Making a link between strategy and process model collections: a multi-layered approach

Felipe Diniz Dallilo, João Porto de Albuquerque
Dept. of Computer Systems, University of São Paulo
São Carlos, Brazil
{fdallilo, jporto}@icmc.usp.br

Marcelo Fantinato
School of Arts, Sciences and Humanities, University of São Paulo
São Paulo, São Paulo, Brazil
m.fantinato@usp.br

Abstract—This paper proposes a multi-level approach that links strategic goals with an organization's collection processes, based on the Business Motivation Model (BMM) and the Business Process Management Notation (BPMN). A multi-layered metamodel is proposed together with a web-based support tool to manage the entire approach. The approach is illustrated and validated through a proof of concept application in a real process of a large company that provides IT services, where the advantages of the proposed model are made clear. Furthermore, the approach is evaluated by means of a systematic comparison with related work and through an empirical evaluation involving users in a real organization.

Keywords- Business Process Management; BPMN; BMM; Multilayer; Process Collections; Strategic Alignment

I. INTRODUCTION

A number of organizations seek to establish a process-based framework to manage their business effectively. Given the advantages of having a process-based organization, the Business Process Management (BPM) approach has become highly valued by managers [2]. This is because it allows the measurement, monitoring, control and analysis of business processes, and can thus enable a company to deliver value to its customers by ensuring continuous improvement in processes.

Before companies can model and manage their processes effectively, they must define those that are efficient and effective with regard to achieving organizational goals and meeting customer expectations [1]. However, organizations often have to handle a large number of cases, and this factor not only impedes the management of specific processes but also the relationship between low-level models and the strategic objectives of the organization. The lack of tools that are able to manage collections of processes exacerbates the difficulties of management, since it is hard to know whether the data from processes can be gathered simply by setting out the strategies involved.

This paper proposes an approach for managing various levels of business processes, and thus allows strategic business objectives to be systematically tied to business process models. The approach consists of a multi-layered metamodel that is supported by a web-based model-editing tool. In the remainder of this paper, Section 2 reviews some related work. The proposed approach is outlined in Section 3. In Section 4, there is an examination of the tool that is developed to support the approach. Section 5 presents a proof of concept of the approach and tool. Experimental validation is shown in Section 6, while Section 7 finally concludes the paper with suggestions for future work.

II. BACKGROUND

Any modeling that fails to meet the strategic objectives of the organization can have a serious effect on the subsequent phases of BPM [6]. In the light of this, Lind and Seigerroth [4] propose an approach at several levels, consisting of a model of the overall macro process and a business model that is designed to describe every part of the process in detail. The collection of data needed for the proposed process modeling is carried out together with the different stakeholders in a collaborative way, to avoid any incompatibility between the strategic plans and conceptual models at different levels.

The same authors have conducted research in this area, in other studies [5] where the term "multilayer-thinking" is employed to mitigate the differences between business processes and technology. In addition, they propose a representation of processes at different levels of abstraction that link the business perspective to an IT perspective. In a similar way, the work of Nuffel and Backer [3] adopts a multi-tiered approach, although they also emphasize the need to process multiple perspectives as this can assist in their management.

The research studies outlined above show that the multi-layered approach can be useful for connecting strategies to process models, but what is still missing are research approaches that provide tool support for this form of process modeling [3, 4, 5]. This is important because a change in a high-level process can trigger a chain reaction at other levels and this cannot be mapped or perceived by making manual connections between the levels. Some commercial software packages do include partial support for multi-layered modeling - e.g. ARIS[9], ArchiMate[11] and BEN[10]. However, they fail to include a strict definition of the modeling syntax and do not offer web-support to enable collaborative process modeling (a systematic comparison of our work with these approaches is provided below).

III. APPROACH

Our approach seeks to fill in some of the gaps pointed out in the previous section, and consists of a multi-layered model,
which is supported by a web-based model-editing tool. This model builds on the multilevel approaches proposed by Mikael Lind and Ulf Seigerroth [4] and Nuffel and Backer [3]. However, in devising our metamodel we employ the Business Motivation Model (BMM) and the Business Process Model and Notation (BPMN) [7, 8], because BPMN is a standard notation in the market and known to be accessible to end users and BMM is of a standard that is recommended by the Object Management Group (OMG). To the best of our knowledge, there are still no approaches that combine BMM with BPMN in a multi-layered model.

