Explicitly Modelling Relationships of Risks on Business Architecture

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Abstract: Todays increased interest in enterprise risk management is motivated by decision making in reaction to change and complex compliance requirements as well as the need to minimize business losses and improve business outcomes. It is therefore important to help business stakeholders become fully aware of applicable risks and their possible impact on other business constituents. This paper represents an extension of the OMG Business Motivation Model that addresses this topic by improving risk visibility through modelling explicit dependencies of risks on business motivation, business decisions, business processes and compliance requirements. This extension in the form of a meta-model as well as its potential to increase overall risk awareness in enterprises were evaluated.

1. Introduction

Today's highly dynamic business environment requires business to be agile. Although there is no consensus on what exactly "agility" is [1], we can use the definition of Op 't Land et al. who define business agility of enterprises as "the ability to quickly adapt themselves to changes in their environment, and seize opportunities as they avail themselves" [2]. Thus, agility calls for being able to change which requires making decisions. These decisions cannot be seen in isolation, but they have an effect on other parts of the enterprise. A new service for the customer might require a change of the process and the information system. A new information technology might change the way companies organize their business processes, communicate with customers and deliver their services [3].

Decisions, however, not always have positive effects but can also bear risks. For example, customers do not accept a new service or the business process is not aligned to a change in the IT. To support business agility, stakeholders and decision makers in an enterprise should be aware of applicable risks and make decisions appropriately.

To ensure that an organization is aware of all existing and future risks, the management of risks should be an integral part of organizational activities and explicitly linked to corporate strategy [4]. This holistic approach toward managing an organization's risk, is commonly referred to as enterprise risk management (ERM). The implementation of an ERM system shall improve firm performance [5].

Hubbard defines risk management as a process of "the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events" ([6], p. 10). Since business agility is not an achieved state but a continuous process [2], it is important to constantly re-consider the environment to ensure that identified risk dependencies are still valid and comprehensive enough. This can be done through the modelling of risks in relation to other important elements of the business architecture.

2. Objectives

As explained above, there is a strong dependency between risk management and decision making [7]. Any decision can lead to risks and on the contrary, risks, resulting from internal or external events, are often drivers for decision making. Although there are guidelines and frameworks for Enterprise Risk Management from COSO [8,9] and ISO [7], an approach for explicitly modelling dependencies between the elements for strategic risk management has not been identified.

Thus, the main objective of this research is to make visible strategic risks and their dependencies on other business constituents. This should enable better risk-aware decision making, help appropriately and continuously readjust business goals and strategies, adapt business processes, align business and IT, and aid a company in staying compliant.

The research question is formulated as follows: *How can the dependencies of risks on business motivation, business decisions, business processes and compliance requirements be visualized in order to increase risk awareness in enterprises?*

The question is answered constructively by defining the semantics and syntax of a modelling language. The meta-model of this language determines the concepts and their relationships as well as defines the restrictions between the concepts.

3. Related Work

In order to stay innovative and agile, enterprises should be able to rapidly respond to changing needs from business and its environment [2]. Multiple challenges may impede the agility of an enterprise, such as the absence of common understanding and governance of key resources, unclear responsibilities or lack of information / communication about products, processes, stakeholders and internal structures [2]. Arising compliance requirements, new business models, fast-developing IT technologies and the need to smoothly and effectively integrate them into the business may create further hurdles for the agility. One way to manage such complexities of challenges and variety of stakeholders is enterprise architecture [2].

What an enterprise does is not driven by change but by how the enterprise decides to react to change [10]. Business Motivation modelling makes the reasons for decision explicit and supports consistency in decision making between different projects, e.g. not changing elements that are essential for other projects and not keeping elements that are not needed anymore.

Business motivation considers the "why" for an enterprise to conduct its business and is regarded a part of the enterprise architecture in such as the "why" column in the Zachman Enterprise Architecture Framework [11]. Modelling language for business motivation are the motivation extension of ArchiMate [12] and the OMG Business Motivation Model (BMM) [10]. Both BMM and the ArchiMate motivation extension support the modelling of influencers, their assessments as well as the goals derived from them. BMM, however, allows for more detailed modelling in the sense that it has more sophisticated modelling elements and relationships.

The COSO enterprise risk management framework [8] argues that to support and further develop business motivation, a company needs to assess internal and external requirements and events to identify what may positively (opportunity) or negatively (risk) impact the business in order to prepare appropriate responses to such events. Additionally, risks may also come from unfit business motivation itself, such as unsuitable goals or inefficient strategies. But neither BMM nor the ArchiMate motivation extension explicitly regard the relation of motivation to business risks.

