Proceedings of the 33rd European Safety and Reliability Conference (ESREL 2023)
Edited by Mário P. Brito, Terje Aven, Piero Baraldi, Marko Čepin and Enrico Zio
 Published by Research Publishing, Singapore.
doi: 10.3850/978-981-18-8071-1_P149-cd

Manageability of risk – a literature study

Torgrim Huseby

Proactima AS, Norway. E-mail: torgrim.huseby@proactima.com

Eirik Bjorheim Abrahamsen

University of Stavanger, Norway. E-mail: eirik.b.abrahamsen@uis.no

Willy Røed

University of Stavanger, Norway. E-mail: wr@proactima.com

In the current practice for analysing risk, the concept of manageability is frequently used to characterize how difficult it is to treat risk. In theory, the manageability concept is intuitively easy to understand. However, in practice we experience that there is a lack of consistency in how the concept is realized and used. In risk assessment applications where the manageability concept is included, a definition of the concept is often lacking. This may lead to different understandings of what manageability is, for example, among participants in risk workshops, which may result in poor assessments and poor decision making. In this paper, we explore how the concept of manageability is used in the research literature in the context of risk analysis and risk management. We have studied to what extent is the manageability concept defined in the research literature and how is the manageability concept defined. We find that there are few research papers where manageability is the main topic and that when the term is used, it is often used in an imprecise manner.

Keywords: Manageability, risk, risk management, risk assessment, uncertainty, decision making.

1. Introduction

Manageability is a concept used within the field of risk management both in common language related to risk, as well as analytically. The term is typically related to the ability to reduce the risk and in practical applications, manageability is characterized along with other attributes such as consequence and probability and used as basis for making decisions.

However, as we will show in this paper, the term is often used without a precise definition and understanding of the manageability concept. We see that research papers and risk analysis reports tend to use the manageability concept without explaining precisely what is meant by this term.

In this paper, we have elaborated on the manageability concept and studied how this concept is used in the research literature. We have studied the following issues:

(i) To what extent is the manageability concept defined in the research literature?

(ii) How is the manageability concept defined?

The background for our interest in the manageability concept, is our own experience of encountering the use of the concept in risk analysis application examples in Norway. For example, we have observed that the manageability concept is used in the guideline for risk and vulnerability analyses for municipalities in Norway (Direktoratet for samfunnssikkerhet og beredskap 2022), in the standard NS 5814:2021 (Standard Norge 2021) and is included in various other guidelines on risk management and risk assessment issued by Norwegian authorities, industry organizations and in organizations' frameworks for risk management.

Based on the anticipation that the manageability concept is widely used, we studied the use of the concept in the research literature. As we will show in this paper, the result came to a surprise: We found few research

papers where the manageability concept is the focus of the article. On the other hand, we found quite many articles where the manageability concept is used as a term, but without explaining precisely what is meant by the term. We also discovered that in the articles where the manageability concept is used, there is substantial variation in how it is being understood and used by the authors.

For example, the concept of manageability is not defined by the International Organization for Standardization (ISO) or the Society for Risk Analysis (SRA). And in practical risk analysis applications, the concept is typically defined in accordance with relevant guidelines, a company's governing documents, or by the analyst in each case.

Based on the above, the current practice seems to be that few researchers are interested in understanding and defining the manageability concept, but still the concept is widely used, although imprecisely, both in the research literature and in practical risk analysis applications.

This situation should not be accepted by the research community: As researchers, we should either define our concepts precisely, or we should not use those concepts at all.

The paper is organized as follows: The literature study method is described in section 2. The main results from the study is described in section 3, divided into two sub-sections focusing on our two main findings; i) that there are few research papers where manageability is the main topic (section 3.1), and ii) that when the term is used, it is often used in an imprecise way (section 3.2). The main results i) and ii) are then discussed subsequently in sections 4.1 and 4.2. Then, in Section 5, we give some concluding remarks, based on the results and discussion in sections 3 and 4.

