

# **Risk Maturity Model: A Systematic Literature Review**

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## **Abstract**

Many unpredictable events make risk management a topic of discussion to avoid losses that affect organizational performance. Many studies have been conducted on risk management maturity, but research on risk maturity models to measure organizational risk is still limited. Therefore this study aims to answer several questions related to the application and maturity of risk management by using a systematic literature review of 30 literatures. There are three stages in conducting a Systematic Literature Review namely planning, screening and analysis. Based on the review, bibliographic summaries, detailed case studies, objectives and scope and maturity models were obtained. It was found that the application field that has the highest average risk maturity level is project management followed by supply chain management and the lowest is management information system. Maturity level consists of 5 levels. The results of measuring the risk maturity level show that most of the research is only at levels 1, 2, and 3. Several variables need to be added to the maturity risk model, such as continuous improvement, time, and quality. It is recommended to use the Living Engineering Process (LEGO) Approach and sensitivity analysis in processing and developing a risk maturity model for further research.

## **Keywords**

Risk Management, Risk Maturity Model, Systematic Literature Review, LEGO approach , Sensitivity analysis

## **1. Introduction**

Risk management is a topic that is often discussed by the industry, both large companies and Small and Medium Enterprises (SMEs) (Sukanta et al. 2020). The occurrence of risks, either positive (opportunity) or negative (threat), is unavoidable in organization because its surrounded with uncertainties (Murray 2009). Risk management is important because many organizations experience losses, such as loss of income, loss of public trust, and even paying fines. Some organizations cannot adapt and there is no action taken to prevent these risks (Hadiwardoyo 2020). Risk management is needed to overcome possible losses and achieve organizational goals (Sofyan 2005). In managing risk management, companies need to measure risk maturity level, which is an approach to identify risks that will occur and determine the appropriate response based on the company's risk appetite (Zhao et al. 2013). To be able to make improvements in risk management, organizations need the right tools that can help them identify areas of improvement and measure progress in improving risk management. Risk management maturity model is used to assist this goal (Yeo and Ren 2009).

In recent years, especially from 2016 to 2020, there have been many studies discussing risk maturity and have been published both in journals and proceedings. The object of study ranges from enterprise risk management, project risk management, Information Technology risk management, to Occupational health and Safety (OHS) risk management, which has a wide range of applications. Likewise, the methods used to select variables and develop risk maturity models are also different. The motivations and objectives of conducting research also differ from one another. Until now there has been no agreement regarding the variables used, the level of risk maturity, and the stages of data

processing, so that the variables, risk maturity level, and data processing are different. Therefore, a study is needed to determine and propose a maturity level of risk management that can be used by companies. Therefore, this study aims to identify and analyze the application of risk maturity in companies from previous studies using a systematic literature review to propose risk management maturity levels and obtain opportunities for further research.

## **2. Literature Review**

Risk management is a series of activities planning, assessing, handling and monitoring risk (Kerzner 2001). According to Hoseini et al. 2021, Risk management is an approach to risk by understanding, identifying, and evaluating risks. To be able to make improvements in risk management, both in terms of resources, monitoring, evaluation, organizations need the right tools that can help them identify areas of improvement and measure progress in improving risk management. Risk management maturity model is used to assist this goal (Yeo and Ren 2009). The purpose of Risk management maturity model is to measure the maturity of risk management in an organization. Maturity in terms of risk management means evolution towards the full development of risk management process. Risk management maturity model is done to identify strengths and weaknesses in risk management and gain insight into improvements (Wendler 2012).

Organizations that implement and improve their risk management maturity can improve quality, reduce costs, and improve work scheduling (Kosmala 2014). Based on a strategic approach in managing corporate risk, the risk maturity model is known as a valid measurement tool so that it can support the improvement of procedures in risk management (Kosmala 2014). Organizations can measure the maturity of their risk management which is described in the risk maturity level. The maturity level scale consists of 5 scales, only having slightly different names in each literature. While the value of the risk maturity level is between 0 and 100 which describes the results of the evaluation on the company's risk maturity (Abdulrahman et al. 2019).

