The Perspectives For Risk-Management In The Age Of Digitalization: A Systematic Literature Review

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Abstract

Digital technologies offer more and more opportunities for compagnies as a driver for operational efficiency, productivity, and profitability. Those technological waves are embarking compagnies in a process of digitizing their risk-management processes to remain competitive in the market and to best meet organizational performance and resilience criteria.

This dynamic process provides a context for analyzing the impacts of digital transformation on risk management.

The main goal of this paper is to present an overall review of a systematic literature to the latest five years, that allows to affirm that digital transformation can contribute positively to provide quality risk management, and consequently improve governance within companies.

The limitation of this study lies in the difficulty of clearly identifying all the opportunities and challenges of digitalization.

Index terms - Digitalization, Digital technologies, riskmanagement, digital transformation, governance.

INTRODUCTION

Today, the world is marked by a constant evolution driven by digital transformation and new information system technologies. These two concepts have a central place in all sectors and result in profound changes at all levels, forcing companies to constantly adapt and increase their innovation abilities [1].

Nowadays, the organizational environment is characterized by a multitude of changes and associate companies with the notion of vulnerability [2]. Also, the world has experienced multiple crises; among others covid crisis, that have significantly affected the economy [3].

Faced to this, companies had to develop a resilience capacity, able to absorb the emergencies imposed by the crisis.

Although it has not been adopted by all companies, the context of crisis and post-crisis has reinforced the importance of risk management [4]. Indeed, it has firmed its crucial role in the good governance of companies, the function requires more attention in order to take advantage of the digital transformation to provide quality risk management through a broader coverage of risks and consequently a support to decision making by management.

Although professionals, including surveys published by audit and consulting firms [5], [6], [7], talk about the importance of digital transformation in improving risk management practices, the current academic literature lacks richness in relation to this topic. However, the rise of digital transformation prompts to be interested in the possible contributions of digitalization in improvement of risk-management.

Moreover, there is no systematic literature review studies until now that focused on digital transformation in relation with risk-management.

The main of objective of this paper is to give an overview of existing research on digital transformation with risk-management. We suggest dividing this paper into three main sections. In the first one, we will introduce the research methodology. The second part will focus on providing a descriptive analysis of the results. The third part will synthesize the results of the content analysis by examining the concept of digitalization, identifying the key digital technologies, and by illustrating the impacts of these technologies on risk-management.

The conclusion will be dedicated to present the potential avenues for further research.

METHODOLOGY

The aim of this study is to explore the links between digital transformation and risk-management on a literature review. We used the systematic review guidelines, following [8] and [9]. The fig.1 1 presents the steps of a systemic literature review:

Fig. 1: Systematic literature review methodology



A. Research questions frame:

The objective of the paper is to examine research about digital transformation and risk management. To that end, we have framed the following research questions:

- RQ1: What is the meaning of digitalization?
- RQ2: What are the main digital technologies related to riskmanagement?
- RQ3: How the use of digital transformation can impact riskmanagement?

Table I: Research Question motivations

Ref_	Research Question	Motivation
RQ1	What is the meaning of digitalization?	Identify the general and conceptual framework of digital technologies
RQ2	What are the main digital technologies related to risk- management?	Select from the variety of digital technologies those that are relevant to the risk management function
RQ3	How can the use of digital transformation impact risk- management?	Identify the impact of digital transformation for risk- management

B. Work identification:

This step involves the examination and evaluation of research on digital transformation in risk-management area, focusing on the research questions mentioned in the previous step (step one).

We started our research strategy by identifying key terms relevant to the research questions, then we conducted a pilot test to determine alternative synonyms for these key terms. We used Boolean operators (OR, AND) for connecting words (Example: Digital transformation or Digitalization)

We found the articles that are potentially related to our topic in "Scopus" database, regardless publication timeline, by using the combination of following key words: "Digital transformation and risk management", "Digitalization and risk management" and "impact of digitalization on rik-management".