2. Method

The objective of this study is to explore the concept of manageability in the context of risk management and risk analysis. Through a literature study, we have established an overview of the occurrence of the concept in a selection of sources and identified examples of how the concept is defined or explained. The literature search was conducted in two parts. First a search in a selection of journals and then an open search in google scholar, several textbooks and ISO standards.

The search of journals was carried out in three steps. First, we made a list of journals evaluated by the authors as the most relevant to our problem. Then, we searched for "manageability" in all journals and counted hits in "title", "keyword", "abstract" and "anywhere". As it turned out that the number of hits in "anywhere" were too many to study in detail, we concentrated the search for definitions of manageability of risk in the articles with hits in title, keyword or abstract.

The ISO standards we have reviewed are ISO Guide 73:2009 Risk management - Terminology, ISO 31000:2018 Risk management – Guidelines and ISO/IEC 27005:2018 Information technology – Security techniques – information security management systems – Overview and vocabulary.

The definitions extracted from the sources were reviewed and compared by performing a conceptual analysis. The basic concepts involved are *manage* and *risk*. Using the suffix -ability, the verb manage is transformed to a noun, *manageability*. To analyse the different definitions of manageability of risk, we have studied how the definitions express manage, ability and risk, respectively.

3. Results

The search on manageability in the 11 identified journals resulted in one hit in article titles, three hits in articles keywords, 22 hits in abstracts and 755 hits in "anywhere" (table 1). A closer look at the articles giving hits in title, keyword or abstract (22 articles) shows that only four articles relate manageability to the risk concept per se and include a definition of manageability. The other articles relate manageability to other characteristics such as difficulties, size, categories, problem, structure, levels, number, rate, cases, and application.

The search in google scholar and textbooks resulted in seven more references where the concept of manageability of risk is addressed.

Table 1. Search on manageability in 11 identified journals.

Journal	Number of hits					
	Title	Keyword	Abstract	Anywhere	Manageability is related to risk**	Manageability is defined
A. International journal of Business continuity and risk management	0	0	*	12	0	0
B. International journal of performability engineering	0	0	0	4	0	0
C. Journal of loss prevention in the process industries	0	0	1	76	0	0
D. Journal of risk and reliability	0	1	1	21	1	1
E. Journal of risk research	0	0	*	81	0	0
F. Reliability engineering and system safety	1	1	12	229	3	2
G. Risk Analysis	0	0	4	149	0	0
H. Risk management: An international journal	0	1	0	1	1	1
I. Safety science	0	0	3	179	0	0
F. SPE Economics and management	0	*	0	1	0	0
G. SPE Production & Operations	0	*	1	2	0	0
Totals	1	3	22	755	5	4

*) Not searchable

**) Hits in title, keyword or abstract

Sandøy, Aven and Ford (2005) discuss risk perspectives in project risk management and conclude with the following: "An important term within uncertainty management is the level of manageability. This expresses the degree to which an element of uncertainty can be managed and controlled by increasing the information basis, changing the probability of events, and influencing the consequences of events. High levels of manageability mean that uncertainties and the consequences can be influenced in the desired direction at relatively low cost". It is further suggested that "Such assessments should be performed by using some type of cost-benefit or cost-effectiveness analysis, addressing manageability characteristics such as:

- potential for reducing uncertainty: this describes the ability to run processes reducing uncertainties to a level that is as low as reasonably practicable (the ALARP principle); and
- human and organizational factors: these describe the ability to deal with human and organizational factors and ensure a good culture of health, safety and the environment".

Aven (2008) discuss a semi-quantitative approach to risk analysis as an alternative to QRA's and describes manageability as a key aspect to be included in the risk picture. Manageability is explained in this manner: "The level of manageability is related to the extent for which it is possible to control and reduce the uncertainties and obtain desired outcomes."