## **3. Methods (12 font)**

There are three stages in conducting Sistematic Literature Review (SLR), namely planning, screening and analysis.

### **3.1 Planning**

The first stage is planning the literature to be reviewed. In the planning process, determining research questions, determining websites and keywords that will be used for literature search. In this study, the questions asked were how the risk maturity model existed in previous research and what methods and variables were used. The websites used to conduct literature searches are Elsevier ([www.sciencedirect.com](http://www.sciencedirect.com)), IEEE ([www.ieee.org](http://www.ieee.org)), Emerald ([www.emeraldinsight.com](http://www.emeraldinsight.com)), and Research Gate ([www.researchgate.com](http://www.researchgate.com)). In addition, search engine namely Google Scholar ([www.scholar.google.com](http://www.scholar.google.com)) is used. The keywords used to search the literature were 'risk management maturity', 'enterprise risk management', and 'supply chain risk management maturity'.

### **3.2 Screening**

The second stage is screening, which is a process of selecting the literature that will be used for this research. The criteria used for selection are Indonesian and English language, the publication year span from 2016 to 2020, and the type of publications are both from journals and proceedings.

### **3.3 Analysis**

Analysis is the last stage. The analysis process is carried out by compiling a review protocol consist of a bibliography, detailed case studies, and publication content, as shown in Table 1.

Table 1. Review protocol

Bibliography	
Author	Who is/are the author(s) of the publication?
Year	In which year was the article published?
Title	What is the title of the publication?
Type of Publication	What kind of publication?
Name of Publication	What is the name of the journal/proceeding?

Details of case study	
Object of case study	What is the object of the case study?
Application field	What are the areas of application of the publication?
Variable selection method	What method(s) is/are used to select variables?
Risk maturity method	What method(s) is/are used to develop the risk maturity?
Focus and content publication	
Goal and Scope	
Motivation	What is/are the reason(s) for the publication?
Purpose	What is/are the purpose(s) of the publication?
Party Involvement	Who is/are the party(es) involved in the publication?
Maturity Model	
Variables	What variables are used?
Level	How many levels are there in the model?
	How is each level explained?
Process	How is the processing carried out in the publication?
Research Opportunities	What are the opportunities for further research?

## 4. Results and Discussion

### 4.1 Results

Based on literature review, it was found that 5 of the publications were published in 2016, 7 publications in 2017, 8 publications in 2018, 8 publications in 2019, and 2 publications in 2020. From 2016 to 2019 the amount of literature on risk maturity continues to increase, but in 2020 has decreased. Moreover, a number of 67% of the publications were published in journals and 33% were published in proceedings. Based on 30 literatures, it is known that the majority are obtained from journals, and sources of journal are different. Then, also known that 57% of the publications is carried out in enterprise risk management, 33% in project risk management, 7% in IT risk management, and 3% in OHS risk management. Enterprise risk management has become the most used object of the time because it has been being a recurring topic for organizations that are aware of the importance of risk management (Oliva 2016). Likewise with project risk management because risk always inherent within all projects, especially construction projects (Wibowo 2017). In addition, project risk management can reflect organizational competence (Hartono et al. 2019). Although many construction projects have implemented risk management, but there are still many projects have overwhelmed to implementing risk management maturity (Chapman 2019). Although there is not much research on risk management in information technology. in fact, the success of IT is influenced by the ability to manage risk (Putri et al. 2017). Occupational health and Safety (OHS) risk management research has also not been widely carried out because there are still many SMEs that have not implemented OHS risk management (Kaassis and Badri 2018).

Base on area of application, there was 47% of the applications in supply chain management, 40% in project management, 10% in information systems management, and 3% in occupational health and safety. It can be concluded that from the 30 literatures, most of them were applied in supply chain management and the least is in occupational health and safety. This is because supply chain management is very important in an organization that has a lot of risks (Oliva 2016).

Based on data processing method, it is found that from 30 literatures, as shown in fig 1, 29% use literature studies to processed the data, 29% use Multi Criteria Decision Making (MCDM) method, 19% use inferential statistical method, 10% use machine learning method, 7% use IT method, 3% use Living Engineering Process (LEGO) Approach, and 3% use sensitivity analysis method.

