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Toward Preventive Management of Risks Theory: Foundation of Process Structuring the Theory

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Abstract: The preventive management of risks in enterprises has a pivotal role in preserving the value created in the business processes. Despite the notable importance of this area of study, it has received little attention from researchers. A deep investigation and analysis of the literature on risk management led to reveal that there is a need for a solid foundation of preventive management of risks theory. Although the contribution of the previous studies in the area of preventive management of risks, by identifying the pillars that constitute it, and highlighting the contribution of the integration of risk management and knowledge management in preventing risks. However, we may only consider these studies as preliminary steps in the development of this new field since they did not justify the integration of different disciplines to generate a new one. Moreover, they did not provide any operational process that structures this paradigm. Thus, we aim through the present study to take one further step in the foundation of preventive management of risks and to develop an operational process that regulates this field by coupling a knowledge management process with the process of the integrated management of risks and business processes. This integration has followed a rigorous and strict methodology to justify and accept the integration of two separated fields in one single field as a scientific and valid foundation. This research has succeeded to provide theoretical implications and a conceptual model for preventive management of risks, which triggers the need for empirical implications to improve the outcomes of this study.

Keywords: preventive management of risks; risk management; business process management; knowledge management; conceptual model

Introduction

Value creation is the crucial mission of business processes, which is exposed to a variety of risks that may deteriorate and change it. Therefore, enterprises attempt to preserve it through risk management (Sienou, 2009). In this regard, (Suriadi , et al., 2014) argue that risk management processes should not be separated from business process management in order to momentarily monitor and mitigate any emerged risk to ensure a proper termination of a process. In other words, risk management (KM) should be one of the business processes activities besides the creation of values, as consequence, the preservation of the created value.

In line with the importance of bringing the risk management activities closer to business process management. The international norms related to risk management outlined the positive contribution of this integration to improve the risk management outcomes. However, none of them provided structured frameworks for integrating risk management into business processes (Basel Committee on Banking, 2003; COSO 2004; ISO 31000, 2018). This lack has triggered the emergence of risk-aware business process management (R-BPM), which seeks to create risk awareness within the business processes (Zur Muehlen et al., 2005; Rosemann et al., 2005; Sienou, 2009; Lamine et al., 2020).

How to cite
Maamir, S. & Derghoum, M. (2021). Toward Preventive Management of Risks Theory: Foundation of Process Structuring the Theory. *Management Dynamics in the Knowledge Economy,* 9(2), 185-203 DOI 10.2478/mdke-2021-0014
ISSN: 2392-8042 (online)
www.managementdynamics.ro
https://content.sciendo.com/view/journals/mdke/mdke-overview.xml

The latest researches in the field of R-BPM have provided the business process-risk integrated method (BPRIM) lifecycle, which structures the integrated management of risks and business processes(IMRBP), and which incorporates the business process management (BPM) and enterprise risk management (ERM) lifecycles to establish a risk-aware culture in the business processes and help business and risk responsible in their missions. (Lamine, et al., 2020). Although the contribution of the R-BPM to promote a risk-awareness in the business processes which leads to the preservation of the created value. R-BPM considers the risk management as an activity that occurs after or at the same time of the occurrence of risk, which may affect the created value. Therefore, the aim of this paper is to take one further step towards the preservation of the created value through the foundation of the preventive management of risks.

A deep investigation of the literature led to reveal that there is no clear and structured theory of preventive management nor an operational process that encompasses consecutive steps for the prevention of risks. However, several studies outline the concept of risk prevention (Neef, 2005; Madagh & Chedri, 2017). Neef (2005) argues that knowledge risk management, which is the field of study that incorporates risk management and knowledge management (KM), helps to prevent risk and to handle effectively the ethical and reputational risks. However, we may consider this study as a first step towards the emergence of the new field of study of preventive management, since it did not follow any methodology to justify the integration of two separated disciplines in one field of study, but it gave the components of the preventive management, which are the risk management and knowledge management.

Therefore, the present paper seeks to achieve the following objectives:

Firstly, create a strong theoretical foundation of the preventive management of risks and a process that structures this field which is the conceptual model of this paper through defining from the literature the components that constitute this area of study.

Then Justifying the integration of these components in a holistic model through the Distillation of the steps which permitted the integration of BPM lifecycle and ERM life cycle to establish the business process of the business process-risk integrated method (BPRIM) life cycle. Then applying the same strategy in our study to justify the integration of a knowledge management process and the integrated management of risks and business processes to establish the preventive management of risks and to develop the operational process that structures this field (which is also the conceptual model of this paper).

The paper is structured as follows. First, we emphasize the research methodology, then we give a brief overview of the literature of risk management, we start by introducing the normative approach, then we discuss the contribution of R-BPM to fill the lack in the normative approach, then we introduce the integrated management of risks and business processes, which is an extent of the R-BPM. After this, we highlight the need for the foundation of preventive management of risks and the contribution of knowledge risk management in the foundation of this new area of study. In the second part of the paper, we introduce the results of the integration of KM process with the process of the integrated management of risks and business processes in one single process, which is the process of the preventive management of risks that we developed, and which is the conceptual model of this study.

Methodology

The aim of this paper is to integrate a knowledge management process with the process of the integrated management of risks and business processes to establish a strong theoretical foundation of the preventive management and to develop its conceptual model. This type of conceptual model, which is also qualified to be called the integrative framework, aims at integrating different components in one single model, and which is

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designed to extend knowledge and generate new areas of research, ''Integration involves synthesis that is, the creation of a whole from diverse parts. Integration leads to overarching ideas that can accommodate previous findings, resolve contradictions or puzzles, and produce novel perspectives'' (Maclnnis, 2011). On the basis of the study of Jaakkola (2020) who provided four types of conceptual papers, this paper is a model paper because it aims at establishing a theoretical foundation of the preventive management which introduces novel relationships between risk management and knowledge management. Moreover, we attempt through this study to develop a conceptual model of the preventive management of risks, which identifies new connections between risk management and knowledge management. These aims are similar to the goals of "the model paper" identified by Jaakkola (2020), and the research design of it includes the following steps:

The first step

The development of preventive management of risks and operational process (the conceptual model of the preventive management of risks)

