The Process Documentation Cube:
A Model for Process Documentation Assessment

Toomas Saarsen, Marlon Dumas

Institute of Computer Science, University of Tartu, Estonia

{toomas.saarsen, marlon.dumas}@ut.ee

Abstract. This paper presents a model for organizing and assessing business process documentation with the aim of identifying gaps and inconsistencies. The proposed model – namely the Process Documentation Cube (PDC) – has been tested in six public sector organizations in Estonia – three of them with years of process modeling engagement and three others in early stages of process modeling adoption. In the organizations where process modeling is already well established, the PDC allowed the relevant stakeholders to identify gaps in their documentation and directions for improving the integration between process models and other documentation. In the remaining organizations, the PDC was perceived as a useful tool for planning process documentation efforts.

1   Introduction

In contemporary business process management practice, it is common for business process models and associated documentation to be produced in the context of specific projects, be it IT projects, business improvement projects, quality management projects or audits [1]. Often these models are used in the project where they are produced, but not consulted nor systematically maintained past the project, thus creating so-called "pollution" in the organization's process model repositories [1].

Several success factor models are available to measure, explain and predict success of process modeling initiatives [2, 3]. These models shed light into the factors that determine whether or not process models are perceived to be useful by the relevant stakeholders (among other dimensions of process modeling success). Other studies have focused on assessing the quality of process models [4] or improving the syntactic or semantic quality of process model repositories by means of refactoring [5]. However, these studies focus on diagrammatic process models, whereas in practice processes are documented in various ways, ranging from free-text documents, such as manuals of policies and procedures, to structured documents (e.g. legislative documents) and tables [6]. Additionally, process models are captured at different levels of granularity and from different perspectives depending on the intended usage.

In order to reap the full benefits of process modeling beyond individual projects and diagrammatic process models, a more holistic approach to process documentation

maintenance is required – one that views process models as integral part of the day-to-day documentation used across the organization.

In this setting, this paper introduces a process documentation assessment model that is intended to help analysts to holistically map the process documentation of an organization and to assess this documentation with respect to three aspects:

1) Completeness: the documentation covers all processes and gives a balanced overview of all processes at different levels of granularity via a process hierarchy.

2) Consistency: different documentation items are consistent with respect to one another. This includes consistency among different types of documents (e.g. textual documents and diagrammatic process models) and across process documentation at different levels of abstraction.

3) Comprehensibility and updatability: it is possible for all relevant stakeholders to comprehend and to update the process documentation.

The proposed documentation assessment model, namely the Process Documentation Cube (PDC), is validated by means of six case studies in Estonian public sector organizations. Three of the organizations have already collected significant amounts of structured process documentation, including several collections of (diagrammatic) process models, while three others have some process documentation, but mostly unstructured and have not been engaged in any significant process modeling effort. Due to space constraints, we do not present all six case studies in details. Instead we focus on three representative organizations corresponding to the following situations:

- Agricultural Registers and Information Board – processes are not documented in a structured way, but instead unstructured documentation is in active usage;
- Labour Inspectorate – processes are described in a structured way and these structured models are in active usage;
- Estonian Tax and Customs Board – processes are described in a structured way but the structured models are not in active usage; instead other unstructured process documentation is in active usage.

From a methodological perspective, the research presented in this paper follows a Design Science approach [9]. First, an analysis of the problem in light of existing literature was conducted, leading to an initial definition of the PDC. Next, the perceived usability of the PDC was tested by means of six case studies using a three-phased data gathering and hypothesis validation method explained in Section 3. Finally, feedback gathered during these case studies was used to refine the definition of the PDC and to identify directions for extension and improvement.

The paper is structured as follows. Firstly Section 2 introduces the process documentation assessment model and its theoretical foundation. Section 3 presents the selected three case studies. Section 4 reviews related works and finally Section 5 contains the conclusion and gives directions for further research.

2 Process Documentation Assessment Model

The proposed process documentation assessment model takes the form of a cube (cf. Figure 1) consisting of three orthogonal dimensions. The first dimension relates to the type of process being documented (*area*), while the other two refer to the level of detail (*granularity*) and the level of structuredness (*structure*) of the document itself. Each document or group of documents is mapped as a cell in the PDC based on its classification along these dimensions.