Aven (2017) discuss risk characterisation and the inclusion of knowledge judgements. The article suggests analysing manageability of measures as well as risk influencing factors as a basis for the prioritisation of risk reducing measures. Manageability is described as "A concept that relates to how difficult it is to reduce the risk and depends on technical feasibility, time aspects, costs, etc".

In their guide on prioritizing project risk, Hopkinson, et al. (2008) define manageability as "A function of controllability and response effectiveness". Further, controllability is defined

as "The degree to which the risk's owner (or owning organisation) is able to control the risk's outcome", and response effectiveness is defined as "The degree to which current risk response can be expected to influence a risk's outcome". Manageability is considered a relevant attribute in risk prioritisation and the article presents various diagrams where manageability is included.

According to the textbook on management of uncertainty in projects, Husby, et al. (1999), manageability «expresses the degree to which we can affect the probability or consequence of uncertain factors (translated from Norwegian)".

Xia, et al. (2017) discuss stakeholder-related risks in construction projects and defines risk manageability as "the capacity of a stakeholder to mitigate an individual risk (i.e., in relation to its probability or impact)". And further that "It is associated with the attributes of both the risk and the stakeholder who will pose it. When experts assess this variable, they should consider (1) the conditions of the stakeholder, i.e., their capacity to manage that specific risk, such as past experience in tackling the risk (Chuing Loo et al. 2013; Dikmen et al. 2007); and (2) the attributes of the risk itself, i.e., the inherent manageability of a risk, given that some risks are by nature more manageable than others (Aven et al. 2007)." The article suggests evaluating risk manageability through a "five-point Likert-type items ranging from 1 (greatly difficult to manage) to 5 (extremely easy to manage)".

Aven, Vinnem and Wiencke (2007) present and discuss a decision framework for risk management in the context of the offshore oil and gas industry. Manageability is described as one of several factors that need to be considered in the decision process and suggests plotting risk against manageability to visualise how different alternatives may have different potentials for reducing risk. The article states that "Some risks are more manageable than others, meaning that the potential for reducing the risk is larger for some risks compared to others". The concept of manageability is further connected to three "building blocks" in the suggested framework. The first emphasises the difference between the expected values at the decision point as a prediction, and the real outcomes. The second is addressing the uncertainties related to future possible consequences of a decision. And finally, the third one is a recommendation to address the potential for uncertainty and safety management in later phases. Hence, as well as giving a definition of manageability as "potential for reducing the risk" this article also provides some interesting perspectives on how to apply the concept in a decision framework.

Abrahamsen and Aven (2011) review and discuss the use of bubble diagrams and procedures to put attributes (probability, consequences, uncertainty, etcetera) into such diagrams within the context of project risk management. They consider manageability as one of three dimensions (consequence, probability, manageability) to characterize the criticality of a risk and define manageability as "The potential for reducing risk and obtain desirable outcomes. The 'potential' is considered as the capability the firm has to reducing risk and obtain desirable outcomes seen in relation to other concerns, in particular cost. We say that the manageability is high if it is considered feasible to implement measures over time which can reduce risk and give increased confidence in obtaining desirable outcomes. Similarly, we understand a low manageability."

Quazi, Quigley and Dickson (2017) discuss a method of prioritising strategies based on associated cost, effectiveness and manageability in the context of supply chain risk management. They relate manageability to "the concept of ease involved in managing a strategy" and propose integrating the cost and manageability of mitigation strategies within a framework of Bayesian Belief Networks (BBNs). They establish a five-point scale for ranking of manageability from very easy (one) to very difficult (five).

Charkhakan and Heravi (2018) discuss manageability in a case study of risk management in a construction project. They refer to the definition of manageability in previous research as "the capacity to reduce the probability and/or impact of negative risks (Fay 2010)". Referring to the scope of the study, they relate manageability to the potential capability to mitigate the probability of risk occurrence.

From above we see that few articles include a description or definition of the concept of manageability of risk. We also see that among

those who use the concept, there are various definitions.