The second step

The choice of domain theories which is the literature that addresses key elements of the phenomenon /concept to be explained. As aforementioned, the study of Neef (2005) provided the key elements that constitute the pillars of preventive management of risks, which are knowledge management and risk management. The review of the literature of risk management and knowledge management showed that there are different approaches of these two fields of study. Hence, we selected the most appropriate approaches for our study as follows. In the present study we adopt the R-BPM approach, particularly, the integrated management of risks and business processes as a particular approach of risk management developed by Sienou (2009) and Lamine et al., (2020) for two main reasons:

The present study has the same objective as the study of Sienou (2009) and lamine et al., (2020) which is the preservation of the created value through the creation of risk-awareness within the business processes of the organizations. Further main contribution of our paper is to integrate the outcome of the previous study, which is the BPRIM lifecycle (which is the life cycle of the integrated management of risks and business processes) with a knowledge management lifecycle (process) to establish the preventive management of risks. Sienou (2009) and Lamine et al., (2020) have followed a particular methodology to integrate two separated fields of study in one single discipline. We adopt in the present study the same methodology and steps to justify and integrate the risk management (precisely the integrated management of risks and business processes) with knowledge management.

Regarding knowledge management, we developed a generic process of knowledge management because it does not exist a holistic process that encompasses all the steps of knowledge management.

The third step

Choice of method theory, which is a theory that enables the explanation of the relationships between the variables studied:

We follow the methodology that has been adopted by Sienou (2009) and Lamine et al., (2020) to explain the relationships between risk management (the integrated management of risks and business processes) and knowledge management, which will justify their integration in one single field of study. An overview of this methodology is given as follows:

- Reconsider the theories/disciplines as processes

-The integration approach is the linking of inputs with outputs of two separated cycles, in order to promote possible interfaces between them. This approach attempts by working on the interfaces to create links between their outputs and their respective inputs, which also requires high degree of control of the information exchanged between the two cycles and which are stored in models shared by the cycles (Sienou,2009) . We can distill from this, that in order to integrate two processes in one single process, (process and cycle are used interchangeably in this study), we should find relations between them in the form of information and data shared by the two processes, which justify their integration in one single process. Hence, the data flow diagram (DFD) technique is appropriate to identify the information exchanged between two processes, which justify their integration in one single process (Sienou ,2009; Lamine et al., 2020).

- Hence, the second step is the design of the diagram that shows the interactions and the flow of data exchanged between the two processes using data flow diagram (DFD) notation (we determine the models shared by the two processes).

- Then we design the model of the final process using business process management notation (BPMN), which shows the logical arrangement of the activities of the disciplines studied.

Literature review and related concepts

In this section, we briefly review the different approaches of risk management. Firstly, we introduce the normative approach, then we introduce R-BPM approach and to provide a better comprehension of our study, we briefly highlight the concept of BPM and BP modelling, which are recently shifted from software engineering to management discipline. Then we outline the limitation of R-BPM and the need to establish preventive management of risks, which is based on knowledge risk management, since it has provided the key components of the preventive management, and we shed light on the concept of the knowledge management process.

Transition from risk management to preventive management

Sienou (2009) argues that all the organizational processes are exposed to numerous risks situated all over the processes. Therefore, risk management should cover all areas of business processes to preserve the created value. The literature review of risk management is initially designed in line with the importance of integrating risk management in business processes since the final objective of this paper is to develop preventive management to preserve the created value within the business processes. Hence, we start by emphasizing the adoption of this current by the international norms related to risk management, then we highlight the lack in the normative approach. After this, the literature review will take another turn to introduce its alternative, which is R-BPM.

Basel Committee on Banking (2003) considers the business line management the responsible for managing risks, which means that the risk management activity should be one of the business lines activities. On the other hand, it emphasizes that the corporate operational risk function should be independent from the other activities, unless in the case of small banks, where this activity can be integrated into functions and processes and maintaining independence through the separation of duties and independent review of processes and functions. Although that, the norm does not provide any explicitly formalized methodology for integrating risk management into business processes.

COSO (2004) also emphasized the importance of integrating risk management into business processes, and it provided three approaches for managing risks, in the first one,

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the risk identification and assessment happen in business lines while the response and control activities occur in central function(s). The second approach considers the risk management as the responsibility of business lines, while the central functions monitor and might have some roles in reporting, and in the third approach, the risk management is the responsibility of both the central function(s) and business lines. From that, we can deduce that the risk management can be one of the business lines activities; however, there is no clear and formalized framework for integrating risk management into the business processes. We find also that BS ISO31000 (2018) highlighted the need for incorporating the risk management process into the organization's structure, operations and processes, but like the other norms it did not structure nor equip this operation.

Hence, the need for a structured methodology for the integration of risk management with business processes management led to the emergence of the R-BPM that encourages risk-awareness within the business processes of the enterprises, to enhance the decisions regarding the value creation and preservation (Lamine, et al., 2020). Although the contribution of the researchers in the field of R-BPM (Zur Muehlen et al., 2005; Rosemann et al., 2005). However, it did not reach the maturity, due to the lack of a structured framework that supports this field, and the need for an approach that enables the integrations of the stages of the ERM lifecycle and the BPM life cycle (Lamine, et al., 2020). Hence, the need for a methodological framework that structures the integration of BPM and the ERM has motivated the foundation of the integrated management of risks and business processes, which is the mature theoretical foundation of R-BPM, and the development of the (BPRIM) framework. The development of the BPRIM has gone through three steps as follows: synchronization of process management life cycle and risk management lifecycle, unification of conceptual models of enterprise and risk uniformization of modeling language (BPRIM) (Sienou, 2009; Lamine et al., 2020)

In the present study, the focus is on the first step, which is the synchronization of process management life cycle and risk management life cycle. Since we are adopting a managerial perspective to understand BPM as management discipline and to understand the integrated management of risks and business processes, therefore, we are not going touch on technology aspect of BPM, which is a field on its own.