The first dimension, namely *area,* is based on Rummler's framework [7], which divides processes into three classes: operational, support and management processes. Operating processes produce outputs directly relevant to external customers. Support processes (e.g. financial and human resource processes) are those required in order to maintain the infrastructure (incl. human and material resources) required to perform the operational processes, while management and those intended to oversee and control other processes and to maximize value to other stakeholders (e.g. shareholders).
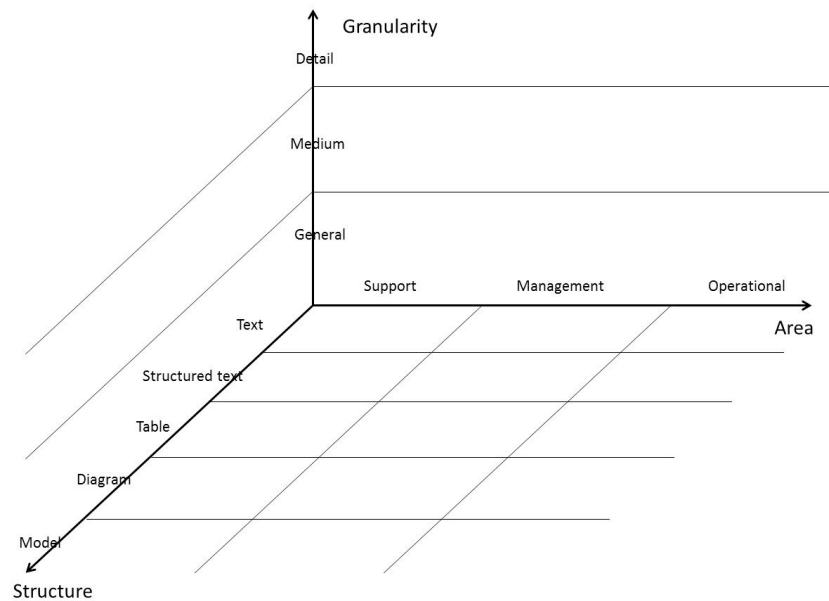
Figure 1. Documentation cube

The second dimension (*structure*) relates to the level of structural meta-data of the document. Here we distinguish between text (plain text without any prescribed structure), structured text (a text with a strict structure), table (a table with a defined structure), diagram (a simple drawing or diagram that does not follow a prescriptive modeling notation or is not stored in a repository, e.g. a Visio or PowerPoint drawing) and model (a diagram abiding to a prescriptive modeling notation and maintained in a repository). Different types of structure are suitable for different stakeholders. For example, legislative documents (structured text), which are widespread in the public

sector, are easy to read for lawyers but hardly accessible for stakeholder without a legal background. These latter stakeholders may prefer simple diagrams or tables.

The third dimension (*granularity*) represents the level of detail (or level of abstraction) of the documentation: general documents, medium-level documents, and detailed documents (cf. process hierarchies [8]). Different granularity levels are suitable for different purposes. For example, for a new employee who has to understand the value chain and their role in the organization – it seems reasonable to have a top down approach. A customer who is interested in getting more information about services should follow the process at the middle or detailed level.

There are many possible ways to define the granularity of process documentation. In order to reduce the scope for subjective interpretation, we rely on the classification provided by the SCOR framework [10], which identifies the following levels:

- General or Top-level: Process documentation focused on defining the scope of the process (what is done in the process);
- Medium or Configuration-level: focused on showing how processes are executed with the aim of communicating this information to a wide audience;
- Detailed or Process element-level: Process documentation that provides details of the process on an element-per-element level (e.g. individual tasks).

In addition to capturing the location of each document along the above dimensions, the PDC includes *consistency links*. A consistency link exists between two documents D1 and D2, if there is a mechanism in place to ensure that an update to D1 leads to an update in D2 and vice-versa. This mechanism can be automated (a document generated from another) or manual. Naturally, consistency links allow us to assess documentation consistency across different dimensions of the cube.

Since a three-dimensional cube is difficult to visualize and comprehend at once, it is convenient to view the PDC through its two-dimensional views. Each view allows one to assess different aspects, as explained below.

