



INTERPRETATION OF RISK MANAGEMENT AMONG SMALL CONSTRUCTION ENTERPRISES

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The purpose of this study is to identify the perceptions of risk among small enterprises in the construction sector and explore the possibilities of using artificial intelligence (AI) as an enabler for improving their risk management practice. This paper is a theoretical study. A systematic literature search and an integrated purposive sampling approach were applied to review the relevant literature. The methodology aimed at identifying the level of awareness and competencies for traditional risk management among small enterprises, and their willingness to adopt related technologies as a way to improve their current practices. The focus was narrowed down to risk handling challenges for small enterprises, with a particular focus on business risks, and the concept of artificial intelligence in risk management. The significant limitation of the study is its theoretical nature at this stage. Findings from the review of extant literature demonstrate that small enterprises do not have a strategic way of handling their risks. They struggle with ranking risks that affect their business, thereby failing to mitigate such risks holistically. Nonetheless, the use of AI in business risk planning presents a possible solution to small enterprises. The paramount advantage of AI is the capacity for precision and the enablement for saving costs and time. Implications of findings include the need to establish the benefits of AI in risk management and decision making within the construction context, and to determine effective AI technologies that can be used by such enterprises to develop systematic risk management frameworks that are reliable. The study forms a basis for understanding current risk management practices of small enterprises, and the possibilities for improvements. This study is at its early stage of a more extensive research project and will be used as the foundation for empirical studies.

Keywords: artificial intelligence, business risks, risk management, risk perception, systematic risk management

INTRODUCTION

The economic growth of developing countries greatly relies on small enterprises ability to create jobs, introduce new products in the markets, define innovation practices, and grow the nations GDP (Hyder and Lussier, 2016). The business dynamics of small enterprises have been extensively researched, and, in the African

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markets, their business growth in the unstable economies they operate in studied (Chileshe and Kikwasi, 2014). The instability in economic movements has seen a rise in business risks that inhibit small enterprises from developing to their full capacity (Belás et al., 2015). Sahebjamnia et al., (2015) In their research state that organizations regularly face disruptive events that interfere with their business objectives, such circumstances require a proactive decision framework that will keep incurred financial losses at a minimum. Rancher (2015) further highlights that risks will severely affect an enterprise if adequate mitigation measures are not efficiently structured. Any enterprise's development relies on its aptitude for efficient management of risks (Falkner and Hiebl, 2015). Risks identified as having a crippling effect on the success of small enterprises are business and financial risks, and they are known to produce a severe ripple effect where the enterprise does not have a defined orientation or business strategy (Belas et al., 2015; Torabi et al., 2016). Unfortunately, small enterprises struggle with comprehending various risks, and as a result, fail to develop a system for risk handling/mitigation (Ekwere, 2016). Their most significant limitations are their understanding of risk analysis strategies that are qualitative, inadequate knowledge, the practice of risk management, and the absence of trained specialists to perform risk identification (Chileshe and Kikwasi, 2014; Yoon et al., 2015; A et al., 2017).

Existing research stresses the importance of having a systematic strategy for handling risks, suggesting that perhaps the most effective way to implement such strategies in an enterprise is to strike a balance between human intelligence and the use of technology intelligence. Schoemaker and Tetlock (2017) in their research show strong support for technology and describe the trend for "smart" organizations as blending technology-enabled insights with a delicate consideration of human judgment, cognition, and choice. Enterprises that effectively carry through this vision stand a high chance of having a competitive advantage over their contenders (Schoemaker and Tetlock, 2017). Given the competitive nature of the construction industry and its inherent risks (Yoon et al., 2015), this approach has a fair chance of success, particularly with small enterprises where a business risk strategy has not yet been identified. Developing an effective business risk strategy is critical for business stability when an enterprise is small and undeveloped (Lechner and Gudmundsson, 2014). The background thus far emphasizes the need to understand risk management practices and challenges for small enterprises. However, there is scarcity of evidence in the existing literature to describe how small enterprise owners/managers in construction perceive business risks, and their risk management style. There is also a need to explore the impacts of technological enablement such as AI in RM for small enterprises in construction. The pertinent research question is, therefore: What is the nature of risk management in small construction enterprises, and how can they integrate AI in their business risk management strategies to achieve business goals?