In our approach, we represent high-level, strategic information which is linked to a business process diagram in a single unified way. This is accomplished through a representation at levels that allow the high-level information to be linked to the tasks performed in the lower-level process. We decided to combine the first two layers proposed by [4] and [3], since BMM can represent them in a horizontal way, which means our proposal consists of 4 layers, as illustrated in Figure 1.

This approach allows elements of business plans and strategies and tactics (at the top level) to be connected with the models of business processes, so that the information contained in the process flow can be compared with the strategies and tactics set out for the process. Since it provides traceability, this form of representation enables a manager at the strategic level of an organization to visualize how its strategies and tactics are being tackled in the processes. Conversely, the person who is performing the process at the operational level, is also able to visualize the effect of their tasks on strategic planning.

A. Metamodel Approach

Figure 2 represents the metamodel of our approach. It consists of a combination of the metamodels of BMM and BPMN, with some additional object types. In this manner, the metamodel makes it possible to define the strategic elements of BMM and establish a connection with the process models defined in the organization with BPMN.

B. First Layer - Strategic Goals

The first level of our approach is represented by the BMM model, which is similar to organizational reference architectures such as the Zachman Framework, TOGAF, and ARIS Enterprise Architecture Framework [4, 3]. These models give prominence to high-level information that is not represented in the current modeling process notations, e.g. BPMN.

The first level thus aims at employing BMM to survey the business strategic information and define how this information is linked to business processes. This level is important because it provides a way of adding information to business processes, which is critical to their development and implicit in current process modeling.

The following information is included at this level: a) the Business Rules and Policies of Organizational Units or Departments, which make it easier to visualize interdepartmental processes as processes that a particular department operates; b) Strategies and tactics; c) ‘Influencers’ within internal and external departments; d) KPIs for responsible sourcing. The process is represented at this level as a black box, with all details of the flow of activities being omitted and this responsibility being delegated to lower levels.

At this level, model elements were assigned to represent the owner of the process and the key performance indicators (KPIs) for the process level, activity level and task level. This procedure is based on the assumption that a KPI of the process can be divided into smaller indicators when they are defined at the level of activities and later on, even more fine-grained indicators, when they arrive at the atomic level of the approach.

A process may have N relationships with each element and these elements can be contained in N processes. Figure 3 represents the first level of our modeling approach.

C. Second Layer - Macro Process

After defining the name of the process and the strategic attributes that it will contain, it is necessary to define its workflow. The second layer of the model represents the specific connections of certain BMM attributes and specifications. At this level, the flow of a business process is represented in detail by means of BPMN, which displays the flow of the process from start to end and its relationships with specific BMM attributes. Another important feature is the
adoption of a good modeling practice that starts at this level. The purpose of this is to show the end-to-end process flow without the need to address the question of its implementation in detail.

One of the benefits of the approach can be compared with the use of similar methods in a programming language. The reason for this is that, if the element needs additional information, it is possible to understand what the method does by just reading one’s name. As well as this, the method can be analyzed in detail, and as in the case of the ‘sub’, the activities and tasks can be analyzed if a greater level of detail is required.

This level displays the activities and tasks contained in the sub without losing the necessary high-level connections obtained from merging the BMM and BPMN.

Moreover, it omits the influencers and strategies employed in the other departments of the process. It also determines the modularization of business processes, and allows the data to be divided so as to cater for individual needs, since low-level details can complicate the interpretation of the process flow. As in the case of the other levels, the attributes can be viewed both before and afterwards. Figure 5 represents the third-layer approach.

E. Fourth Layer - Activity

The fourth layer represents the atomic level of the segmentation process at different levels of complexity.

This level shows the flow of execution of the tasks involved in the process. As illustrated in Levels 2 and 3 of the approach, at this level there is also a connection with the high-level attributes of the BMM. As in the previous levels, this level acts as the key indicator of performance-linked tasks. Figure 6 represents the fourth layer approach.

IV. TOOL

As discussed earlier, we developed a web-based tool to support the whole of the proposed approach. The web-based development was chosen because it allows easy access to users who can model processes collaboratively, by working together with other users and the same model.
The tool was developed in a Java framework with GWT (Google Web Toolkit) for the view layer and Hibernate as the persistence layer data. GWT was selected because it only uses one language (Java) for the application layer client server model by automatically converting all the code for the Javascript client at runtime. As a result, the objects used in the communication layer between the client and the application server, are mapped and remain with Hibernate, thus eliminating the need to convert the objects into a relational structure.

