Conducting Rigorous Reviews of Research on Risk Management in Construction

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Abstract

This paper is methodological. The purpose is to introduce a method for conducting rigorous reviews of targeted conceptual research on management (areas) in construction-related contexts and to demonstrate the use of this review method in the area of risk management (RM) inside and outside construction. The ten principles for conducting a review of conceptual research are re-introduced, i.e. (1) a choice of an independent review, (2) a choice of a targeted area of research and the formulation of a review problem, (3) the setting of the aims and the limitations for a review, (4) a search for eligible concepts published through formal channels, (5) an inclusion (and a retrieval) and an exclusion of identified concepts, (6) the coding, exposure, and analysis of conceptual data, (7) the protection of the overall validity of a review, (8) a discussion of the findings of a review, (9) suggestions for the advancement of focal, conceptual knowledge and future reviews, and (10) conclusions on the usefulness of the reviewed concepts for practicing managers. These principles have been applied to a pioneering review of RM concepts. The core RM view was enlarged to encompass uncertainty, complexity, and crisis management. A broad variety of the generic RM concept types could be identified from among the books, the chapters, and the articles published between the years 2000-2006. 116 concepts were included in the review. 81 (70%) concepts (references) belong to the traditional risk view, 10 (9%) to the complexity view, 19 (16%) to the uncertainty view, and 6 (5%) to the crisis view. This group includes also a sub-population of 49 (42%) construction-related concepts. Thereof, 11 (9%) concepts are designed for managing firm or business level issues and 38 (33%) concepts are designed for managing project level issues. The method includes the evaluation of the levels of theoretical advancement and practical applicability of each concept. The results serve as a state-of-art database on RM vis-à-vis scholars (planning future research) and practitioners (searching for highly applicable RM concepts). Similarly, researchers may now conduct their rigorous reviews of conceptual research on any construction-related management areas in the future.

Keywords: Conceptual research, literature review, research method, risk management
1. Introduction

In general, literature reviews provide readers with a synthesized and analyzed comprehension of a targeted area’s state-of-art empirical research (Cooper 1998). Recently, Fink (2010) emphasizes that literature reviews are being conducted to justify courses of actions such as strategic plans, grant proposals, or topics of dissertations. Literature reviews are justified as attempts to identify and to interpret what is known about topics. In particular, the results of a qualitative research review are depicted as a detailed, complex, and holistic picture or story. However, Fink undermines any differences between quantitative or qualitative research reviews by stating that conducting an accurate review with valuable findings should be the primary concern. In turn, Ridley (2008) addresses literature reviews from a (PhD) student’s perspective and sees them foremost as a means to gather a wide understanding from a targeted domain, including its historical background and focal concept introductions. Literature reviews are rarely entrusted upon as the only or primary research method in management studies. Likewise, conceptual literature reviews or systematic management-related literature reviews are not addressed in the recent handbooks (e.g. Fink 2010, Ridley 2008). As one exception, Huovinen (2006, 2008) has planned a review method for conducting rigorous reviews of conceptual research on targeted (construction-related and international) areas of management.

The purpose of this paper is (i) to re-introduce and to deepen a method for conducting rigorous reviews of targeted conceptual research on management (areas) also in construction-related contexts as well as (ii) to apply this review method to the relevant area, i.e. risk management (RM) inside and outside construction as well as to provide a pioneering overview of the state-of-art RM literature published in English between the years 2000-2006. The latter was chosen as the application area jointly by the synergic research teams in the area of construction management as part of Department of Structural Engineering and Building Technology at Aalto University School of Science and Technology.

This exemplary review combines the findings from two separate, complementary reviews as follows. The first sub-review covers the relevant RM books with and without a construction context published between the years 2000-2006. The second sub-review covers the relevant RM journal articles with a construction context published between the years 2000-2006. The systematic and extendable nature of the review method allows adding new sub-reviews to the state-of-art database whenever extensions are seen appropriate. Thus, a third sub-review covering the relevant RM books published between the years 2007-2009 is on-going.

2. Conceptual research reviews

2.1 Reviewing of empirical research versus conceptual research

Empirical studies commonly rely on literature reviews as a complementary method. However, reviews are seldom conducted in a comprehensive way. Only a few handbooks address literature
reviews as a primary research method on its own right, underlining the task of synthesizing empirical research (e.g. Cooper 1998). According to literature review pioneers, like Cooper (1998) and Cooper and Hedges (1994), the role of a reviewer is to conduct meta-analyses, to combine primary, empirical studies’ results statistically with quantitative procedures, and to draw conclusions from investigations that address related or identical hypotheses. In turn, Ghauri and Gronhaug (2005) posit that any empirical research should start and occasionally look back as a consultation of past literature. This is so to identify a relevant research problem and its background, to plan a sampling, to formulate questions, and to choose statistical tests. A minimum requirement for a literature review is such an evaluation that enables a researcher to justify the choices of an empirical research design and a conceptualization.