C. Inclusion and exclusion criteria

We defined selection criteria to determine which studies are included or excluded:

Criterion	Inclusion	Exclusion
Subject area	Digital transformation, digitalization, risk- management	Studies not related to research questions
Literature type	Journal, paper, books introductions	Conference proceedings, abstracts and short papers, white paper, non- peer-reviewed research articles
Language	Article written in english	Non-english

Table II: Inclusion and exclusion criteria

We conducted the process of identification of the most relevant articles in February 2023 and we made the selection by reading titles, articles summaries, index terms, and books introductions. The articles which they weren't accessible stated as excluded, as well as, proceedings and conference articles, master and doctoral theses, working papers and textbooks. We followed [10] guideline, which states that "academics and practitioners a like use journals most often for acquiring information and disseminating new findings and represent the highest level of research." C. Quality of studies assessment:

The step of quality assessment helps to evaluate the rigor and reliability of selected articles. We formulated or quality criterias based on the works of [11], [12] and [13] as following:

- Is the research objective adequately explained and justified?
- Is the aim of the research clearly formulated?
- Are the standards and criteria used for evaluation appropriate for addressing the research question?
- Is the literature review comprehensive and sufficient?
- Does the collected data address the research issue effectively?
- Is the data analysis sufficiently precise and rigorous?
- Are the findings clearly presented?
- Does the paper discuss limitations or validity?
- D. Data collection

The data was collected from qualified articles and books.

E. Data analysis

In this step, we structured data synthesis according to a descriptive analysis to give a brief presentation about included articles and to refer to future directions of research.

Fig. 2 presents the main steps of research process according to [14] approach:

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Fig.2: Systematic literature review process



RESULTS AND ANALYSIS

This part will focus on the results of database review.

A. Presentation of publications by nature:

The analysis of the nature of research work selected shows that most of them are journal articles.

Fig.3: Allocation of research work by nature



B. Presentation of articles by year of publication:

Table III: Presentation of research work by year of publication

Year of publication	Number of articles	References
2018	3	[15], [16],[16]
2019	0	-
2020	1	[18]
2021	2	[19], [20]
2022	4	[21], [22], [23], [24]
2023	2	[25], [26]

As presented in table III, we deduct that it is relatively a recent subject, since the first articles and books were published in 2018. Fig. 4 reveals that the highest percentage is near 30% in 2022.

Since 2020, and according to the graph, the rate of publications related to digitalization and risk-management is increasing year by year.

Fig.4: Number and percentage of publications per year



C. Presentation of articles by research methodology:

The analysis of research methodology of the selected articles gives the following results:



Fig.5: Percentage of publications per research methodology

While analyzing the papers, we observed that the literature review of the digitalization concept linked to the risk-management is limited. Also, the quantitative and qualitative research of our scope doesn't present a rigorous research limitations.

Table IV presents the number of articles by research methodology, excluding books:

Table IV: Presentation of research work by research methodology

Research methodology	Number of articles
Case study	2
Conceptual model / framework / strategy	3
Quantitative research	5
Qualitative research	5
Total	10

D. Content analysis:

a). Digitalization:

The analysis of the current literature about digitalization reveals distinct definitions.

We have considered [27] definition of digitalization as the process based on the use of digital technologies to change a business model, offer new revenue opportunities, and produce value.

Additionally, the definitions presented in the existing literature reveal that that the digitalization doesn't imply only the use of digital technologies, but also the process of moving to a whole digital business model that involves breaking old business processes, and traditional relationships with stakeholders.

b). Digital technologies related to risk-management:

According to the literature, developing new digital business models is based on different types of digital technologies.

From our selection of publications, we have identified in Fig.6, the digital technologies that are able to be linked to the process of developing a new framework for risk management, and which are likely to modernize the perception of this function within a digitized business model [17], [22], [24]:

Fig.6: Digital technologies related to risk-management digitalization process.



- Blockchain: Essentially, a blockchain consists of a chain of blocks, where each block contains a list of transactions. These blocks are linked together using cryptographic hash functions, creating an immutable record of all transactions. Once a block has been added to the blockchain, it is extremely difficult to modify or delete the information it contains without the consensus of the network. [28], [29].
- Big Data: According to [30], big data is based on the famous "three Vs": volume, variety and speed.

In fact, big data is characterized by the scale of the data (volume), the diversity of sources and formats (variety) and the speed with which data is generated and processed (velocity). [31]

 Robotics Process Automation: RPA is "a preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management". [32]

In short, it's about the use of software robots or "bots" to automate repetitive, rule-based tasks in business processes as data entry and validation, reports generation, data migration...etc.