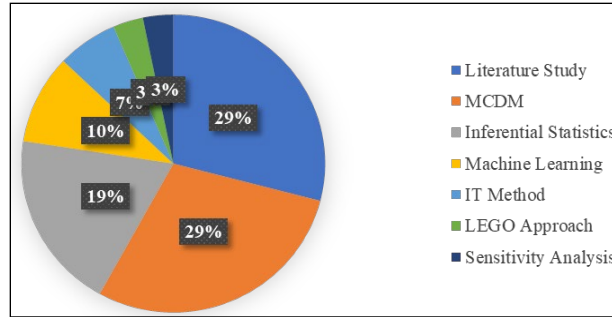


Figure 1. Data Processing Method

It can be concluded that of the 30 literatures, most of them use literature studies and the MCDM method for the data processing. The MCDM method category consists of fuzzy, AHP, ANP and TOPSIS method. Meanwhile, the least used methods are the LEGO Approach and sensitivity analysis. The fuzzy methods widely used because it considered the most suitable and has many advantages (Kurniawan and Wibowo 2016). Besides that, fuzzy can also solve ambiguous problems (Abdulrahman et al 2019). Likewise, the ANP method was used to weight the questionnaire (Bhosale et al 2017; Bhosale et al. 2018). The AHP method is also widely used because it can help to make decisions based on opinions (Araujo et al. 2017). In the other hand the LEGO method, although not widely used, but it can help extract several maturity models into one model that can be a facility to achieve risk maturity. LEGO is an approach that can help organizations strengthen their existing process the model by combining each item from various models (Buglione et al. 2016).

Base on motivation, there were 80% or 24 literatures have done due to internal factors, while the other 20% or 6 literatures have done due to external factors. Internal factors mean factors which appear within the organization itself, such as problems to be solved, while external factors mean factors come from outside the organization such as increased competition between organizations. This is due to the many risks that may occur from an internal organization that can cause large losses (Hadiwardoyo 2020). Today, every organization is trying to optimize the risk management and starts to solving problems within their organization.

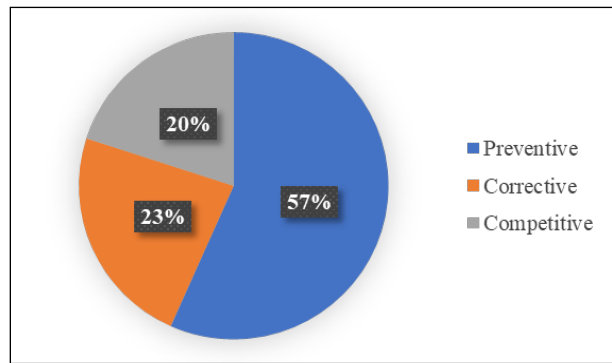


Figure 2. Specific Motivation

Figure. 2 show that from 30 literatures, 57% of research was conducted as a preventive effort as anticipated losses by risk, 23% was carried out as a corrective effort due to ongoing problems, and 20% was carried out as competition effort caused by organizational competition. Then, it concluded that most of the motivation for conducting research is preventive to anticipate risks that cause losses to the company. Many companies do preventive efforts because risks were cross-border and company management realizes to implementing risk management to achieve their successes (Tjahyono 2017).

Base on objectives, it indicates 70% were done to develop strategic plans to improve performance and quality, 23% were done to fix the problems that occur in corporate, and 7% were done to fill the existing regulations. So it can be

concluded that most of those research have purpose to preparing strategic plans for the future because enterprise risk management provide an assessment of all risks and affect to company's business strategy (Sprcic 2017).

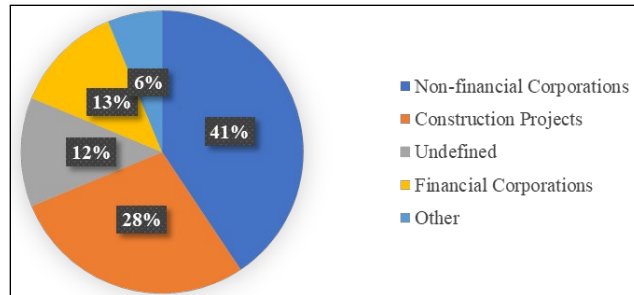


Figure 3. Party Involve in publication

Figure. 3 represents 41% of the 30 literature that has carried out risk maturity management in non-financial companies, 28% is carried out in construction projects, 12% is carried out in financial companies, 13% is not defined, and 6% others.