Within the reviewing of conceptual research, the units of analysis are concepts. Conceptual research reviews produce syntheses, quantitative analyses, qualitative comparisons, and conclusions along the generic view as well as any notable exceptions to it. Herein, the term concept is used to cover all indications of theory such as models, concepts, frameworks, and methods (Huovinen 2008).

### 2.2 Key rules for reviewers

The success factors for a research review are the principles of selectivity and neutralism (Hart 1998, Cooper 1998). The principle of selectivity implies limiting the potentially original scope of a targeted review by selecting basic criteria for eligible concepts and defining a unit of review. Primarily, criteria should be considered to ensure a functional, minimum size of a targeted concept population and its sub-populations, to describe the economic and societal context, and to determine the language(s) and the period (years) of publication. Secondarily, a reviewer may define a conceptual study process respective to a unit of review. The principle of neutralism protects the validity of a review from biases such as preferring only one of paradigms of methodology, research traditions, business or market contexts, or ways of assessing the theoretical advancement and practical applicability of concepts. Neutralism is closely related to following the pre-decided selectivity. Key objective criteria for a study should be the only factor for including or excluding concepts, not a reviewer’s own preferences. Key criteria should remain unchanged during a review process and not be subject to alteration to support e.g. a certain minimum number of a sub-group or a simultaneous side study.

Fink (2010) emphasizes four key virtues for a literature review, i.e. systematic, explicit, comprehensive, and reproducible. The four virtues of an objective review are best appreciated when contrasting with the subjective one. For example, a subjective literature review lacks a justification for the selection of data, leaves out the availability of data, handles a literature population only partially, and makes inaccurate conclusions. The four virtues are being respected when a reviewer defines clearly what is targeted and where, evaluates data and results with a critical stance, and documents her or his process (aligning Fink 2010). In addition, a reviewer is advised to adopt a dualistic approach. For example, this duplicity implies the gathering of generic RM concepts at the same time with applied concepts across focal (construction-related) contexts and the non-focal ones.
This results in a wider pre-understanding for the selected, specific subject than a narrowly targeted approach would accomplish.

2.3 Ten principles for conducting a conceptual research review

In analogy with empirical research, literature review processes are being structured into five stages, i.e. formulating a research problem, searching literature, reading literature and evaluating data for an inclusion, analyzing eligible references, and designing and writing a report (Cooper 1998). In the case of conceptual research reviews, Huovinen (2006) advocates the adoption of **10 guiding principles** as follows: (1) Choosing an independent conceptual review (as the primary/only research method) to be conducted, (2) choosing a targeted area of research and formulating a review problem, (3) defining the aims and limitations for a review, (4) searching for eligible concepts published through formal channels, (5) including (and a retrieving) and excluding identified concepts, (6) coding, exposing, and analyzing conceptual data, (7) protecting the overall validity of a review, (8) reporting on the findings and conclusions of a review, (9) providing suggestions for the advancement of focal, conceptual knowledge and future reviews, and (10) providing recommendations (including the evaluation of the usefulness of the reviewed concepts) to practicing managers.

![Figure 1: 10 guiding principles for conducting a rigorous, conceptual research review.](image-url)
3. Case study – a pioneering review of conceptual research on risk management

3.1 Rationale for a review of research on risk management

In principle, state-of-art knowledge on RM is needed for various purposes. It can be compiled and absorbed through literature, scholar writings, seminars, consultants, experience, etc. In our case, such knowledge was perceived to be essentially needed for **enhancing RM practices and competencies among Finland-based firms** that were aiming at achieving significant growth in their international construction businesses (as this is reported upon in Palojärvi 2009). Future growth would imply major challenges, opportunities, and requirements for managing inherent risks well. The Federation of the Finnish Construction Industries (RT 2004) foresaw that the fast expanding international businesses will be the primary driver. In the same vein, the Association of Finnish Civil Engineers introduced the scenarios of Finnish construction-related companies’ potential to strengthen their competitive positions in international construction markets by the year 2030 (RIL 2004).