2.1 View 1 – Area-Granularity

The first view comprises the area and granularity dimensions. This view gives us the whole picture of the documentation and allows us to assess documentation completeness. Specifically, it allows us to assess if there are documents about different areas (horizontal layout) and covering each level of granularity (vertical layout).

If there is any empty area on the diagram, then it may raise a question – whether we missed a document during documentation gathering or there is a gap in the documentation? For example, in the public sector the main processes are usually described, but not enough attention is paid to the supporting processes and management activities – a gap in the detail documentation.

2.2   View 2 – Structure-Granularity

The combination of structure and granularity form the second view. This view is useful for assessing comprehensibility and updatability. Indeed, different stakeholders need different types of documents and at different levels of granularity. Thus ensuring comprehensibility of process documentation by all stakeholders requires that documents are available in different structures and levels of granularity. Plain text is probably most common format for daily documentation – there are no any restrictions or assumptions – all employees can read text documents. In the public sector several legislative and regulatory documents are used to describe the organization activities, rules, etc. All these documents are described as a structured text. But these voluminous and specialized texts are not easy for employees or clients to comprehend – the latter preferring plain text, simple diagrams or combinations thereof. Business analysts and managers on the other hand may take full benefit from process models, while management and monitoring processes are usually described via different tables. If there is a simple structure (1 or 2 dimensions) and some calculation needed, the table is a good choice as it is easy to define and track later.

2.3   View 3 – Area-Structure

The third view covers area and the structure. This view allows us to assess completeness, comprehensibility and updatability. It gives an opportunity to decide which processes are documented as structured text (e.g. legislative documents), which ones are presented as a table, which documents are generated from a model, etc.

If an organization uses a sophisticated modeling tool, this view is a convenient structure to fit the model outputs onto the documentation map. If most of the facts about the organization (roles and structure, activities and processes, data, etc.) are in the model repository, and different documents are generated (job description, process description, data usage, etc.), documentation update is simplified.

View 3 highlights the parallel layers of documents and gaps that may exist in these layers. For example, legislative documents have to be in place, but additional documents covering the same processes, possibly generated from a business process model also need to be in place for employees performing day-to-day tasks.

3   Case studies

As a preliminary evaluation, the PDC was applied in six public sector organizations in Estonia. The choice of public sector organizations is motivated by the fact that these organizations are more inclined to disclose their internal documentation – and in many cases this documentation is publicly accessible. This allowed us to freely collect details that would be more difficult to access in some private companies. However, conducting a similar evaluation on private companies is a direction for future work.

3.1 Methodology

In each organization, data collection was performed via three meetings:

1) The first meeting consisted of an interview with a process analysts or the organization's stakeholder who would be closest to playing this role. The aim of the interview was to make an inventory of all process-related documents in the organization, without restriction on the type of document. For each document we sought to obtain information about three aspects: document creation; maintenance/update; and usage. There were 4 main questions about each phase: who; when; what and how. Copies of the documents were also collected.

2) Based on collected information, the first author prepared three views of the PDC for the organization in question, and highlighted potential gaps and ideas for document integration. The PDC, gaps and integration ideas were discussed during a second meeting with the same stakeholder as in the first interview, plus additional analysts and subject matter experts invited by the first stakeholder. The aim of the second meeting was to gather feedback on the accuracy of the PDC and the pertinence of the gaps and integration ideas.

3) Feedback from the second interview was summarized in a final report that was sent to the participants of the second meeting. Based on this report the last meeting was organized for a wider audience, including management. The aim of the third meeting was to gather feedback about the perceived usefulness of the PDC.

3.2 Case study 1 – Agricultural Registers and Information Board (ARIB)

This is a typical example of an organization where mainly text is used for a process description. View 1 gives an overview of the documentation (Figure 2). The blue trapeze emphasizes the document hierarchy. Red lines are used to represent consistency links between different documents.