Figure 7: Interface of the support tool

Figure 7 shows the tool interface. The numbers in Figure 7 correspond to the following features:

1) The tool has different panels for each model level, and thus the modeler is only concerned with the current level of modeling and can choose to compare it with other levels when necessary.

2) Within the first ‘accordion’, there are tabs that are responsible for a change in perspective. The first tab carries out an entire modeling of the top-level elements of the process and the tool automatically shows the perspective of the elements by creating collections by type.

3) The side menu allows a new element to be included in the modeling.

4) Item presents an example of a newly-created process.

5) After defining the element, the user can select it and see all the possible relationships of the selected object.

6) Example of creating a process with a business rule.

7) When someone selects a specific process, its detailed workflow can be modeled at Level 2. The same is true for the sub-process activities at Level 3 and Level 4.

All of the examples in this paper, together with the proof of concept discussed below, were modeled with the developed tool.

With the aid of the tool, the proposed approach can be represented in a better way, and allow an effective control system to be operated between the attributes and attribute changes. The reason for this is that when creating a strategic element, it is possible to check if any process is listening to it and make any necessary change. An element can be seen where the processes will have an impact, (as is displayed in the diagram which shows the connecting element together with the accompanying processes).

V. PROOF OF CONCEPT

Our proof of concept included the modeling of the actual processes found in a large IT service organization in Brazil. The company already uses BPM as an effective management system and BPMN for modeling processes. The high-level strategies of the organization are currently documented in the machines of any managers who complain about the lack of tools or means to connect this information to the process models.

The approach was applied to a process designed to support a customer call center. This process is triggered when a problem arises in systems used by the call center. When confronted with this situation, this center records the problem in a service tool and the support team of the company that provides the service, analyzes the incident. There is a SLA (Service Level Agreement) that sets the maximum amount of time that the service provider has to perform the service required.

Every problem in the call center systems that causes an incident, contains information relating to the systemic failure or inconsistency that prevents an operation from being carried out within the client system.

If a problem is already known, the conventional way of handling an incident is to correct the inconsistency at the database of the system. This is undertaken in accordance with what has been mapped in the Log's Problem by the Second Level (2N) team, which refers to the lessons learned about each problem in the Customer's system. If a problem is not yet known, the Third Level (3N) has to debug the system in the same scenario as the attendant call center. The purpose of this is to identify why the system is not keeping up with the desired activity, and after the problem has been detected, it is necessary to document the information in a log of problems that will be submitted to the Fourth Level (4N) for approval, and to contact the customer (if necessary).

If a particular incident is concerned with a high volumetric demand, an attempt should be made to survey all the incorrect data in this scenario so that there can be a ‘batch’ correction of the problem. The batch correction is carried out from the script, which is a set of SQL commands executed in the database of the client.

This enables the development process to convey Script within the process of the call center support to modify the script of the incident within a specific scenario. The strategy process provides with a fully proactive service for correcting root problems and avoiding various incidents that may have a direct impact on the client’s operation. Since this information is related to the clients of the organization who are provided with the services, (through exchanging production data of extreme importance), a number of security measures are taken to secure the endorsement of the customer for their execution.

A. First Layer

As described earlier, it was evident that the current processes of the organization are not divided into levels and do
not have a relationship with high-level information. In view of this, Figure 8 illustrates how the process of the call center support tool has been modeled on the first level of the proposed approach.

At this level it is possible to understand certain factors that were not previously clear e.g. the role of all the influencers of the various departments. The key performance indicator of this process is a requirement that the incident should be handled within a strict deadline of 72 hours. The business rule requires that the procedure should only be triggered by an incident; the business policy states that the client should be alerted to any changes of the data and responsible for the process (the name has been omitted for reasons of confidentiality).

Figure 8: Example of the model in the first layer

B. Second Layer

Figure 9 shows the entire process that has been modeled on the support call center and its relationship with the BMM attributes. It is also possible to identify the fragmentation of process KPI in Sub-processes KPI and the Owner of this Process.

Figure 9: Example of a model in the second layer

C. Third Layer

Among the sub-processes and tasks defined in the process support call center, is the sub-process ‘development Script’ that was reconfigured in a more consistent way, since both the processes were considered to be at the same level.