BMM at least considers risks as potential impacts based on influencer assessments. However, the level of granularity is not deep enough. There is no explicit relationship

between risks and other elements of the business architecture like goals, strategies or business processes.

Risks of the BMM are also not related to processes, although ill-structured business processes may cause communication delays, inefficient collaboration, etc. [13] and thus may have an impact on the risks. Modelling approaches to relate process activities to risks already exist (e.g. the risk model of ADONIS [14]), but again the risk is isolated from the rest of the enterprise architecture model, i.e. is not related to other business constituents in question.

Also missing are approaches to model the relationships between risks and decisions. ISO 31000 states that risks and risk management are an important part of decision making [15]. Although there already exist ways to model decisions in the enterprise architecture, e.g. through BPMN gateways or with the help of decision models [16], risks are not explicitly related to decisions in either of them.

Furthermore, risk management is part of the governance, risk and compliance triad (GRC) whose underlying idea is to consider these three elements together [17]. Exemplary risks coming from non-compliance are fines, product recalls, rating losses, etc.

To summarize, we see that modelling approaches are missing which relate risks to other elements of the business architecture like business processes, decisions, business motivation or compliance. This, however, would be necessary to increase risk awareness in decision making and thus to create a holistic view for enterprise risk management.

4. Methodology

In order to answer the research question, we followed the design science research strategy whose main objective is to create an IT artifact through the implementation of the four main phases [18,19]:

1. *Awareness of the Problem*. An intensive literature review was made to establish a common understanding of the investigated concepts and identify their dependencies on each other. To ensure business relevance and consistency of the research, several interviews were conducted with practitioners and researchers in the field of risk management in order to verify and extend the literature findings.
2. *Suggestion*. The findings from the awareness phase served as a basis for developing a risk-centered extension to the OMG Business Motivation Model [10] on a conceptual level. Namely, the Risk Awareness Model and Notation (RAMN) modelling technique was developed which consists of a modelling language and a procedure model that guides one in the hands-on application of the language. The suggested technique was pre-evaluated in order to support the identification of concepts and model types.
3. *Development*. A meta-model for RAMN was developed and implemented in a meta-modelling tool.
4. *Evaluation*. The meta-model was critically evaluated to establish whether it works as expected and whether it is value-adding. A study program at a university of applied sciences was used as a case for evaluation.

5. Technology Description

The core of this research is development of the Risk Awareness Model and Notation (RAMN) as an extension of BMM. The modelling language was implemented in the ADOxx[1] meta-modelling platform.

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[1] http://www.adoxx.org

To develop the meta-model, we followed the metamodelling approach of Karagiannis and Kühn [20] who state that a modelling technique comprises of a modelling language and a modelling procedure on how to apply the language (see Figure 1).
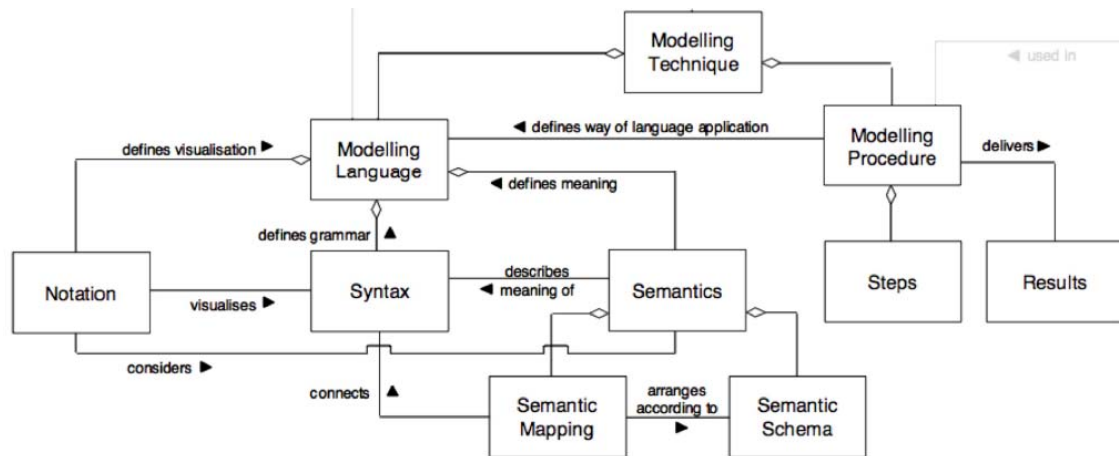

Figure 1. Modelling Technique and Some of Its Elements from [20]

6. The RAMN Modelling Language

The developed RAMN modelling language extends the OMG Business Motivation Model by explicitly regarding risks and their dependencies on other business constituents.