Processes are described through the document "Procedure description". There are ~400 different procedures and the main complaints about these documents were that update is too complicated; documents are not updated properly; quality and usability degrade over time. The update problem is directly related with the size of the document – all descriptions are too voluminous. Instead of a simple diagram with a brief description, there is a bulky text with cross-references inside. These cross-references make the update procedure very complicated and time consuming. Finally, it is very difficult for the reader to grasp general structure of the process and understand all nuances correctly: loops in the process, exceptions, parallel tasks, etc. This case illustrates that if an organization is interested in starting a process modeling project, the PDC provides a structure to design the project outputs and fit these outputs (documents) into the daily documentation and to move toward more structured documents (e.g. Figure 3 → Figure 4). Figure 4 highlights how to bind the process model with the documentation: blue lines indicate documents that are generated from the model; green color highlights new documents; and yellow color highlights old documents in the new format.
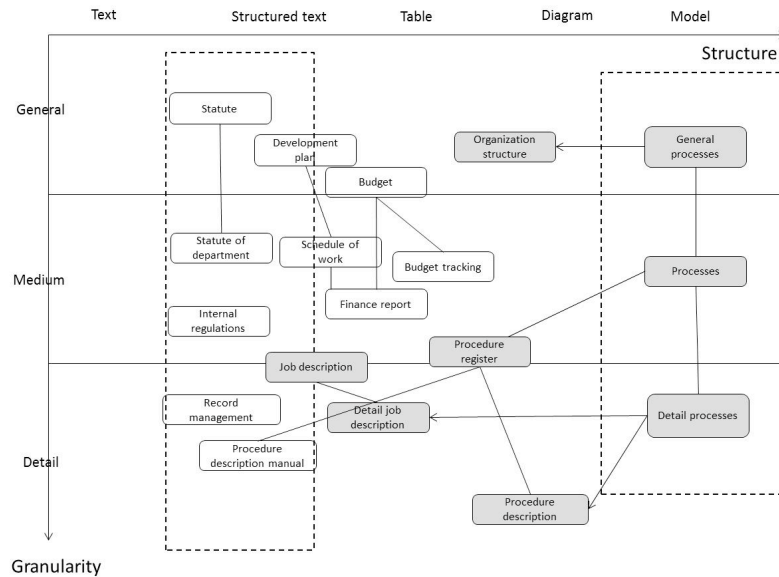
In this organization, a process modeling tool would simplify documentation update by generating different outputs (e.g. documents) from models. During the assessment, attention was focused on an upcoming process modeling project – what tools should be used; how to involve and train employees; how to use the process model, etc.
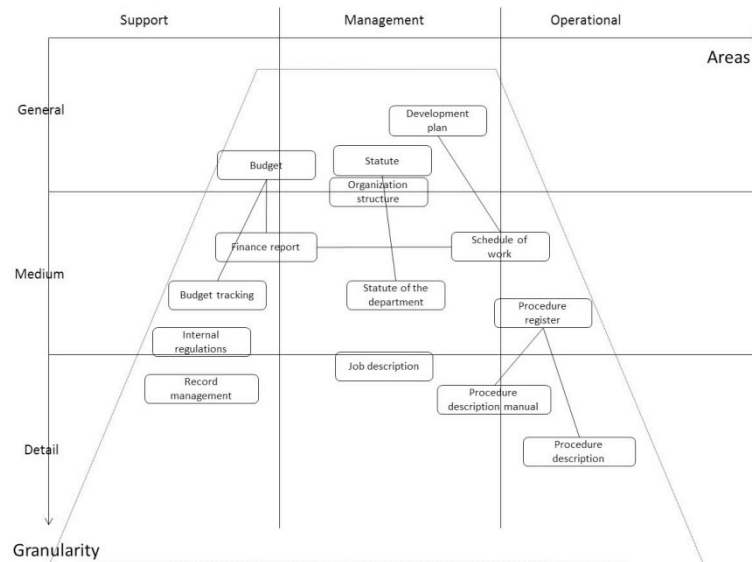
Figure 2. View 1, ARIB.
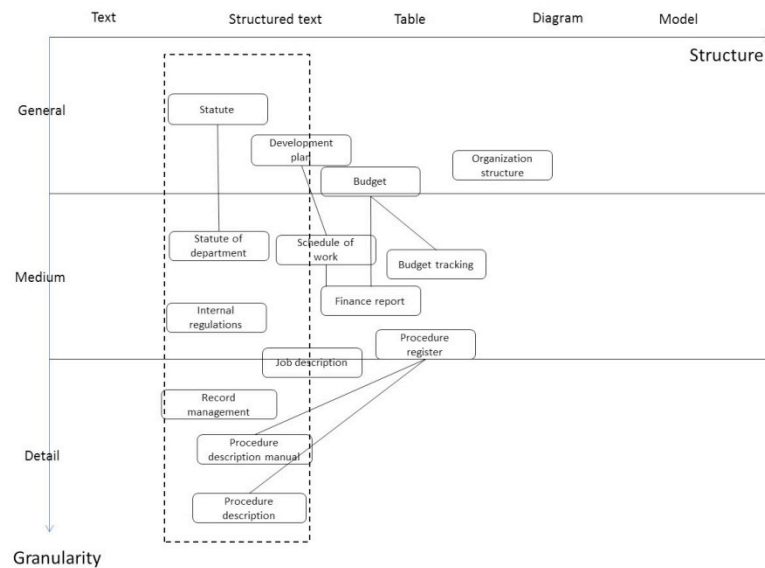
Figure 3. View 2, ARIB.