As seen in Figure 10, the department is influenced internally by the demand for Log problems since the sub-process that was analyzed, occurs at the ‘team room’ level and also has an external influencer. This is because the execution that is based on the production data obtained from the created script, can only be carried out with the client's approval. Finally, the sub-process, together with the performance indicators for creating a script, should take less than 40 hours and its activities were fragmented by KPIs so that they could handle the performance.

Figure 10: Example of a model in the third layer approach

D. Fourth Layer

As can be seen in "Produce Script", in the development process, there are several tasks involved in defining a script. With this level of detail, it is possible to have a clear sense of how the tasks are being carried out and also a refined view of the influencers and strategies of this department, (as can be seen in Figure 11). There is also a more detailed flow where an activity can be observed that includes tasks for development, testing and evidence of testing, which results in the production of artifacts of scripts and test plans. This activity has led to the definition of a performance indicator.

Figure 11: Example of the model in the fourth layer

VI. EVALUATION

The proposed approach was evaluated by means of a two-fold strategy as follows: a systematic comparison with related work and an experimental evaluation.

A. Systematic Comparison

Table 1 shows a systematic comparison of our approach with related studies (columns): Aris [9]; (N&B) Multi-abstraction layered business process modeling [3]; (L&S) Multi-Layered Process Modeling for Business and IT Alignment [4]; (Archi) Archimate [11]; BEN [10]; (This) This study.

The criteria for the comparison (the rows in Table 1) were defined as follows: (a) the tool support is available to assist in defining the models; (b) the tool allows collaborative modeling by several different users in the same diagram; (c) the tool must be open source; (d) the tool offers flexibility in choosing the desired language for the modeling; (e) the tool is web-based; (f) the approach provides a framework for representing Business Information; (g) the approach provides a framework for combining information modeling with Business Processes; (h) the approach provides a framework for combining Information modeling with Business Process Activities; (i) the approach provides a framework for combining Information modeling with Business Process Tasks; (j) the approach includes a
rigorous metamodel (e.g. in UML); (l) the approach has been applied to real case studies; (m) the approach was recommended by researchers or statements issued by organizations; (n) the approach assists in the management of process collections, and allows the various processes of the organization to be modeled and visualized.

TABLE I: SYSTEMATIC COMPARISON WITH RELATED WORK

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The comparison thus shows that the approach proposed here clearly outperforms those of existing research studies, and has decisive advantages vis-à-vis commercial software packages. At the same time, there are features of our approach that need improvement such as the flexibility of the modeling language (d) and further empirical evaluation (m).

B. Experimental Evaluation

After modeling the processes in the approach, an experimental evaluation was carried out. Semi-structured interviews were conducted with people who work with the modeled process. In all, 18 participants were selected who had 3 to 10 years’ experience with the processes. The number of participants in the experiment was selected on the basis of their position in the hierarchy of the organization (in Strategic, Tactical and Operational areas), so that they could be representative of the participants at all levels. The interviews were conducted individually and on average lasted 40 minutes.

The results showed that the multi-layered representation can be regarded as useful at the strategic level, since it avoids giving a detailed account of how the processes are run and allows managers to focus on strategies and the process as a whole. It was also considered helpful for people at the operational level as it enabled them to obtain details of how processes are implemented and who it is most suitable for in the wider organizational context. Finally, interviews at a tactical level showed that our approach can help people understand expectations better and align the strategic level with the operational level through modeling.

Interviewees at the operational level said that if they knew what strategies are linked to their tasks, they could serve as guidelines when making strategic changes. At the same time, people at the strategic level were pleased that they had the ability to monitor what was taking place at the tactical and operational level.

It was clear that with the web-based support tool, the same model could be made available to all employees and also allows diagrams to be edited in a collaborative way. The participants also considered the BMM representation to be intuitive and easy to learn. However, the participants lacked a suitable mechanism for tracking changes in the process models or issuing a system of automatic warnings via e-mail. Another potential area of improvement that was highlighted in the interviews was the need for BMM elements to have more descriptive fields. This could allow a detailed description of the entities, attachment of files, definition of deadlines, dates of creation and the disclosure of other information.

VII. CONCLUSION

The multi-layered approach proposed in this paper allows higher-level strategic objectives and their relation to the lower-level business processes to be defined by means of a suitable, web-based editing tool. The proof of concept application in a real-world process, together with the experimental evaluation, have shown that the approach is a valuable means of making the link between strategic goals and business process collections. Future work should concentrate on improving the model editor so that it can include other features such as descriptive fields, the tracking of changes, as well as supplying process owners with automated notifications.

REFERENCES