To sum up, the integrated management of risks and business processes is the latest paradigm in risk management, which is an extent of the R-BPM that has been developed due to the lack in the normative approach related to risk management. In the present paper, we consider the integrated management of risks and business processes as the appropriate paradigm of risk management for our study. In the next section, we will describe the synchronization of process management life cycle and risk management lifecycle, which is the outcome of the integrated management of risks and business processes. This description helps to understand this area of study, which constitutes a component of preventive management that we attempt to develop. It also helps to distill the methodology adopted to integrate ERM lifecycle with BPM lifecycle, which we will follow in this study to justify the integration of the integrated management of risks and business processes with knowledge management in one field, which is preventive management of risks. But before that, we consider important to give a brief overview of these concepts to permit a better comprehension of the methodology adopted by (Sienou 2009) and (Lamine et al., 2020) and which will be adopted in this study, since the BPM and BP modelling concepts originate from the software engineering and shifted to management discipline.

Business Process Management (BPM)

Every business is considered as a processing system, or a value machine, which transforms the inputs into outputs to create value. (Rummler, Ramias, & Rummler, 2009, p. 47). In other words *"all work is process work"* (Hammer, 2015, p. 11) . A business process (BP) is defined as: *"a collection of activities that takes one or more kinds of inputs and creates outputs that is of value for the customer.* " (Hammer & Champy , 1993, p. 35) .

While business process management (BPM) is defined as "a management discipline focused on using business processes as a significant contribution to achieve an organization's objectives through the improvement, ongoing performance management and governance of essential business processes" (Jeston & Nelis, 2014, p. 4). This definition emphasizes the core motives for managing the BPs, including the improvement of the main BPs to realize the purposes of the enterprises. Another study emphasizes also that BPM is used by employees to improve the BPs to achieve the organizational objectives (Lee & Dalle, 1998). Therefore, we conclude that there is a consensus among researchers that BPM supports the BP improvement for the sake of achieving the organizational purposes.

The BPM is a continuous cycle, which aims at developing and monitoring the BPs (Dumas et al., 2013, p. 21) . Many BPM lifecycles were developed by researchers, which did not include the same stages. In the present study we adopt a generic BPM lifecycle proposed by Sienou (2009) in which he integrated eight BPM steps to create new model, this choice is motivated by the ambition to extend the study proposed by Sienou (2009).

The different stages of the generic BPM lifecycle are described as follows:
- Plan: this phase establishes the objectives of the process management, the mission of business process and the plan to realize the expected advantages. It fixes the framework of the process management and determines the expected value of the output of the current iteration (Sienou, 2009) .
- Design (Process modeling): the business analyst designs systematic process model to identify the different activities in the business processes by using process modeling tools, which help the creation of graphs (Wetzstein, et al., 2007) . The output of this activity is the creation of the to-be process model (Dumas et al., 2013, p. 22).
- Implement: This phase includes two things: organizational change management, which consists of making the necessary changes in the methods of working of all the individuals included in the process, and the automation, which consists of the creation of automated systems, which helps the to-be process (Dumas et al., 2013, p. 22).
- Pilot: it consists of reviewing and monitoring the BPs (Sienou, 2009) .
- Evaluate: this phase consists of assessing the needs for the processes' improvement (Sienou, 2009) .

In the present article, our focus is on the design phase (business process modeling), which we use as a means to justify the incorporation of different processes in one single process, and consequently the integration of two fields in one single discipline, and for other purposes that we are going to highlight in the next section.

Business process modeling

Besides to the importance of BP models in software engineering, the use of these models are also of high importance in the realization of organization's objectives such as the reorganization of processes (Becker, Rosemann, & Von Uthmann, 2000). Business process modeling is used to provide a representation of the actual processes and design other new models (Lin, Yang, & Pai, 2002)

In this paper, we use BP modeling for designing the process that we attempt to develop, which integrates a knowledge management process with the process of the integrated management of risk and business process. Moreover, we attempt to justify graphically this integration through modeling the flow of data and information exchanged between these two processes to reveal the possible relations between them, and these relations between these two processes will justify their integration in one single process.

A variety of BP modeling techniques have been already presented, among these techniques we adopt in our study, the Data Flow Diagrams (DFD) and Business Process Modeling Notation (BPMN) techniques. As aforementioned in the previous section, we seek in this study to represent the data flow exchanged between a Knowledge

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management process and the process of the integrated management of risks and business processes. Hence, the appropriate technique for this, is the DFD notation. While, the BPMN technique gives a comprehensible notation and serves the development of models understandable by the business analyst who models the initial representation of the model, the technical developer who implements the technology which will execute the process and the business people who are the responsible for managing and controlling the processes (ISO/IEC 19510, 2013) . Moreover, DFD and BPMN are supported by many software tools, which support the modeling. Our study is an extent to the study presented by Sienou (2009) who used DFD and BPMN techniques, hence we consider important to continue with the same techniques.

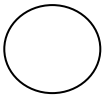
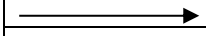
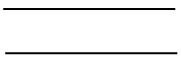
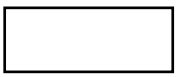
In the following part of this paper, we give a brief explanation of the DFD and BPMN concepts to increase the understanding of the figures provided in this paper.

Data flow diagram (DFD)

Data flow diagram (DFD) is defined as "A picture of the movement of data between external entities and the processes and data stores within a system" (Valacich & George, 2017, p. 183) . The literature emphasizes the advantages of DFD technique, which include, but are not limited to, the following benefits: DFD is flexible tool to redesign BPs models; it is also understandable and easy to use by inexpert user in modeling and it is an effective tool for communication between users and modelers (Aldin & De Cesare, 2009). It represents the flow of data and information, which gives a representation of the inputs and outputs of the process (Tangkawarow & Waworuntu, 2016).

DFD symbols are presented in the following table:

Table1. DeMarco and Yourdon DFD symbols

Element	Description	Notation
	Process	« The work or actions performed on data so that they are transformed, stored, or Distributed. »
	Data flow	Data flow
	Data store	« Data at rest, which may take the form of many different physical representations. »
	External entity	« The origin and/or destination of data. Sometimes referred to as external entities. »

Source: Adapted from (Valacich & George, 2017, p. 185)

Table 1 lists the symbols of the DFD notation, each symbol has a particular description that help the comprehension of the figures included in this paper.