4. Discussion

4.1 Manageability of risk is used by relatively few authors

Manageability seems to be a widely used concept in everyday speech on risk, although it is less used analytically and less discussed in the research literature. When used analytically, it is claimed that information on manageability adds value to the decision process and contributes to resource optimization. Put simply, by categorizing manageability, we can divide risks into those the decision maker can deal with and those he/she cannot deal with and prioritize the effort on the first category.

To obtain this, risk analysts and decision makers can also use other tools. Among the most common is the cost/benefit approach, which provides information on the cost of implementing a risk treatment strategy and the anticipated effect on risk (often expressed as the difference between existing risk and residual risk). We may say that the cost/benefit approach is a way of describing and measuring manageability in practice. However, the manageability concept is wider than pure cost and benefit as it also includes the "ability". Given a certain cost, the ability to manage a risk will of course depend on the decision maker's resources such as money, technology, authority and political power. In a practical situation, risk treatment may also be subject to complex decision processes involving multiple decision makers, stakeholders, and organizational levels. Hence, to assess "a priori" the ability of such systems to manage a risk, appears to be challenging.

4.2 Among those who use the concept, there are different definitions

We see that the definitions describe the concept of manageability of risk differently with respect to both manage, ability and risk. To explain *manage*, some definitions include the terms reduce risk or mitigate risk and others use affect or influence. While the first pair indicates reduction of risk, the last pair are more open and may allow for a broader understanding of what it means to manage risk than just to "reduce", that risk is not inherently negative. Further, a change in risk may be favourable even if the product of C and P are unchanged. For example, to trade reduction in consequence with higher probability may be preferable in some contexts.

Going to ISO 31000, the concept of manage encompasses to *treat* risk. Risk treatment is categorized into several options where "retaining the risk by informed decision" is one category. Likewise, in SRA's list of management actions (SRA, 2018), acceptance and retention are included. In definitions of manageability, manage is typically associated with reducing risk. Acceptance or retention are not included. Hence, there is a discrepancy between the way ISO 31000 and SRA defines manage and how manage is used in definitions of manageability of risk.

Moving to *ability*, we see that there is even more variability than as for *manage*. However, for the larger part, it may be difficult to understand whether the terms in the identified definitions are meant to be synonyms to ability or are meant to explain ability. For example, *difficulty* seems to be the inverse of *ability*, *capacity* seems to be similar to *ability*. Aven (2017) includes that ability may be related to technical feasibility, time aspects and costs. Some of the definition also refer to actors like stakeholder, risk owner and "the firm" and make the definition clearer with regards to the context.

The reviewed sources apply distinctively different risk concepts. Three of them include the knowledge base, K, while the others are based on probability and impact. If we introduce K to the manageability concept, we also need to consider how changes in K affects manageability.

Introducing a measure may, for example, enhance or reduce the strength of the background knowledge. The measure may strengthen K if the system becomes more predictable and vice versa. This adds value to the risk assessment and hence the manageability assessment.

A risk treatment strategy may also include measures to increase the knowledge, K, in isolation or in conjunction with measures to modify the consequence, C, and probability, P. As we do not know what new knowledge we will gain (if any) and how this new knowledge will affect our assessment of C and P, it becomes

difficult to assess the manageability. However, it is reasonable to argue that the risk associated with the possibility of increasing the knowledge basis should be preferred over a similar risk without this possibility. And hence, the potential for increasing the knowledge basis should be included when assessing manageability.

5. Conclusions

In our search of 11 journals, we found only four articles where the concept of manageability is included in either title, keywords or abstract, the manageability concept is related to risk, and the concept of manageability is defined. The supplementary search in textbooks and Google scholar resulted in seven more sources that include a description or definition of the concept of manageability of risk. The earliest article is from 2005 (Sandøy, Aven and Ford 2005). Five of the later articles refer either directly or indirectly to this article. Three of which are written by one of the authors of the earliest article (Aven). The concept seems to have a widespread use in the literature on risk and risk management, but at the same time less studied per se.

