

# A Survey of Risk-Aware Business Process Modelling

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## ABSTRACT

For organizations, risk is a key concept when dealing with business process. Integrating risks aspects during business process management starts with an accurate consideration of risk's characteristics in the modelling phase. Most research is needed on integrating risk and business process modelling. Actually, the literature suggests various approaches to represent risk-related information in business process models. The diversity of those methods and the fact that this domain is still emerging make it difficult to choose the most suitable language. This paper aims to represent a survey of the existing risk-annotated business process model's notations.

## KEYWORDS

Business Process Management, Business Process Models, Risk, Risk-Aware, Survey

## 1. INTRODUCTION

In a competitive environment, organizations have been transformed in order to meet their needs in terms of quality and productivity. Many of them have deployed business process management (BPM) systems to manage their businesses. Business process management enables organizations to ensure that its processes are implemented in an effective and efficient way and that they meet customer needs with the expected level of performance (Harmon, 2003).

Nevertheless, organizations face, every day, several uncertainties. The effects of those uncertainties on the objectives of the organization are known as risks. Those risks should be managed through the use of relevant principles, frameworks, and processes. Their implementation is commonly known as risk management (ISO/IEC, 2009).

However and despite the adoption of risk management approach, the economic sphere has experienced several financial scandals (Suriadi, Weiss, Winkelmann, Ter Hofstede, Adams, Conforti, Fidge, La Rosa, Ouyang, Rosemann, & Wynn, 2014). This has demonstrated the limits of a separate management of process and risk. Therefore, the need to adapt risk management practices in the field of business process management arises.

To this end, Risk-aware Business Process Management (R-BPM) is a discipline that has drawn special attention in the past decade because of the benefits obtained by integrating the principles of management risks in all phases of process management (Suriadi, Weiss, Winkelmann, Ter Hofstede, Adams, Conforti, Fidge, La Rosa, Ouyang, Rosemann, & Wynn, 2014).

The literature suggests, indeed, a set of approaches in this context. Most of them concentrate on design stage of BPM lifecycle. Obviously, managing risks in business process starts by a convenient representation of risks and their characteristics in business process models. By integrating risks and their potential characteristics directly into business process models, a clearer connection is seen

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between operational workflows and the risks inherent to each process. For this, different approaches have been developed to deal with the issue. In fact, most works that addressed the field of Risk-aware Business Process Management, have concentrated their focus on representing risks at the design stage and how to integrate their representation in business process models (Suriadi, Weiss, Winkelmann, Ter Hofstede, Adams, Conforti, Fidge, La Rosa, Ouyang, Rosemann, & Wynn, 2014). Nevertheless, the modelling of risk in business processes is still a challenging research task.

This paper surveys the current state of art in modelling risks in business processes. Next, the authors identify and provide a comprehensive comparative overview of the identified approaches, in light of the evaluation criteria. Finally, the survey concludes by exposing common limitations of existing approaches.

This paper is organised as follows: Section 2 gives an overview on the existing modelling approaches in the Risk-aware BPM field, followed by an evaluation of those approaches according to a set of criteria in Section 3. Finally, conclusions are provided in the last section.

## **2. OVERVIEW ON THE EXISTING RISK-AWARE BUSINESS PROCESS MODELLING METHODS**

As a preliminary step of this work, a classification of the existing risk-aware business process models is given. Mainly, those approaches are grouped in two different categories:

- Methods that reason about risks by extending existing business process modelling languages;
- Methods that attempt to reason about risk through the introduction of new integrated risk constructs to capture risk-related information within a business process model.

### **2.1. Representing Risks by Extending Business Process Modelling Languages**

#### ***2.1.1. EPC-Based Business Process Modelling Approaches***

Most representations of risk-relevant extensions to business process models were considered in the Event-driven Process Chain. Rosemann and zur Muehlen (2005) is the first work that deals with risk-aware business process modelling. In this paper, the authors present a risk-relevant extension of business process models in the Event-driven Process Chain (EPC) notation and a method for incorporating risks into EPCs. They propose 4 interrelated model types to capture risks in business process environment:

- The Risk Structure Model that provides information regarding the relationship between risks. This model type supports two basic semantic relationships: composition and generalisation/specialisation;
- The Risk Goal Model which represents a risks/goals matrix. This model supports two viewpoints. First, it can be studied what impact a risk can have on different goals. Second, it shows the risks that a goal is exposed to;
- The Risk State Model that captures the dynamic aspects of risks and consists of the different object types risk, consequence and connectors.
- Event-driven Process Chains (EPCs) are extended to consider risks, enabling the assignment of risks to individual steps in the specific process.

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