Business process modeling notation (BPMN)

BPMN is used to transfer information and to model the end-to-end business process (White , 2004) . The BPMN has many advantages, which include, but are not limited to, the following benefits: minimizing the gap between the system technicians and the business analysts because the BPMN notation is understandable by all the employees in the organization, it is also used to all kinds of projects (Tangkawarow & Waworuntu, 2016). BPMN symbols are presented in the following table.

Table 2. BPMN symbols

Element	**Description**	**Notation**
Event	An Event is something that "happens" during the course of a Process.	
Activity	An Activity is a generic term for work that company performs in a Process.	
Gateway	A Gateway is used to control the divergence and convergence of Sequence Flows in a Process and in a Choreography	
Flow	A Sequence Flow is used to show the order that Activities will be performed in a Process and in a Choreography	
Pool	A Pool is the graphical representation of a Participant in a Collaboration	
Data object	Data Objects provide information about what Activities require to be performed and/or what they produce	
Group (a box around a group of objects within the same category)	A Group is a grouping of graphical elements that are within the same Category	

Source: adapted from (ISO/IEC 19510, 2013)

Table 1 lists the symbols of the DFD notation, each symbol has a particular description that help the comprehension of the figures included in this paper.

After explaining the notations used in this paper, we discuss in the next part of this paper the results of the studies of Sienou (2009) and Lamine et al., (2020) to distil the methodology that we follow in this research to justify the integration of two separated processes in one single process.

Figure 1 shows the interactions between "process design" stages, which is one of the phases of the BPM process, with the stages of RM process (the generic RM process developed by Sienou (2009). The integration approach requires the exchange of information, these pieces of information are contained in the models (e.g. business process model) (see figure 1) shared by the two cycles (Sienou, 2009) . The DFD is chosen to show the flow of data created and stored in the models shared by the two life cycles as it is represented in figure 1.

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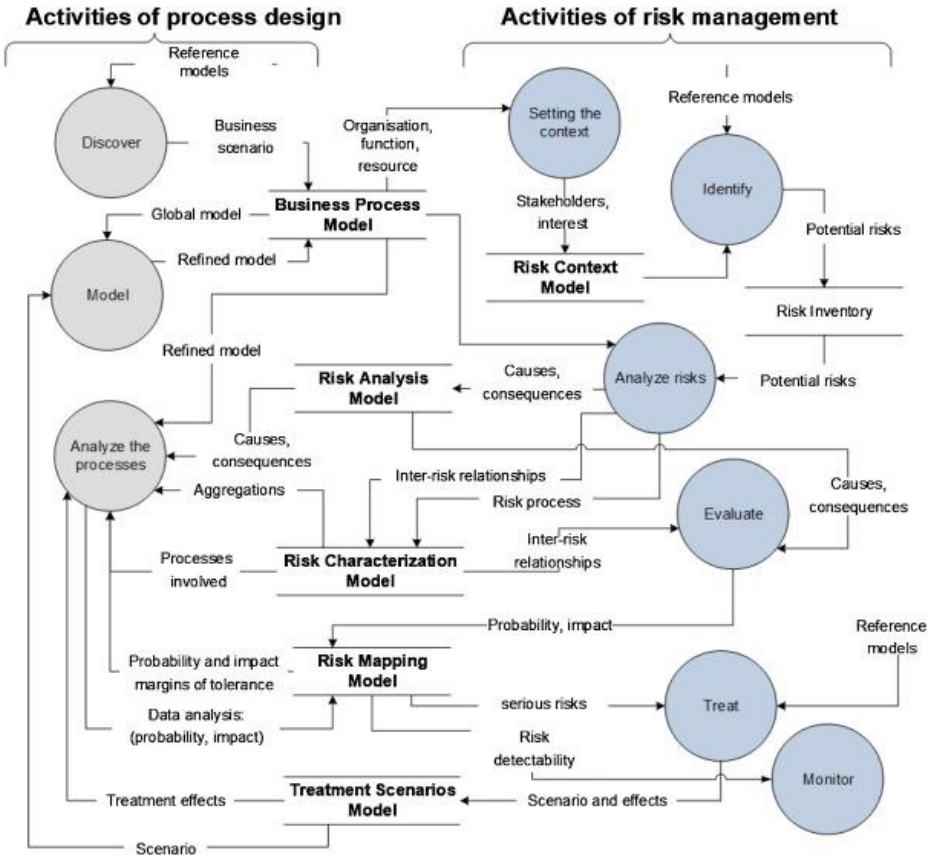


Figure 1. Overview of interaction between process design stages and risk management stages (DFD notation)
(Lamine, et al., 2020)

BPMN technique is chosen to design the logical arrangement of activities to achieve the objectives of the risk management as it is shown in figure 2, because the DFD technique does not permit the study of the logical arrangement of activities. (Lamine, et al., 2020).