Figure 4. Proposed "to-be" View 2 for ARIB

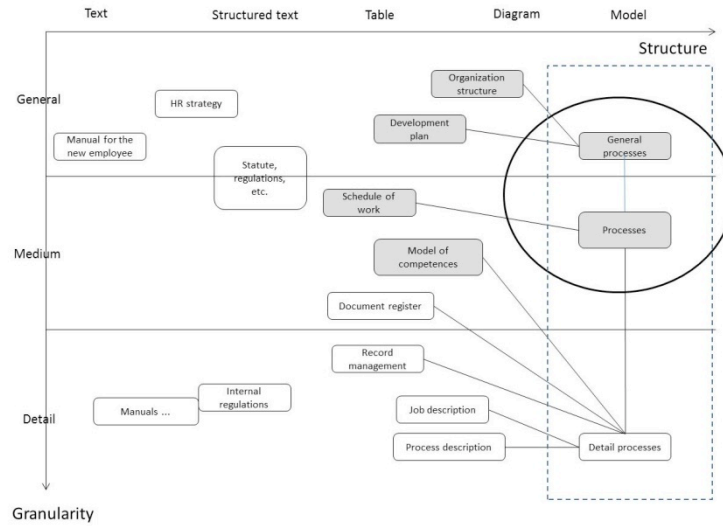### 3.3 Case study 2 – Labour Inspectorate

This case study led to a very different picture, as shown in Figure 5. In this organization, there is a sophisticated process modeling tool in use, and number of documents have been generated from the models managed by this tool. In this case, the main gap we discovered was that the process hierarchy was not properly modeled. The green boxes in Figure 5 show where this missing process hierarchy would go in the PDC and how this hierarchy could be bound with other documentation.

An update procedure of detailed documents (job description, daily procedures, data usage etc.) was in place. The process hierarchy gave better understanding about the full processes and a big picture about the whole organization. Upper layers of the process hierarchy give a structured base for general documents like goals and strategy. Additionally, process hierarchy could be used as a table of contents for the process model – flexible entrance into the detail level of the process diagrams.

View 3 gives an interesting result here (Figure 6): there are two layers of duplicated documents: the upper red circle is highlighting legislative documents (that have to be used in theory) and more structured documents (that employees use in practice).

During the assessment process, the main attention was focused on the comprehensibility and usability of the process model outputs. The document cube gave a good structure to design changes

Figure 5. Proposed "to-be" View 2 for Labour Inspectorate
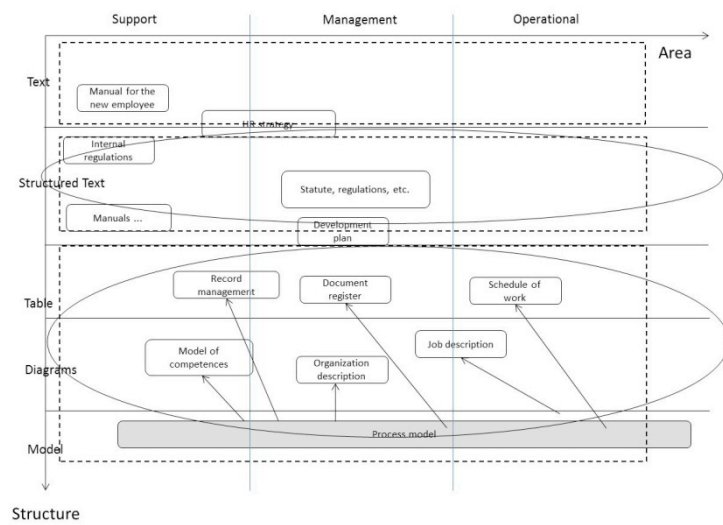