It turned out that no comprehensive, up to date reviews of generic RM concepts were available, not to talk about the construction-related ones. In the year 2006, a RM research team at the Helsinki University of Technology (TKK) initiated an on-going review of the key generic RM concepts and the applied, construction-related RM concepts, published between the years 2000-2006. The ways and levels of evaluating the degrees of theoretical advancement and practical applicability of RM concepts were planned. The results of the 1st and 2nd phases have been published via the two reports (Ahonen 2007 and Lehtiranta et al. 2010a). The review method and its use are reported upon in this paper and some of the relevant insights based on the results in Lehtiranta et al. (2010b).

3.2 Four views on enlarged risk management

The browsing of the RM literature early revealed that, besides the traditional RM concepts, the generic theories of complexity, uncertainty, and crisis were increasingly applied also to the construction-related contexts of managing firms, businesses, and projects. Many researchers aim at gaining new insights, more advanced RM concepts, and more useful RM methods along these three views (e.g. van der Velde and van Donk 2002, Langlo et al. 2007, Loosemore 2000). Aligning with Hart (1998), the domain of the pioneering RM review was enlarged to encompass also the concepts of uncertainty management, complexity management, and crisis management in order to allow the capturing of any breakthrough ideas. At the outset, risk was perceived as a possibility that the goal(s) set for the managing of a firm, a business, or a project may not be attained due to one or several (risky) events. The consequences of a realized risk may be negative or positive. Uncertainty is seen as a lack of knowledge of future actions. Complexity is a sum of multiple tasks and their interdependencies. In turn, both of them increase the existence of risk. Crisis is deemed to be a mishandled negative risk. This pre-understanding was later both strengthened and challenged by the findings of the review.
3.3 Conduct of the review of enlarged risk management concepts

The review process was planned by applying Huovinen’s (2006) 10 guiding principles as follows. The principles were applied in the same way to each of the two sub-reviews as follows.

1) The conduct of an independent conceptual review as the primary research method was justified by its partial comprehensiveness versus targeted RM concepts and its extensiveness versus the two eligible publication channels (scientific books and articles).

2) The enlarged, conceptual RM research was selected as the targeted scope of the review. The context of internationally growing firms was adopted as the major criterion for including the initially identified concepts in the review. The study problem, shortly, was to map and to review the state-of-art literature on enlarged RM along the generic dimension and the contextual, construction-related dimension.

3) The sub-objectives for the review were specified as follows:

   (a) To identify and to procure the eligible references, i.e. books and articles on managing uncertainty, complexity, risk, and crisis by using the representative publishing and procurement channels

   (b) To assign each reference primarily (i) to one of four views: uncertainty, complexity, risk, and crisis, (ii) to one unit of review: a firm and/or a business or a project, and (iii) to one of two contexts: non-construction or construction-related

   (c) To retrieve the relevant information from the eligible references and to tabulate it in the structured way, i.e. the name of each concept, the purpose, the primary view, (the typology of) the definitions, the context, the qualitative and quantitative methods, and the empirical evidence (in a form of in-depth applications, cases, and examples)

   (d) To introduce and to analyze the common (and possible divergent) definitions of uncertainty, complexity, risk, and crisis to be found within the references

   (e) To introduce and to analyze all the eligible concepts for managing uncertainty, complexity, risk, and crisis as part of firm, business, and project management in non-construction and construction-related contexts

   (f) To assess the theoretical advancement of each reference and the practical applicability of each concept

   (g) To choose and to introduce one exemplary concept for dealing with uncertainty, complexity, risk, and crisis as part of firm/business and project management
(h) To compile the direct distributions (listings) of all the eligible management concepts and their focuses, contexts, typologies, applications, and techniques/tools as well as to assess them in terms of commonness, newness, and practical applicability

(i) To recommend the most useful concepts of managing uncertainty, complexity, risk, and crisis to construction-related firms (primarily based in Finland) for the planning of their own RM strategies and procedures

(j) To establish a structured, extendable on-line database, in a form of the excel-based tables, that initially consists of all the reviewed references and to plan the procedures for making the compiled RM literature and the database available among firms based in Finland and for updating this literature/database in the future

(k) To suggest the critical areas and topics for complementary studies in the future.

The limitations of the review, i.e. the selection criteria for the inclusion and exclusion of the identified concepts were set as follows:

(i) The systematic search focused only on the scientific and professional books and the scientific articles published in English between the years 2000-2006.