6.1 Language Elements

Business Motivation corresponds to the "why" column of the Zachman Enterprise Architecture Framework [11] and, thus, is a good starting point for making explicit the reasons for strategic decisions and their relation to risks. Therefore, we extended the OMG Business Motivation Model BMM [10].with further concepts, such as

- Risk Indicator
- Internal Control
- Decision
- Compliance
- Activity

and adapted the attributes of the already existing concepts

- Risk
- Potential Reward

Each concept has a definition, notation and attribute(s). Table 1 shows the notation and attributes of the Risk concept.

Table 1. Details of the "Risk" Concept

Definition	Notation	Attributes	Attribute Type and Values
"An effect of uncertainty on objectives" [4]	⚠	Type	- Strategic - Operational
		Impact	- Low - Medium - High
		Likelihood	- Low - Medium - High
		Referenced instance	Intermodel reference to other risk instances; allows referencing an instance to another instance or to another model type.

Additionally, relationships and restrictions between the concepts were identified. An excerpt of relationships and restrictions of one of the concepts is provided in the Figure 2:
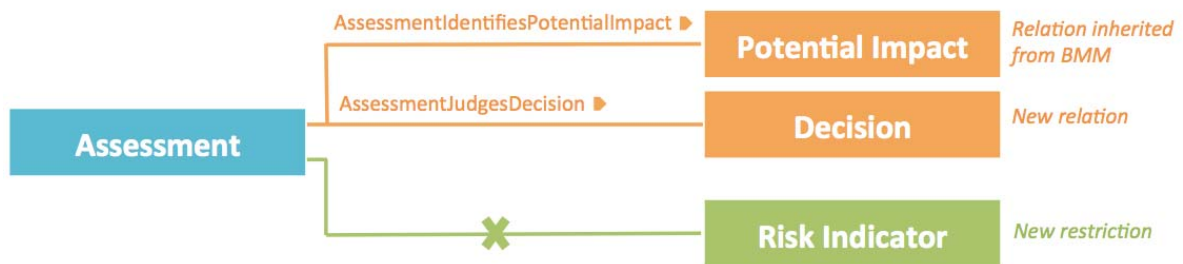

Figure 2. Some Relationships and Restrictions of the "Assessment" Concept

6.2   Model Types

To support the usability and maintainability of the modelling language, different model types were developed, which allow creating an easy-to-understand overview with further possibilities to drill down to explicit dependencies of each particular risk. The developed model types are:

1. *RAMN Overview Model*. The purpose of the overview model is to visualize a landscape of decisions, risks, courses of actions and assessments in order to get a general awareness of the situation (see left part of Figure 3).
2. *RAMN Risk-Centered Model*. A risk-centered model provides a detailed view on a specific risk and shows all dependencies to and from this risk instance (see left part of Figure 3).
3. *Risk Library*. This model type, developed on the basis of the risk model of the ADONIS Community Edition [14], is not mandatory but it is recommended to use it to get rid of redundancy issues.
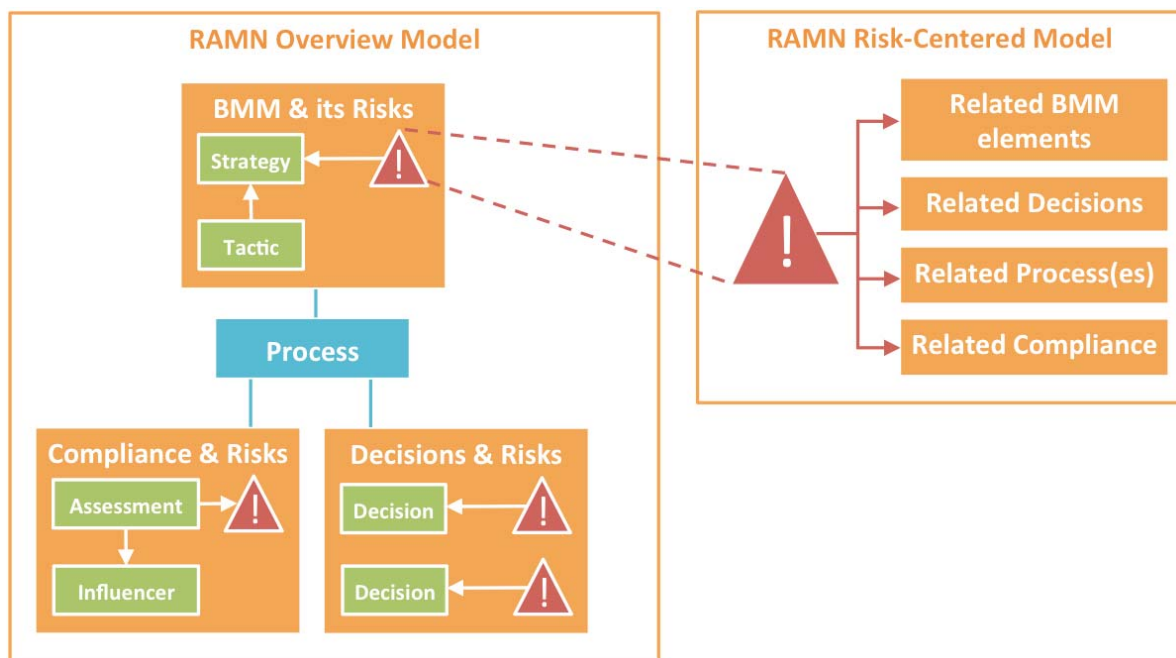

