually provides the requester with the answer.*

**Fig. 3.** A simplified "information request" story

**Table 1.** Episodes of the "information request" story – cf. Fig. 3

| | |
|---|---|
| E.1 | A request for information is received. |
| E.1.1 | The communication manager receives a request for information. |
| E.1.2 | (s)he passes the question on to the most appropriate head of division. |
| E.1.3 | The head of division forwards the question to his most appropriate collaborator. |
| E.2 | The head of division returns the question, possibly on behalf of his/her collaborator, as not relevant/related to his/her division – maybe suggesting another division or civil servant. |
| E.3 | The collaborator processes the request. |
| E.3.1 | The collaborator rejects the question and explains why. |
| E.3.2 | The collaborator accepts the question. |
| E.3.3 | (s)he browses through his/her (physical) sources of information and/or consults other (external) parties responsible for a part of the answer. |
| E.3.4 | The collaborator composes an answer and sends it to his/her head of division. |
| E.4 | The head of unit processes the answer. |
| E.4.1 | The head of unit reviews the answer. |
| E.4.2 | (s)he forwards the answer to the contact point or ask his/her collaborator to improve the answer. |
| E.5 | The communication manager archives the answer. |
| E.6 | The communication manager sends the answer to the requesting party |

An episode can be loosely considered as a "part of the story plot" or an intermediary level (E1, E2, …, E6) of granularity that groups some related activities (e.g., E.3.1, … E3.4). Creating episodes is a first way of decomposing a story into smaller units that are usually chronologically and hierarchically ordered. Some similarities with drawing

activity hierarchies (cf. [4: p.779]) hold. As Zhao proposes [16], simple techniques (segmentation and highlighting) can be applied and specific forms can be used to document the various modelling rounds [14,16].

A domain expert can subsequently transform the sentences of the episodes into elementary sentences (see Table 2) that are defined as sentences that cannot be reduced into smaller ones without a loss in "vital" information [4: p.63] – e.g., no subordinated sentences. Many of the "rules" described in the step 1 of the ORM conceptual schema design procedure (CSDP) [4: p. 63-81] can be applied to reduce sentences of a story or of an episode into elementary sentences. It is expected that natural language processing tools (parser) can largely automate this procedure. As noted by Proper et al. [10], and quite common knowledge in the field of linguistics, activities are mostly expressed by a particular class of verbs (not surprisingly called *action verbs*). When creating elementary sentences, care should be taken to include a meaningful *actor* and *item* of the activity as they represent relevant business information objects and roles. A tripartite template "*actor – activity – item*" was used.

**Table 2.** Some sample elementary sentences derived from Fig. 3

| *Actor (subject)* | *Activity (verb)* | *Item (object)* |
|---|---|---|
| Person | Mails | Request |
| Communication manager | Receives | Request |
| Communication manager | Forwards | Request |
| Communication manager | Forwards to | Head of division |
| Head of division | Forwards to | Collaborator |
| Head of division | Quality checks | Proposed answer |
| Head of division | Forwards | Request |
| Collaborator | Assesses | Request |
| Collaborator | Accepts | Request |
| Collaborator | Consults | Sources |
| Collaborator | Forwards | (sub)request |
| Collaborator | Refuses | Request |
| Collaborator | Composes | Answer |
| Communication manager | Archives | Final answer |

A first draft of a graphical BP model can be drawn on the basis of the set of elementary sentences or triples (= a row of Table 2) as a result of the following transformation. The *actor* slot of a triple contains the basic label for a BP swim lane, the *activity* slot includes information on the BP activity boxes while many relevant information objects can be found in the *item* slot.

Various (real life) examples are used to check whether or not Table 2 contains all the elementary sentences needed (no unused triples and no missing triples). Example cases are "navigated" through the activity boxes while checking the corresponding triple. At the same occasion, the activity boxes are (graphically) arranged in a sequential manner. One can mark (or count) the triples "passed through" to detect unused triples that might be superfluous. Missing triples (= missing activities in the flow) are detected when the example case cannot "reach" an end situation. Also artificial (counter-)examples can be

introduced to have the domain experts additionally (in)validate the model. These two activities more or less resemble the CSDP step 2 of drawing the fact types and applying a population check.