(ii) The book search was limited to the on-line catalogues of 23 international publishers, including some professional organizations, and the article search to 20 scientific journals.

(iii) Any eligible books must imply a view on uncertainty, complexity, risk and/or crisis.

(iv) The typical reasons (criteria) for the exclusions were as follows: (a) the book did not emphasize RM enough, (b) the book focused too much on the technical risks and not enough on any firm, business, or project management risks, and (c) the book focused too much on a limited market area or too a specific business.

(4) The search for eligible concepts was conducted through the formal channels by using a pre-selected set of the search words each time when the initial numbers of the hits were otherwise too large (> 500 hits).

(5) The inclusion and exclusion of the identified concepts was based on the original selection criteria, following the principles of neutrality. A few exceptions were allowed to include some older key references (e.g. Flanagan and Norman 1993) on which many recent references are based. Or, to cover less popular sub-populations such as complexity in construction by literature identified outside the hits of the basic literature search.

(6) The coding, exposure, and analysis of the conceptual data were performed formally by using the pre-structured excel database and by exposing each concept and reference in the same way.
(7) The high validity of the review was pursued after by following the principles of selectivity and neutralism. The comprehensiveness of the book search was tested applying a random check, i.e. “Are the six key references of Kaliprasad’s (2006) article on the state-of-art RM in construction included?” All the six references were among the search hits, but only one of them was evaluated to be eligible. The review team consisted on one MSc student, two senior scholars, and one senior doctoral candidate. This candidate had made his prior career by occupying many key managerial positions inside the three internationalizing, Finland-based firms. The complementary pre-understanding of the members increased the likelihood that the principle of neutralism was protected successfully.

(8) The reporting was pre-planned, by sub-group, to consist of the basic results, i.e. the review of the references that contained the RM concepts (the introductory text and the summary table), the key findings (the text paragraphs), and one exemplary concept (the text paragraphs and 1-2 key figures).

Finally, the findings and validity of the review enabled (9) to prepare the suggestions for the advancement of focal, conceptual RM knowledge and future reviews as well as (10) to plan the recommendations to practicing managers (based on the evaluated applicability of the RM concepts).

### 3.4 Overview of the results of the review

The 1st sub-review, i.e. the comprehensive book search through the 23 publishers’ digital catalogs and the 3 article databases resulted in the 3247 hits published between 1 January 2000 and 31 December 2006, whereof the 388 book-related hits were assessed. Thereof, the 37 eligible books and the 18 chapters were included into the review. All these hits were based on the 14 publishers’ catalogs. In turn, the complementary article search produced the 914 hits, whereof the 60 construction-related articles were included into the review as well (Figure 2).
In total, the 116 references were reviewed and the inherent RM concepts analyzed (the authors will submit a complete list of these references at request). The pre-itemized information was retrieved from each reference and typed into a set of the structured tables in order to ensure the similar, reliable treatment of each reference and each concept. The quoted items included the primary view, the definitions and the typologies for the key terms, the context, the purpose, the applications, the methods, the techniques, the tools, and the empirical evidence (as the in-depth applications, the cases, and the examples). The analysis was enabled by the 3-factor categorization as follows.

(1) The enlarged RM view enabled to assign each of the references into one of the four views. The 81 (70%) concepts belong to the traditional RM view, the 10 (9%) concepts belong to the complexity view, the 19 (16%) concepts belong to the uncertainty view, and the 6 (5%) concepts belong to the crisis view.

(2) The three focal areas or levels of management could be identified, i.e. the 48 (41%) concepts are designed for managing firm level or business level issues and the 68 (59%) concepts are designed for managing project level issues.

Figure 2: Overview of a 3-factor categorization of the 6948 hits (published between the years 2000-2006) during the two search rounds in the years 2006 and 2007.
(3) The focal contexts could be grouped into the two groups, i.e. the majority or the 67 (58%) concepts deal with the non-construction contexts. Only the 49 (42%) concepts address the various construction-related contexts. Thereof, the 38 (33%) concepts are designed for managing project level issues and the 11 (9%) concepts are designed for managing firm level or business level issues.

In addition, (4) the dual evaluation of each of the 116 references (containing the concepts) was performed along the dimensions of theoretical advancement (completeness, system likeness, and variety) and practical applicability (a variety of applications, methods, techniques, and tools; and empirical evidence) on the 3-level scales. The respective criteria were specified for the high, medium, and low levels, see Table 1. Thus, the 28 (24%) references are theoretically highly advanced, the 69 (59%) references are fairly advanced, and the 19 (16%) references are less advanced. In turn, the 20 (17%) references are highly applicable, the 62 (53%) references are fairly applicable, and the 34 (29%) references are less applicable.