Figure 6. View 3, Labour Inspectorate

3.4 Case study 3 – Estonian Tax and Customs Board

Case study 3 highlights the problem of lack of integration of process models produced by a modeling project and daily documentation in the organization. The goal of the implemented process modeling project was process optimization and process change. The project produced high-quality process models. The analysis phase of the project highlighted different problems and a To-Be model was produced. If we look at

the project from the business process analyses perspective, then result is excellent. Unfortunately, there were not any output to the daily documentation, and for this reason, the model was not used by the employees (Figure 7).

The main problem in the long term here is the process update. After the project, there is not enough time and attention to the process model. The model is not used and updated in daily life. The "death" of the model is just a matter of time.

The PDC was an excellent tool to design changes in the documentation and find suitable outputs from the business process model to support deployment of the model (Figure 8). These changes brought together employees around the process model and made them think about the daily processes, problems, needed changes, etc.

There main issues were identified. First, there was a lack of a proper process hierarchy – table of contents. Second, more documents were needed for daily work of employees. Finally, process modeling tool simplifies documentation update, and even more important, intensive use gives motivation for the model update.
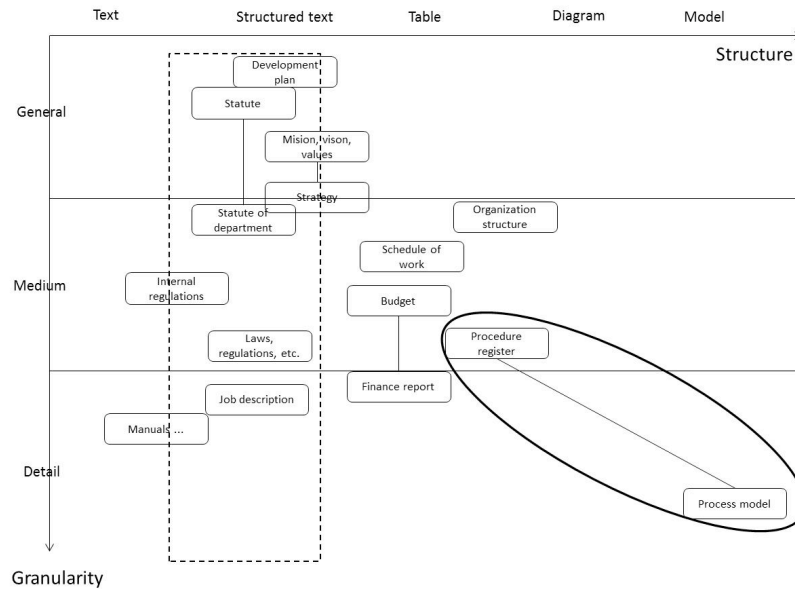
Figure 7. View 2, Tax and Customs Board
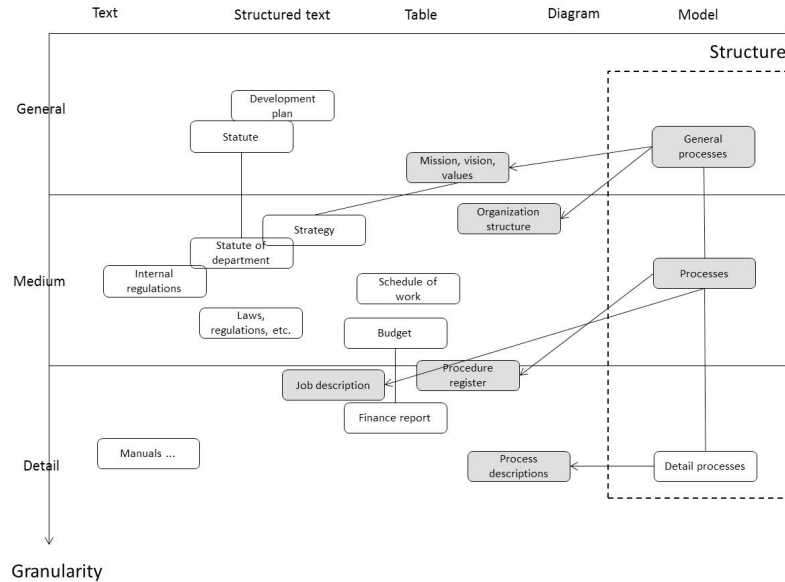
Figure 8. Proposed "to-be" View 2 for Tax and Customs Board