Figure 3. Overview and Risk-Centered Models at a Glance

Risks modelled in an overview model must be related to risks in risk-centered models via references (see Figure 3). In case further models exist (e.g. process models), it is highly recommended to reference corresponding elements as well.

Finally, a modelling procedure with a step-by-step description of how to apply the modelling language was developed using BPMN.

7. Evaluation

The modelling approach was critically evaluated in a workshop with an expert in the field. During the workshop a RAMN model for a concrete case study at the School of Business FHNW was created.

The relevance and value-add of the modelling technique as well as its usability were discussed in both unstructured discussion during modelling and a semi-structured interview at the end with predefined questions. Additionally, potential improvements were identified and implemented. Figures 4-5 provide an excerpt from the modelling results of the evaluation:
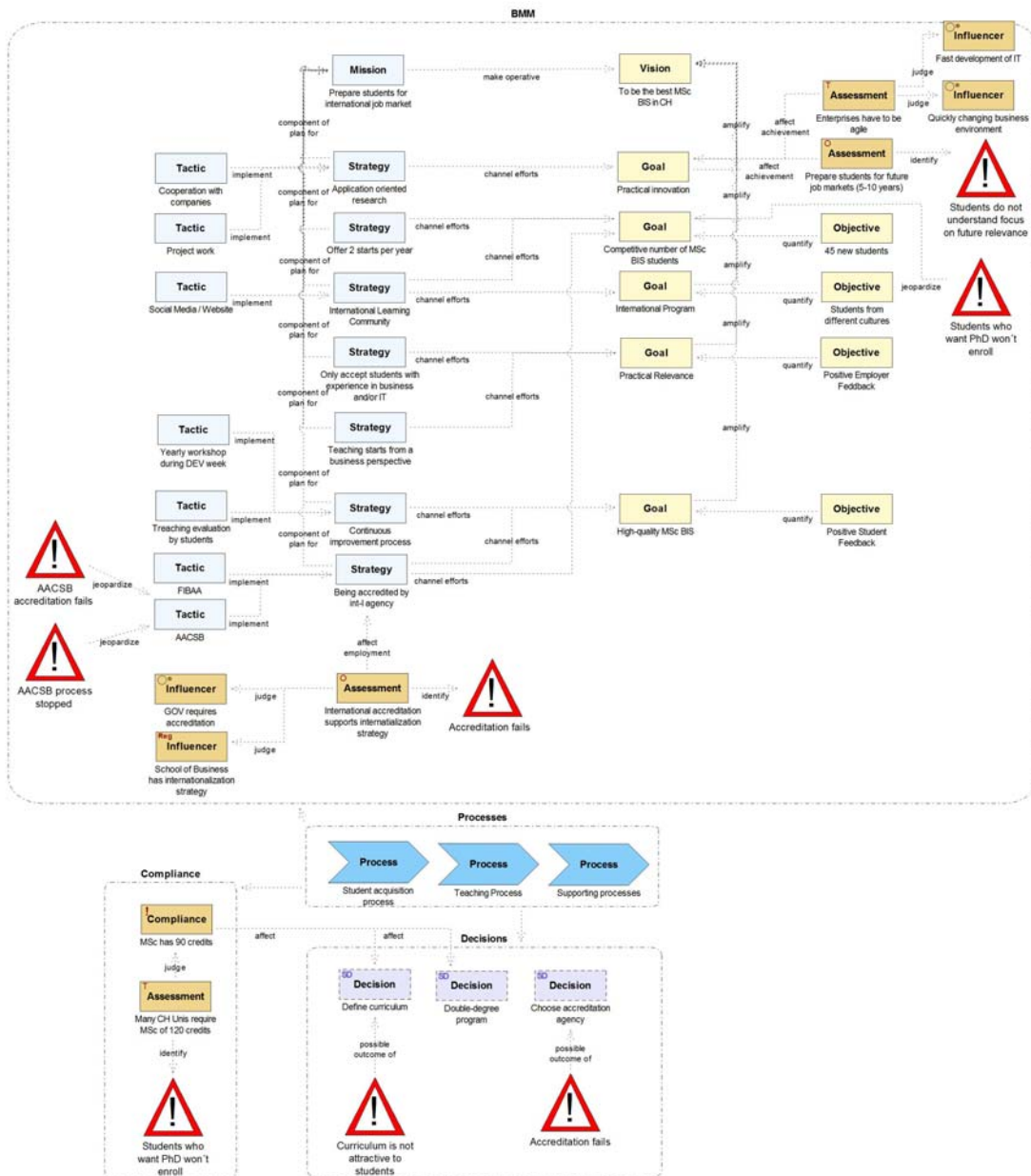