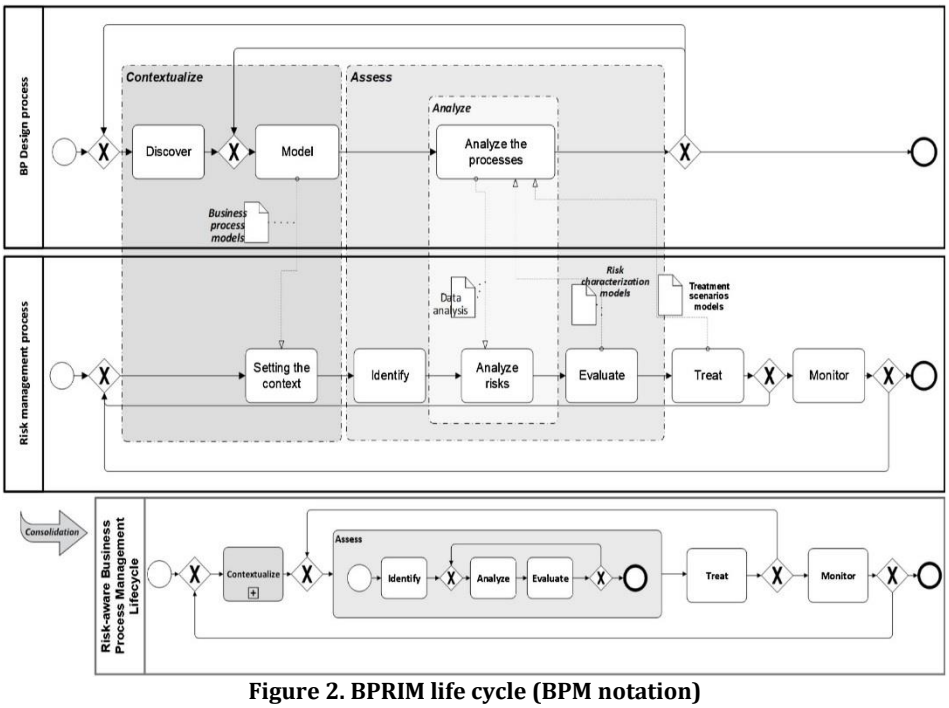


Figure 2. BPRIM life cycle (BPM notation)
(Lamine, et al., 2020)

From the study of Sienou (2009), we can distill the steps of integrating two different processes of two different disciplines in one single process through the integration approach; these steps are summarized in the following points:

- Reconsider the theories/disciplines as processes.

- Then justify graphically the integration of two separated processes of two different fields in one single process through:

- Designing the diagram that shows the interactions and the flow of data exchanged between the two processes using DFD notation (we determine the models shared by the two processes) (e.g. figure 1). The flow of data shared by the two processes justifies their integration in one single process.

- Then Designing the model of the final process using BPMN, which shows the logical arrangement of the activities of the disciplines studied (e.g. figure 2).

Although the positive contribution of the integrated management of risks and business processes in the preservation of the created value within the business processes. However, it is still restricted paradigm in terms of risk prevention because it is conducted after or simultaneously with the risk occurrence, which may affect the created value partially or totally. Thus, the lack in the integrated management of risks and business processes with regard to risk prevention has motivated the foundation of preventive management of risks.

Investigations of risk prevention showed a limited number of studies that have discussed this concept. Madagh and Chedri, 2017 have emphasized the importance of the risk prevention in managing individuals in enterprises which becomes also a strategic act to face the new challenges of this century, they also have argued that the success of the risk prevention depends on the communication, preventive culture, leadership, emotional and relational management. This study has delivered an interesting discussion on the concept of risk prevention; however, it did not provide a scientific foundation nor a solid theoretical basis. While the study of Neef (2005) contributes to the foundation of preventive management as a new area of research by determining its components, which are risk management, and knowledge management. The author in his study has integrated these two-separated fields of study in one single discipline, which is the knowledge risk management; however, the weakness of the study consists of the lack of scientific rigor and the need for an explicit methodology to equip and structure and justify the integration of two different disciplines in one single field. These weaknesses in the literature and the need for a solid foundation of preventive management and the lack of an operational process that supports this discipline has motivated this research.

To sum up the objective of this paper is to contribute to the foundation of a solid theoretical basis of the preventive management of risks and the design of operational process to structure this paradigm. We conclude from the literature that the preventive management is the result of the combination of two separated fields, which are risk management and knowledge management. As aforementioned, we adopt in this study the integrated management of risks and business processes as the appropriate risk management approach for this research. For knowledge management we discuss this concept in the next subsection.

There is a general consensus among researchers that knowledge management is the process that encompasses different steps (Bhatt,2001; Dalkir, 2005, Kucza, 2001; Nonaka & Takeuchi,1995), however each definition includes number of steps and ignore others, , which implies a lack of consensus over the most relevant knowledge management process (KMP) . Hence, we conducted a comparative study of the most important KMPs that we have found in the literature to reveal an integrated KMP, as it is shown in figure 3, which includes all the steps that were emphasized. Table 3 shows further details about the

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comparative study.Symbol (+) means that the study emphasized the step of the KM process, symbol (-) means that the study did not emphasize the step of the KM process.

Table 3. Comparative overview of the knowledge management phases in four studies

Stages of KM / Authors	Establish the context	Capture	Discover	Share	Store	Apply	Update
(Nonaka & Takeuchi, 1995)	_	+	+	+	_	+	_
(kucza, 2001)	+	_	+	+	+	_	+
(Bhatt, 2001)	_	_	+	+	_	+	_
(Dalkir , 2005)	_	+	+	+	_	+	+

Source: Elaborated by the authors

Kucza (2001, p.16) defines the knowledge management as" *the overall task of managing the processes of knowledge creation, storage and sharing, as well as the related activities. Generally speaking, this has to include the identification of the current state, the determination of needs, and the improvement of affected processes in order to address these needs"*. From this definition, we can distill that the KMP encompasses five steps, which are the identification of need for knowledge, knowledge sharing, knowledge creation, knowledge storage and knowledge update. While the KMP developed by Dalkir (2005) involves Knowledge capture and/or creation, knowledge assessment, Knowledge sharing and dissemination, contextualization, knowledge acquisition and application and knowledge update we notice that he excluded the identification of need for Knowledge and knowledge storage steps which were outlined by Kucza (2001) and included two other steps which are the knowledge capture and knowledge application. The KMP proposed by Bhatt (2001) encompasses the same steps proposed by Dalkir except knowledge capture and knowledge update.

Knowledge management refers also to knowledge creation, which includes four modes of knowledge conversion, including Socialization, which is the acquisition of tacit knowledge through experience. Externalization, which corresponds to the conversion of tacit knowledge into explicit knowledge. Internalization, which is the process of transforming explicit knowledge into tacit knowledge and Combination, which consists of mixing tacit and explicit knowledge to create new knowledge (Nonaka & Takeuchi, 1995). Socialization and combination correspond to knowledge discovery, while externalization and internationalization correspond to knowledge capture Becerra-Fernandez and Sabherwal (2010, p. 59). So according to Nonaka and Takeuchi (1995) the KMP confined only to knowledge discovery and capture, but it includes implicitly knowledge sharing because the authors emphasized the importance of conveying the knowledge created across the different levels of the organization and they have discussed the contribution of the application of knowledge created to innovate and create new products.