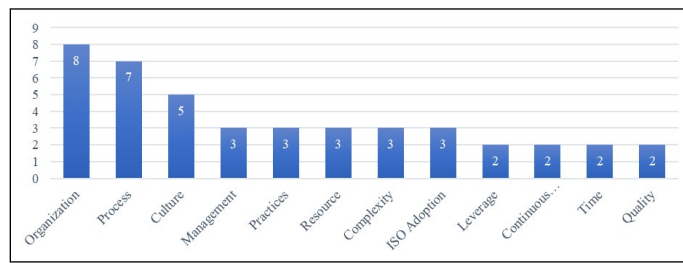


Figure 4. Variables

Figure. 4, exhibit that 8 literatures used organizational variable, 7 literatures used process variable, 5 literatures used culture variable, 3 literatures used management variable, 3 literatures used practice variable, 3 literatures used resource variable, 3 literatures used complexity variable, 3 literatures used ISO adoption variable, 2 literature used leverage variable, 2 literature used sustainability improvement variable, 2 literature used time variable and 2 literature used quality variable. Based on these results, it is known that the variables most widely used are organizational variables.

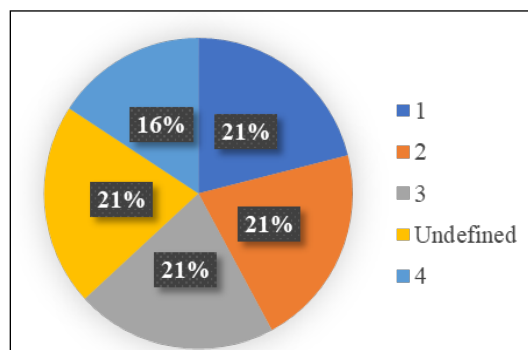


Figure 5. Measurement Result of Risk Maturity

Based on the results of maturity level measurements it was found that the results for maturity level 1, level 2, and level 3 were 21% respectively, level 4 was 16%, and the other 21% was not determined. There is no research that shows

the results of risk management at level 5 as shown in figure 5. Average risk maturity level based on application fields is presented in Table 2.

Table 2. Average risk maturity level based on application fields

Application Fields	Average Risk Maturity Level
Project Management	2,6
Supply Chain Management	2,4
Information System Management	2

The application field which has the highest average of risk maturity level is project management with a value of 2.6. Next is the supply chain management with a value of 2.4 and the smallest is a information system management with a value of 2.

## 5.2 Analysis

After conducting a review and analysis of 30 literatures, it can be concluded that there are several proposed methods and variables that can be included in the maturity risk model such as LEGO Approach method (Buglione et al. 2016), sensitivity analysis method (Heravi and Gholami 2018), leverage variable (Tjahyono. 2017) (Farrel and Gallagher, 2018), continuous improvement variables (Chamoun et al. 2019) (Chapman. 2019), time and quality variables (Heravi and Gholami 2018) (Suryani et al. 2019).

Several opportunities for further research are based on several things that have not been done in many previous studies, one of which is the use of the LEGO method. The use of the LEGO method on risk maturity can be done by implementing 4 steps to match each risk with the risk management process in the organization (Buglione et al. 2016). Apart from the LEGO method, the sensitivity analysis method can also be used to create a risk maturity model, determine the magnitude of the causal relationship between inputs and outputs and determine the value of each factor against other factors (Heravi and Gholami 2018). In addition, opportunities also lie in the use of variable leverage and continuous improvement. Leverage is one of the variables that greatly influences the implementation of risk management (Tjahyono 2017). Meanwhile, continuous improvement is a variable that really helps organizations to increase knowledge by carrying out continuous improvements so that organizations can be more observant in identifying risks (Chapman 2019). Another opportunity is to use time and quality variables, because time and quality are important variables especially in project risk management because time can be efficient in the process, which can be measured by payment time, preparation time, and approval time. Furthermore, quality can be measured from the conformity between the output and the specifications that have been designed (Heravi and Gholami 2018) (Buglione et al. 2016).