### 4. Conclusions

The 2-stage review of the conceptual research on enlarged RM has been conducted during the two rounds, during the years 2006 and 2007. It is herein posited that the variety of the enlarged RM concept types vis-à-vis risk, uncertainty, complexity, and crisis could be identified reliably and covered to the large extents from within the books and the articles published in English between the years 2000-2006.

In principle, a research review may be considered successful only when it reveals vital needs for further research on targeted areas (applying Huovinen 2006) and when its results become a useful platform for advancing the knowledge of researchers and practitioners on targeted areas.

Table 1: Evaluated levels of the theoretical advancement and the practical applicability of the 116 references and the RM concepts, published between 1 January 2000 and 31 December 2006.

<table>
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<th>Level</th>
<th>Theoretical advancement</th>
<th>Practical applicability</th>
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<tbody>
<tr>
<td>High</td>
<td>28 (24%) complete, systemic concept designs with a high variety</td>
<td>20 (17%) references with high variety of applications, methods, techniques, and tools and/or highly valid empirical evidence</td>
</tr>
<tr>
<td>Medium</td>
<td>69 (59%) partially systemic concept designs with a limited variety</td>
<td>62 (53%) references with limited variety of applications, methods, techniques, and tools and/or limited valid empirical evidence</td>
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<tr>
<td>Low</td>
<td>19 (16%) concept designs with no systemic features and no variety</td>
<td>34 (29%) references with some or no variety of applications, methods, techniques, and tools and/or no valid empirical evidence</td>
</tr>
<tr>
<td>Total</td>
<td>116 (100%) references</td>
<td>116 (100%) references</td>
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This review of the RM research is verifiably meeting the two criteria. The 116 references, i.e. the 56 books and the 60 articles are today compiled within an enlarged RM library of the unit of Construction Management and Economics at Aalto University School of Science and Technology. The structured, extendable Excel database consists of the itemized reviews of the references and the concepts with the evaluations of the theoretical advancement and the practical applicability, respectively. Since the year 2006, this database has been exploited frequently by scholars and it has been modified and distributed, for example, to lay a ground for the relevant readings as part of new studies and to provide the theoretical bases for the renewal of RM practices among Finland-based, internationalizing contractors and building product suppliers. In the future, this knowledge of the enlarged RM knowledge will be promoted at seminars, workshops, and public presentations. In the same vein, the first inquiries on the usefulness of this database will be carried out among business and project managers.

Noticeably, the state-of-art knowledge database becomes soon outdated without updates on a continuous basis, i.e. many future sub-reviews of books, journal articles, and conference proceedings will be conducted to support this pioneering database. Readily, it is assumed that new references published after 31 December 2006 provide some novel RM concepts. Thus, a third complementary sub-review is being processed, targeting the books and journal articles published in English between the years 2007-2009 on enlarged RM concepts vis-à-vis risk, uncertainty, complexity, and crisis.

Today, researchers rely very rarely on literature reviews as the primary research method. Literature reviews are no popular subjects within handbooks etc. on research methods. Likewise, only a few comprehensive reviews have been conducted vis-à-vis the managing of construction-related companies, businesses, and projects. Nevertheless, it is herein envisioned that scholars will gain deeper pre-understanding and rigorous conduct of comprehensive literature reviews in the future and this will advance the respective piles of generic and applied knowledge. For example, more highly relevant research problems will be disclosed and formulated as valuable starting points for new research programs.

In general, the rigorousness of a literature review lies in its retractable process and the careful, documented application of the guiding principles (e.g. Huovinen 2006, 2008). Indeed, a hurdle of validity of a literature review can be markedly heightened from the traditional level where reviews are being started with a few well-known references and such references’ references as well as researchers are easily content with random or subjective hints, e.g. recommendations from collaborative peers. In some cases, this so-called chain-method may well lead to a high coverage of up to 80% of relevant, published knowledge, gathered with only 20% of the total (and in part ‘hidden’) efforts. Without a systematic, comprehensive search, it is very likely that researchers fail to identify many contradicting and/or emerging concepts. The same risk is embedded within saturation methods where new references are sought for until no new information is found, i.e. a researcher should learn the sub-areas and boundaries of a targeted knowledge base before he or she makes a decision that no more interesting knowledge will be looked after.
References


[The authors submit a complete list of the 116 references at request.]