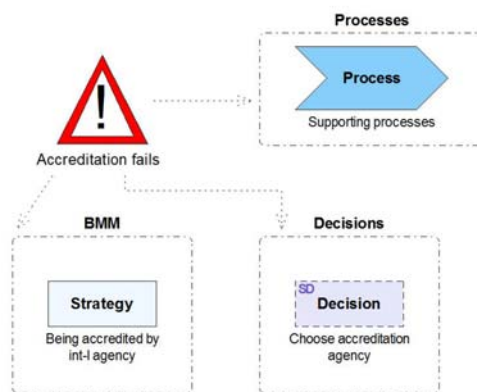*Figure 4. RAMN Overview Model of the Evaluation Case*

Figure 5. One of the RAMN Risk-Centered Models for the Evaluation Case

Since the evaluation was conducted only on one case in one department/industry, further evaluations and applications of the approach are necessary. In case the evaluation results are confirmed and consistent, the RAMN extension can be proposed to the OMG.

8. Business Benefits

The developed modelling technique is an approach to increase risk awareness in enterprises by providing a way to identify and manage risks as well as to understand why a certain risk occurs. This is possible because risks and other business constituents are considered in one model and their dependencies on each other are visible and clear. Increased risk awareness can support business agility since decisions are taken faster, are risk-informed and are in line with up-to-date business motivation and compliance requirements.

The explicit modelling helps create visibility and facilitates implementation of any required changes. The transparency and reusability are also improved since once necessary cases / processes are modelled, they can be easily maintained and adapted to reflect the changing business environment. Communication of the models to the relevant stakeholders across the enterprise also promotes a risk-aware corporate culture.

Since the modelling language is not industry- or size-specific, it is to a certain extent open and non-restrictive, which means it can be applied at any company. In spite of that, companies, especially large ones, have to consider the time and resources needed for the modelling. However, modelling of any kind (e.g. business process modelling) requires time and commitment but in return helps deal with complexities which in a large enterprise is even more important. An incremental implementation process is advised, namely applying the approach firstly on a department or individual process levels to gradually gather the experience and improve on lessons learned.

9. Conclusions

The RAMN modelling technique is an extension of the OMG Business Motivation Model. The technique helps increase risk awareness in enterprises by improving the visibility of risks through the explicit modelling of risk relationships to other elements of business architecture. The technique is not industry-specific and can be applied at any company.

The developed modelling technique not only guides a person in identifying the risks but also helps clearly see the changes that may be required in case the situation changes.

The modelling technique was evaluated for usability and value-add during a workshop. While the evaluation was successful, further research work in this area will be conducted, namely (1) applying the modelling technique on operational risks to verify if the results remain consistent and (2) conducting further evaluations in different industries and on

different cases in order to refine the concepts and their relationships as well as to ensure the consistency of the results. It is also expected that further applications of the modelling technique in different business sectors will trigger the creation of common use cases for standard processes.

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