3.5 Discussion

One can distinguish three *patterns of process documentation* from the case studies:

1) Processes described via text (ARIB). The organization used the document cube in process modeling planning phase – design process model outputs and integrate these outputs with daily documentation.

2) BP tool is used and good integration with daily documentation exists (Labour Inspectorate). The organization in question found several gaps in the documentation and new ideas for the process model integration.

3) BP tool is used but without integration with daily documentation (Tax and Customs Board). The output of the process modeling project was not oriented to employees. The PDC allowed us to identify outputs that could be generated from the process models and thus to integrate the process models with daily documentation.

4 Related Work

We are not aware of previous work that addresses the question of how to visually map organization-wide process documentation (including textual documents) in order to identify gaps and integration opportunities. A recent work [6] proposes a tool for integrated diagrammatic and textual process description, but it does not address the above question. Some related work has addressed the question of what is the perceived value of process modeling and process models [11] or what are the main obstacles and pitfalls of process modeling [1]. Other work has discussed the importance

of wider usage of process models – beyond analysts [12]. This latter work argues that participation and involvement of employees in the process modeling project is important and correlates with quality and usability [2, 3]. However, this body of work is orthogonal to the PDC's objective of identifying gaps and integration opportunities.

5   Conclusion

The PDC gives a simple structure for mapping the organization documentation and to assess its completeness, consistency, comprehensibility and updatability. In organization with comprehensive process documentation, the PDC allows one to identify gaps and integration opportunities. Meanwhile, if an organization is starting a new process modeling project, the PDC can be used for planning purposes in order to determine how the process models will fit with other documentation.

In the case of organizations with extensive process documentation, effective visualization of the PDC or its individual views may become a challenge. Accordingly, a possible avenue for future work is to design visualization techniques that can help users to navigate through PDCs covering large amounts of process documentation.

6   References

1. Rosemann, M. "Potential pitfalls of process modeling: part B." Business Process Management Journal, 12(3):377-384, 2006.
2. Bandara, W., Gable, G. G., & Rosemann, M. "Factors and measures of business process modeling: Model building through a multiple case study." European Journal of Information Systems 14:347-360, 2005.
3. Trkman, P. "The Critical Success Factors of Business Process Management." International Journal of Information Management 30(2):125-134, 2010.
4. Krogstie, J., Sindre, G., Jørgensen, H. "Process models representing knowledge for action: a revised quality framework." European Journal of Information Systems 15:91–102, 2006
5. Weber, B., Reichert, M., Mendling, J., Reijers, H. "Refactoring large process model repositories." Computers in Industry 62(5): 467-486, 2011.
6. Pinggera, J., Porcham, T., Zugal. S., Weber, B. "LiProMo-Literate Process Modeling. " In Proceedings of the CAiSE'2012 Forum, Gdansk, Poland, June 2012, Springer, to appear.
7. Spanyi, A. "Business Process Management Governance." Handbook on Business Process Management Vol. 2, 2010, Springer, pp. 223-38.
8. Harmon, P. Business Process Change: A Guide for Business Managers and BPM and Six Sigma Professionals. Morgan Kaufmann, 2007.
9. Alan R. Hevner, Salvatore T. March, Jinsoo Park, Sudha Ram: Design Science in Information Systems Research. *MIS Quarterly* 28(1): 75-105, (2004).
10. Supply-Chain Council. Supply Chain Operations Reference Model Version 10. 2010.
11. Dalberg, V., S. Jensen, and J. Krogstie. "Increasing the Value of Process Modelling and Models." *Proceedings of the Norwegian Conference on the Use of IT in Organizations (NOKOBIT)*, 2005.
12. Eikebrokk, T. R., et al. "Exploring Process-Modelling Practice: Towards a Conceptual Model". *Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS),* 2008, IEEE, pp. 376-376.