Based on the review that was carried out on 30 literatures, a summary of bibliograph, details of case study, goal and scope and maturity model were obtained for each of the protocols as presented in Table 3.

Table 3. Summary based on review protocol

Bibliography		
Author	Who is/are the author(s) of the publication?	Most of the writers are academics, such as students, lecturer or professors. However, there are also writers who work as practitioners in risk management.
Year	In which year was the work published?	From 2016 until 2018 there has been an increase in the number of literature from 5, 7, to 8 literatures. Then in 2019 the number of literature remains at 8 and in 2020 it has decreased to 2 literatures.
Title	What is the title of the publication?	Literature titles are 'enterprise risk management', 'risk management maturity', and 'risk management maturity'.
Type of Publication	What kind of publication?	67% of literature comes from journals both national and international, while the other 33% comes from proceedings.
Name of Publication	What is the name of the journal/proceeding?	From the 30 literatures studied, all came from different journals and proceedings.
Details of case study		

Object of case study	What is the object of the case study?	The most research object is in enterprise risk management because it has become the main topic for every organization.
Application field	What are the areas of application of the publication?	Most application fields are in supply chain management
Variable selection method	What method(s) is/are used to select variables?	Literature study is the method mostly used in variable selection because it is quite simple and easy to do.
Risk maturity method	What method(s) is/are used to develop the risk maturity?	Literature studies and MCDM are the mostly used methods to develop the risk maturity model.
Focus and content publication		
Goal and Scope		
Motivation	What is/are the reason(s) for the publication?	In general, 80% of research is caused by internal factors due to the many risks and problems that arise in the internal organization, while the other 20% is caused by external factors. Meanwhile, specifically the research motivation is 57% for preventive action because many organizations are increasingly aware of the importance of risk management, 23% for corrective action, and 20% for competitive action.
Purpose	What is/are the purpose(s) of the publication?	The aim of the research is 70% to develop a strategic plan, 23% to make improvements, and 7% to meet government regulations. Specifically, 77% of the studies were conducted for long-term goals and 23% were conducted for short-term goals.
Party Involvement	Who is/are the party(es) involved in the publication?	Non-financial companies have the most involvement with 41%, followed by construction projects by 28%, financial companies 13%.
Maturity Model		
Variables	What variables are used?	The most used variables are organization variables, while the least ones are leverage, continuous improvement, time, and quality, which are often the criteria for project success.
Level	How many levels are there in the model?	The level of maturity consists of 5 levels. The results of measuring the risk maturity level show that most of the research is only at levels 1, 2, and 3. Application fields that have the highest average risk maturity level are project management with a score of 2.6, followed by supply chain management with a value of 2.4 and the lowest is management information systems. with a value of 2.
	How is each level explained?	Most of the researches identify the effect and develop the risk maturity model and measure the risk maturity level. Meanwhile, the least process carried out was the provision of suggestions for improvement.
Process	How is the processing carried out in the publication?	Opportunities for further research are being able to use the LEGO method and sensitivity analysis. In addition, research can be carried out using leverage, continuous improvement, time, and quality variables.

## 6. Conclusion

This research aim to answer some question regarding application and maturity of risk management using sistematic lirature review from 30 literatures. Based on systematic literature using three stages, namely planning, screening, and review analysis, it was found that application fields that have the highest average risk maturity level are project management followed by supply chain management and the lowest is management information systems. The level of maturity consists of 5 levels. The results of measuring the risk maturity level show that most of the research is only at levels 1, 2, and 3. From these results, there are still many opportunities for companies to improve their maturity risk management. Opportunities for further research are to use the LEGO approach and sensitivity analysis in processing

and developing a risk maturity model and adding some variables such as continuous improvement, time, and quality variables in the risk maturity model. Suggestions for further research is to develop a maturity model with several variables found in this study.

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