Based on the previous discussion, we suggest a working definition of knowledge management:

"The knowledge management is the process, which involves the establishment of the knowledge management context, the capture and/or the creation of knowledge, the

knowledge sharing, the knowledge storage, the application and the update of knowledge to achieve the organizational objectives. "

Likewise, the other descriptions, this definition considers the KM as a process that involves different steps to achieve the organizational objectives based on managing knowledge. In contrast, the other definitions, this definition provides a holistic process of KM, which encompasses all the steps discussed in the literature. These steps constitute the integrated Knowledge management process (IKMP) (see figure 3) which is the outcome of the combination of four Knowledge management processes presented in the literature.

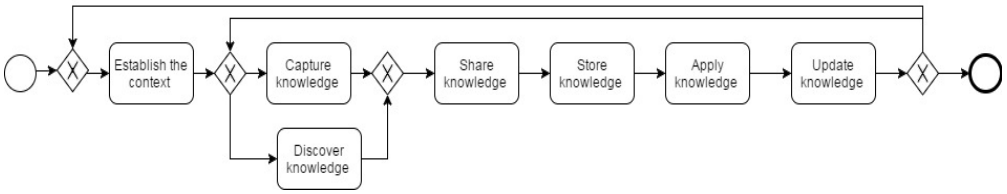


Figure 3. The integrated knowledge management process (BPM notation)
(Elaborated by the authors)

As we can observe from figure 3, the knowledge management process starts with the establishment of the context, which consists of identifying the organizational objectives related to the management of knowledge and the assessment of missing knowledge and the knowledge needed to achieve the objectives of the organization. After the first step, it comes the second one, which consists of capturing knowledge by identifying the existing knowledge developed by the individuals within or outside the organization. However, if there does not exist enough knowledge to achieve the objectives set, new knowledge should be discovered and created through socialization and/or combination strategies. After capturing or creating knowledge, it should be shared by transferring it from the employees who possess it to the rest of the employees who need it. Then comes the step of storing knowledge, which refers to the creation of organizational memory through the codification and record of the knowledge captured and/or discovered in the knowledge repository of the organization. The stored knowledge should be applied and used to achieve the organizational objectives. If the knowledge available did not help to achieve the organizational objectives, the knowledge should be updated by recapturing the existing knowledge and/or discovering new knowledge to accomplish the setting goals.

Knowledge flows are of crucial importance to the business processes and to the execution of activities in organization (CIOTLOS, 2020) we can deduce from the previous discussion that the KM contributes to the achievement of the organizational objectives. This has motivated this paper to disclose the contribution of the KM, particularly the IKMP, besides the IMRBP process to the prevention of risk. Hence, in the next part of this paper we will discover how does the integration of the IKMP with the IMRBP process contribute to the prevention of risks? And how does this integration contribute to the foundation of the preventive management of risks?

Results

As aforementioned in the preceding section the objective of this paper is to contribute to the foundation of preventive management of risks and its operational process, which is the conceptual model of this paper. Through the integration of IKMP with the process of the IMRBP. The integration of two separated fields in one single discipline should follow a rigorous methodology to accept the outcome of this integration as a scientific foundation. In order to meet this condition, we follow three steps that have been distilled from the study of Sienou (2009) which are summarized in the following three points:

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-Firstly, we reconsider the theories of KM and the IMRBP as processes, in other words, we define the theories in the form of a set of successive steps. The first stage of the integration was completed in the previous section (see figure 2 and figure 3).

-Then we design the diagram that shows the interactions and the flow of data exchanged between the two processes using DFD notation (we determine the models shared by the two processes).

-Finally, we design the model of the final process using BPMN, which shows the logical arrangement of the activities of the preventive management of risks, which we have called the K-PIMRBP (which is the conceptual model of the preventive management of risks).

In the next section, we exhibit the outcomes of the integration of IKMP with the process of the IMRBP (BPRIM). After completing, the first stage we proceed with the second one, which consists of coupling the stages of the two processes. The result of this coupling using DFD notation, is shown in figure 4.