## 5 Discussion and Lessons Learnt

Similar techniques as used in NIAM/ORM to reduce a complex sentence into elementary fact types are easily applied to business process modelling – e.g., to avoid the introduction of complex activities (e.g., "compose and send letter" becomes "compose letter" followed by "send letter") in the model. By applying the "*actor – acts on – item*" template the domain experts are much more inclined to include all the relevant information on objects and actors in the analysis right away. Otherwise, there is a tendency to overlook these objects and roles in the heat of discussions or reflections on the process flow. Breaking down complex sentences into elementary ones makes domain experts express their thoughts more clearly and concisely (i.e. drop irrelevant details). However, not all relevant information can be captured in this way, in particular, the gateways or connectors and their related logic.

Evidently, performing the analysis by natural language constitutes a working technique much easier for a domain expert or informant, having no prior formal modelling experience, to learn than a graphical notation, even if the latter has been simplified. As a consequence, domain experts feel much more at ease to participate actively in the analysis, which, in addition, results in a richer description than when using from the start a graphical notation. Once a set of elementary sentences is available, it is also easier for domain experts to validate the elementary sentences (or triples) and "supervise" their transformation by a knowledge engineer into a graphical BP model.

Currently, only a very simple (and idiosyncratic) BP modelling notation was used (cf. Fig. 1). Subsequent steps similar to ORM CSDP steps are probably useful to add sophistication to this basic model – e.g. to define state conditions (including timers). In particular, if the business processes modelling exercise does not remain limited to the "happy flow" – as often is the case[5] – expressing conditions correctly and clearly becomes more important in a flow with (many) ramifications. In addition, a preliminary phase of vocabulary uniformisation by the individual experts should happen. And one could also use n-ary sentences - e.g., an actor forwards something to someone else. Currently, inspired by the DOGMA tradition of fact based modelling [6], only binary elementary sentences have been used.

The following remark might seem obvious, but it must be stressed that appropriate domain experts are to be included in the modelling project team (there is a substantial difference between people simply willing to participate and actual domain experts). Also, all relevant (and only the relevant) documentation (e.g., regulations or existing descriptions) has to be available in its most recent form. Translated in methodological terms, this corresponds to what is usually called "preparing and scoping"

[5] Evidently the happy flow exhibits less complexity, requires less time to model and less knowledge of all the intrinsics of an organisation's procedures and working habits, and hence, less effort. In addition, employees are not always eager to reveal their procedural short-cuts (sometimes "illicit").

(e.g., [14:p.19]) and constitutes an integral part of any serious knowledge engineering project. Even though the consultant did include scoping in his proposal for a modelling methodology, in practice it turned out that not all relevant (human) sources of expertise and knowledge for the process under scrutiny had been gathered from the start on.

## 6 Future Work

Currently, mainly impressionistic and subjective feedback has been gathered from the participants in the modelling experiment (loose talks, intuitive comparison of graphic BP models etc.). Hence, before exploring new research avenues on combining process modelling and fact oriented modelling (e.g., adapting the other CDSP steps, verbalising the graphical process model, formalising the various steps, developing guidelines to make the method more widely applicable, …), the benefit of the method presented here should be validated more solidly. This involves more modellers, more and different processes and a number of evaluation criteria (e.g., perceived simplicity and experienced time gain for the lay modellers/experts, efficiency gain for the professional (external) knowledge engineers, improved quality and completeness of the knowledge elicitation results, overall cost reduction, etc.). An often used method consists of inviting subjects to fill out questionnaires and attribute scores (using a Likert scale). Further statistical analysis of the scores should determine whether or not this alternative method constitutes an effective improvement over the working method proposed by the consultant. Nevertheless, the results of the experiment seem promising enough to make the organisation of a solid evaluation worthwhile. Involving more modellers and more processes to be modelled will also prove beneficial for formalising the process described in this paper and for transforming the business process modelling craftsmanship of individuals in a methodology applicable by others and teachable to others.

## 7 Conclusion

Combining fact oriented modelling and story telling principles, as an alternative method to initial business process or workflow modelling knowledge elicitation steps, seems to improve, for the limited EWI experiment, the overall quality and completeness of the model as well as the level of commitment of individual project team members having various backgrounds and functions. Non formally oriented modellers/experts felt more comfortable in the way of providing information to professional knowledge engineers. Nevertheless, “hard” and objective evidence to substantiate this claim is currently not yet available, although the experiment reported on seemingly provided promising results.

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