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- Artificial Intelligence: it refers to all methods enabling computers to learn from data and perform tasks that would otherwise require human intelligence. [33], [34].
- Cloud computing: is an approach where computing capabilities are extended and offered as services via Internet technologies "in the cloud". This also involves the use of software owned and accessed remotely by a third party for a fee or subscription (also known as "software as a service" or "SaaS").[35].

c). Impacts of Digital Technologies on operational risk-management:

Risk identification:

Identifying potential sources of risk has become even more effective with the rise of digital technologies, mainly big data. With its capacity of collection and analysis of large quantities of data from, big data enables organizations to detect and identify trends, patterns, and weak signals.

Similarly, artificial intelligence can be used to analyze large amounts of data from a variety of sources to detect potential risks. [36].

Risk assessment:

Big data provides valuable information for assessing and quantifying risks, including financial risks. [37]

By integrating data from a variety of sources, such as historical data, external data, social network data, etc., organizations can improve their understanding of potential risks and make more informed decisions.

In the same risk management sub-process, BI facilitates risk assessment and measurement by providing advanced analytical tools [39]. Analytical models and predictive algorithms can be used to assess the likelihood of risks occurring and estimate their potential impact. For example, using techniques such as historical data analysis, statistical modeling or machine learning, a company can predict the risks associated with fraud, cybercrime, or market fluctuations.

Compliance:

Digital technologies can help with compliance-related tasks, such as monitoring and reconciling data across systems, ensuring adherence to regulations. RPA can help automate regulatory compliance processes, ensuring that rules and policies are followed consistently. Bots can perform regular checks, generate compliance reports and flag any deviations, helping to reduce the risk of non-compliance. [39]

Blockchain technology also helps to guarantee compliance [40]. Using advanced cryptographic techniques, blockchain ensures the integrity and security of recorded data. This reduces the risk of falsification and fraud, which is crucial in many fields, such as finance, real estate and legal services. [41] According to [40], blockchain can act as a "trust machine", reducing dependence on traditional trusted third parties.

Data protection:

Risk management involves the management of sensitive data linked to all organizational processes.

Potential risks include privacy breaches, data leakage and cyber-attacks, etc.[19]

Through identity and access management, blockchain technologies can be used to create decentralized, secure identity management systems. This helps to better control access to data and reduce the risks associated with the security and confidentiality of sensitive information.

Cloud computing also provides an ex-post contribution through more robust data backup and disaster recovery solutions. Data is replicated across [24] multiple servers and geographical locations, reducing the risk of data loss in the event of hardware failure or disaster. Cloud services also offer rapid recovery capabilities, enabling operations to be restored quickly after an incident.

Additionally, artificial intelligence helps to detect attacks and malicious behavior, analyze patterns of suspicious activity and strengthen security systems to prevent cyberattacks. [36]

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

The purpose of this paper is to provide a systematic literature review about digitalization and risk-management, grouped by type of publications, research methodology in the last 5 years.

Through this literature review, we have seen that digitalization can be described as a catalyst for improving the risk-management process, for example:

- Data collection and analysis: Digitization has enabled faster, more efficient collection and analysis of risk-related data.
- Process automation: Through Artificial Intelligence and Robotics Automation Process
- Risk assessment modeling: Big data and AI enable companies to create models to assess and predict potential risks, identify vulnerabilities and test different scenarios.

The findings of the study can be presented as follows:

Table V: Findings summary

Research Qu	Findings	
What is the meaning of digitalization?		- Business models change through digital technologies
	Block chain	Integrity and security of collected data / Compliance guarantee / Secured access
What are the main digital	Big Data	Risk identification and risk assessment
technologies related to risk- management? And how can these digital technologies	Robotics Process Automation	Interactions / compliance
impact risk-management?	Artificial Intelligence	Advanced risk-assement through analytical tools / Large risk- identification / Detecting attacks and risks
	Cloud computing	Data backup and recovery

However, this research is limited by various factors including methodological factor of choosing criteria due to time constraints. For next studies, it is recommended to consider different research criteria.

Another factor is related to the content analysis, it would be interesting to challenge the findings and consider the limitations of the digital technologies, for example the use of cloud computing carries a risk of confidential data leakage, which represents a high risk to risk management.

Additionally, we suggest using empirical methods to reinforce the current findings.

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