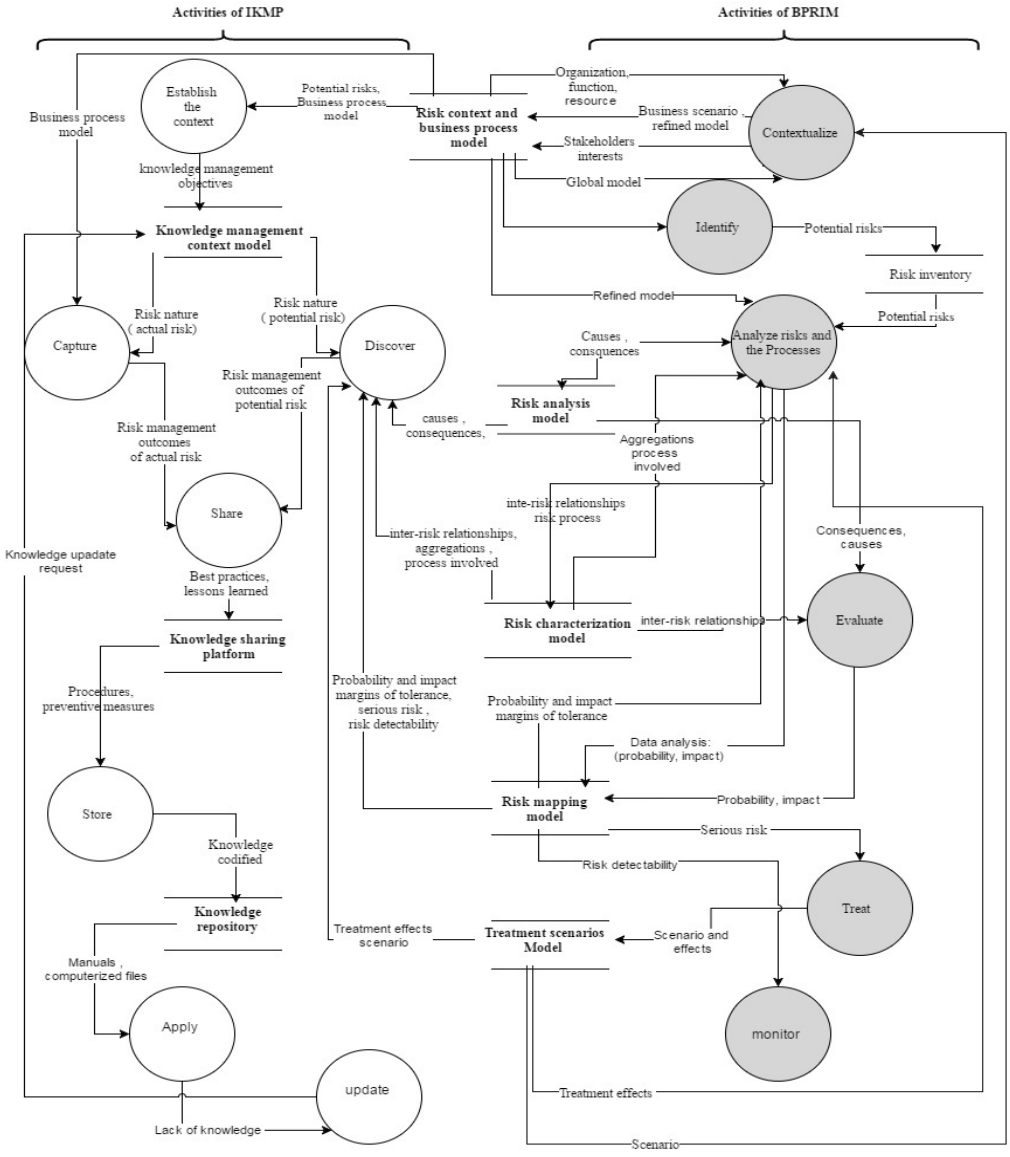


Figure 4. overview of the interaction between IKMP activities with BPRIM activities (DFD notation)

(Elaborated by the authors)

As a reminder, DFD notation gives a graphical representation of the flow of data and information exchanged between the BPRIM process and the IKMP. These data and information are stored in the models (Ex: risk context and business process model, knowledge management context model, and risk analysis model…etc.). These interactions between the two processes reveal the relations between them, which justify also their integration in one single process since there are relations between them. In the next part of this paper, we discover the nature of these relations and how does this integration contribute to the prevention of risks.

The analysis of the graph in figure 4 led to the following remarks:

The step of "establish the context" is triggered by the identification of potential risks, which orient knowledge management objectives. These objectives consist of identifying the existing knowledge that we should capture, and the knowledge needed that we should discover. The inputs of "Discover knowledge" step are the outputs of the BPRIM activities, which consist of the data analysis of risks, which are the causes and consequences of risks etc. The inputs of "capture knowledge" process are provided from risk context and business process models, which support this step by providing an overview of the business process affected by the risks and the actors who managed them which are considered as the source of knowledge. Risk management outcomes are shared in form of lessons learned and best practices, which serve the development of risk prevention procedures. Risk prevention procedures should be then stored in the knowledge repository of the organization in form of manuals and/or computerized files to facilitate the use of them by the employees. Risk prevention procedures (knowledge) should be updated to fit new risks. Besides the justification of the integration of two separated processes in one single process, the DFD notation shows the path of converting the integrated management of risks and business processes outcomes, precisely the contents of the risk context and business process model, risks analysis model, risk characterization model, risk mapping model and treatment scenarios model into knowledge. Which pass through the integrated knowledge management process to evolve into risk prevention procedures and measures that contribute to the prevention of risks by applying them through the implementation of these procedures in the business processes activities of the enterprises.

Table 4. Description of the K-PIMRBP models

K-PIMRBP models	**Aims**	**Contents**
Risk context and business process model	Establish the objective of risk management, identify the actors involved and the business process scenarios, and determine the models of the business processes	- Business processes - Business scenarios - Actors, data flow - Events - created Value - Potential risks
Knowledge management context model	Identify the existing knowledge that we should capture, and the knowledge needed that we should discover	- Business process models - The outcomes of risk management of existing risk
Risk analysis model	Determine causes and consequences of risks	- Risk causes - Risk location in business process - Risk consequences on the value created - The actors caused and affected by risk - Data analysis
Risk characterization model	Determine the inter-risk relationships and the processes involved and affected by risks	- Risk category

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Risk mapping model	Measurement of risk exposure	- Probability, impact, severity, etc.
Treatment scenarios model	Determine treatment scenarios and their effects on the risk	- Treatment scenarios
Knowledge sharing platform	Share the lessons learned and the best practices to develop preventive procedures	- Preventive procedures
Knowledge repository	Save the knowledge (preventives procedures) in the organizational memory	- Manuals and computerized files

Source: Elaborated by the authors

After discussing the path of converting the outcomes of the integrated management of risks and business processes into risk prevention procedures, which lead to the prevention of risks. Now we focus our endeavor to discuss the contribution of the models, which are represented by two separated lines in figure 4. Table 4 displays the eight models shared by the IKMP and BPRIM process, where five of them are consecrated to store the outcomes of the integrated management of risks and business processes, which aim at determining the outcomes of risk management and business process management, which are, described in the column "contents". These outcomes will pass through the IKMP to be stored and converted in three models of this process , until they become knowledge prepared to be applied in the risk prevention.