Acknowledgement
The work has been partly funded by Proactima AS. The support is gratefully acknowledged. Caroline Metcalfe deserves a special thanks for excellence proofreading of this paper.

Appendix A. How the different definitions address *manage*, *ability* and *risk* (conceptual analysis)
Terms describing manage:

- manage
- control
- reduce
- influence
- affect
- mitigate

Terms describing ability:

- how difficult it is to…
- depends on technical feasibility, time aspects, costs, etc.
- the extent for which it is possible to…
- the degree to which the uncertainty can be…
- the degree to which an element of uncertainty can be …
- the degree to which the risk's owner (or owning organisation) is able to
- the degree to which current risk response can be expected to
- the degree to which we can…
- the capacity of a stakeholder to
- the potential for…
- the capability the firm has to
- the ease involved in …
- the capacity to…

Terms indicating the risk concept:

- increasing the information basis, changing the probability of events, and influencing the consequences
- uncertainties and obtain desired outcomes
- risk
- control the risk's outcome
- affect probability or consequence
- in relation to its probability or impact
- consequence, probability
- probability and/or impact of negative risks

References

Abrahamsen, E. B., and T. Aven. 2011. "Safety Oriented Bubble Diagrams in Project Risk Management." *International Journal of Performability Engineering*, 91-96.

Aven, T. 2008. "A semi-quantitative approach to risk analysis, as an alternative to QRAs." *Reliability Engineering and System Safety*, 93 ed.: 768–775.

Aven, 2017. "Improving risk characterisations in practical situations by highlighting knowledge aspects, with applications to risk matrices." *Reliability Engineering and System Safety*, 42-48.

Aven, T., J.E. Vinnem, and H. S. Wiencke. 2007. "A decision framework for risk management, with application to the offshore oil and gas industry." *Reliability Engineering and System Safety*, 433-448.

Charkhakan, M. H., and G. Heravi. 2018. "Risk Manageability Assessment to lmprove Risk Response Plan: Case Study of Construction Projects in Iran." *Journal of Construction Engineering and Management,*, 144(11) ed.

Direktoratet for samfunnssikkerhet og beredskap. 2022. *Veileder til helhetlig risiko- og sårbarhetsanalyse i kommunen.*

Hopkinson, M., P. Close, D. Hillson, and S. Ward. 2008. *Prioritising Project Risks - A short Guide to Useful Techniques.* Buckinghamshire: Accosiation for Project Management.

Husby, O., H. Kilde, O.J. Klakegg, O. Torp, S. Berntsen, and K. Samset. 1999. *Usikkerhet som gevinst – styring av usikkerhet i prosjekter.* Norsk senter for prosjektledelse / Institutt for produksjons- og kvalitetsteknikk, Norges teknisk-naturvitenskapelige universitet .

International Organization for Standardization. 2018. *ISO 31000:2018 Risk management – Guidelines.*

International Organization for Standardization. 2009. *ISO Guide 73:2009 Risk management - Terminology.*

International Organization for Standardization. 2018. *ISO/IEC 27005:2018.*

Quazi, A., J. Quigley, and A. Dickson. 2017. "Cost-Effectiveness and Manageability Based Prioritisation of Supply Chain Risk Mitigation Strategies." *Supply Chain Risk Management*, 23-42.

Sandøy, M., T. Aven, and D. Ford. 2005. "On Integrating Risk Perspectives in Project Management." *Risk Management: An International Journal*, 7: 7-21.

Society for Risk Analysis. 2018. *Society for Risk Analysis Glossary.* Society for Risk Analysis.

Standard Norge. 2021. *Requirements for risk assessments.* Standard Norge.

Xia, N., R. Zhong, C. Wu, X. Wang, and S. Wang. 2017. "Assessment of Stakeholder-Related Risks in Construction Projects: Integrated Analyses of Risk Attributes and Stakeholder Influences." *Journal of Construction Engineering and Management*, 143(8) ed.