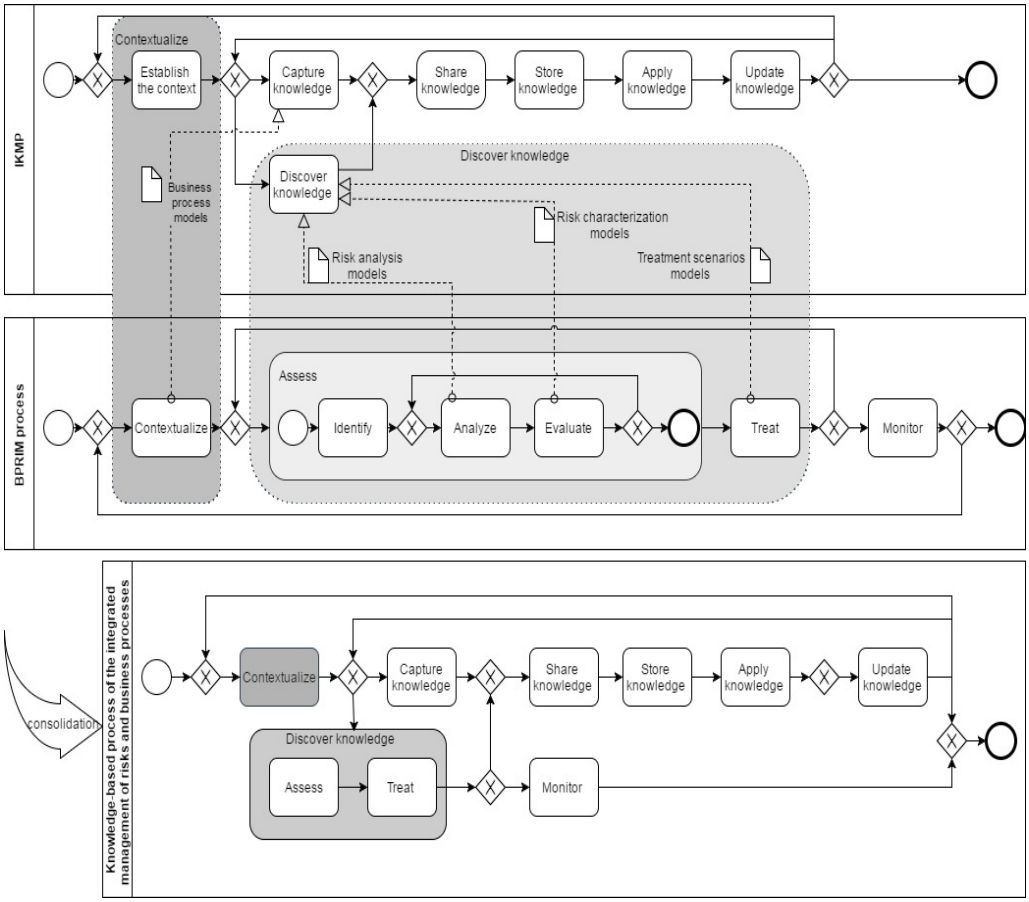


Figure 5 . K-PIMRBP model (BPM notation)
(Elaborated by the authors)

DFD diagram (see figure 4) has allowed the justification of the integration of the process of BPRIM with the IKMP, it also displayed the path of converting the outcomes of the

integrated management of risks and business processes into knowledge prepared to contribute to the prevention of risks. However, as aforementioned, the DFD notion is restricted in terms of studying the logical arrangement of processes, in other words it is difficult to understand from DFD diagram (see figure 4) the process of preventive management. Hence, we have selected BPMN technique to draw a comprehensive process of preventive management of risks, which we have called the *knowledge-based process of the integrated management of risks and business processes.* The K-PIMRBP, which involves the following seven activities:

Contextualize: This stage aims at establishing the context of both the IKMP and BPRIM process by coupling the IKMP objectives with BPRIM process objectives. It may be set off by potential risks identified in the BPRIM activities, which determine the KM objectives, which consist of knowledge capture in the case of potential risks or knowledge discovery in the case of new risks.

Capture knowledge: This stage aims at capturing the existing knowledge of actual risk (risk management outcomes) from the actors who caused the risk or who treated it. In other words, we capture knowledge from the workers who possess it and who developed tacit knowledge from their experience in dealing with the risk.

Discover knowledge: This stage aims at creating new knowledge of risk (risk management outcomes), which is qualified to be called the creation of organizational memory of risks.

Share the knowledge: Transfer the captured or created knowledge of risk from the workers who possess the knowledge to the rest of the workers in the sharing platforms, in the form of lessons learned from their experiences in risk management (e.g., causes of risks, the impact of risk on the process involved etc.) which allows the development of preventive procedures. In other words, the aim of this stage is to convert the knowledge of risk management in the form of preventive procedures through communication among the organization members by means of different tools.

Store knowledge: Save the knowledge (preventive procedures) in the organizational knowledge repository in the form of manuals and computerized files.

Apply knowledge: Use the preventive procedures to eliminate the causes of risks in the business processes or immediately apply the appropriate treatment scenario to minimize the effects of risks on the created value without going through all risk management steps.

Update knowledge: If the preventive procedures or the treatment scenarios do not serve to prevent or treat effectively risks, an update of knowledge is required.

As a final result of this research, we provide the definition of preventive management of risks as follows:

> *"Preventive management of risks is a process based on the knowledge which is converted from the integrated management of risks and business processes outcomes, then shared and stored in the databases in form of risk prevention procedures prepared to be applied to prevent risks".*

Conclusion, limitations, and recommendations

Nowadays, enterprises are evolving in complex and turbulent environment, which make their activities exposed to different factors of risks and uncertainties. Risks in business processes can influence and change the created value. This has motivated the foundation of different approaches of risk management to serve the purpose of preserving the created value in the business processes. The analysis of the literature has disclosed the need for the development of a solid theoretical foundation of preventive management of risks and a process that structures this field, which is the conceptual model of this research.

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The results of this paper have shown that the incorporation of the process of the integrated management of risks and business processes with the integrated knowledge management process has given rise to the knowledge-based process of the integrated management of risks and business processes (K-PIMRBP) which is the process that structures the preventive management of risks. In order to justify and accept the integration of two separated fields in one single field as a piece of scientific and valid knowledge, we followed a particular methodology, which encompasses three steps: (1) reconsidering the theories as processes, then (2) drawing the DFD diagram that shows the interactions of the data and information flow between the two processes. Finally, (3) drawing the K-PIMRBP using BPMN.

The implementation of the K-PIMRBP in the business processes will structure and regulate the prevention of risks activity in enterprises, which has suffered from a lack of frameworks and structured methodology that regulate it. This research also contributes to the definition of the preventive management of risks, because to the best of the authors' knowledge, there is no research that defined this field of research.

This research is the first path toward the establishment of a solid theory of preventive management of risks it provides theoretical implications, but it lacks practical implications. Hence, a future research is needed to apply the K-PIMRBP the process developed in this study in real case study to increase the validity of the model and to reveal any shortcomings in the current model.

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Received: March 18, 2021
Accepted: May 16, 2021

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