LITERATURE REVIEW

The research is primarily grounded on risks and the principles of risk management. The link between risk and risk management is that risk management exists because of risks being present. The study is focused on business risks of small construction enterprises, and as such, it is necessary to establish a link between risks, risk management, and business strategies.

Risk and risk perception

The concept of risk is interesting because risks are subjective and context based. Torabi et al. (2016) explain that there are varying definitions of risk, and it is essential to define what is meant by risks when conducting academic research. In this study, a risk is an event that alters the expected desired outcomes of an enterprise, thus affecting the enterprises business objectives. Culture plays a significant role in how individuals identify risks. A group of people can be presented with the same information and still have different opinions on the implications of such information; some may interpret it as a threat, an opportunity, or neither (Yates and de Oliveira, 2016). This aspect will significantly influence one's perception of risks and how they handle them as a result. Mostly the concept of risk lies in a person's knowledge and valuation of risks, thereby making risk perception a strong factor for risk interpretation and management (van Winsen et al., 2016). Risks do not only have an adverse impact; they can also be an opportunity for an enterprise/company (Cagliano et al., 2015). Common types of risk include credit risk, market risk, project risk, business risk, strategic risks, operational risks, reputational risks, liquidity risks, political risk, employee risk, enterprise risk and financial risk (Griffin, 2018). The current study focuses on business risks.

Business Risks

All enterprises encounter risks; without risks, there is no reward (Truong Quang and Hara, 2018). However, too much risk can result in business failure, and as such, there are numerous methods to identify business risks, and every identifying strategy should comprehend the specific business activities that pose a threat to the company (Hyder and Lussier, 2016). The following diagram gives examples of business risks as identified by (Aven and Renn, 2019); Griffin 2018).



Figure 1: Identified Business Risks

Risk Management (RM)

The principles of RM have been widely researched, both in practice and academics in the past decades. Standard RM procedure explains that all risks need to be identified and known to determine their severity and management styles (Abderisak and Lindahl, 2015; Serpell et al., 2015; A et al., 2017). Risk management allows for equilibrium between taking risks and decreasing them. A more effective risk management approach is one that cares to address the risks an organization faces holistically, as well integrate effective risk-taking strategies for when risk is an opportunity (Wu et al., 2014). And likewise, the risks will then be analyzed and prioritized to plan for mitigation strategies. The RM process arguably needs to be systematic for efficiency and should be structured to consider the following crucial component: risk identification, risk measurement, risk mitigation, risk reporting & monitoring, and risk governance (Aven, 2012; Amundrud and Aven, 2015).

Risk management for small enterprises

Every operating business is not exempt from risks, and small companies are no exception. The importance of risk management cannot be more emphasized in this regard. Enterprises need to be strategic in the way they design their risk management approach to sustain business continuity, and as such, an integrated Business Continuity Plan (BCP) is crucial (Hyder and Lussier, 2016; Torabi et al., 2016). Sahebjamnia et al., (2015) in their research share the same sentiments and further caution that for any BCP to be more integrative, business owner/managers need to factor for limitations like budget availability and shared resources. Unfortunately, small enterprises still fail to comprehend these strategies, let alone defining their risk strategies as per their risk culture; this derails their business success (Yolande Smit, 2012; Gao and Banerji, 2015; Hyder and Lussier, 2016).

The construction industry context

Risks in construction are primarily associated with projects due to the nature of the industry (Abderisak and Lindahl, 2015). Construction risks are regarded as events/activities that adversely affect project objectives such as costs, the scope of work, quality, and time (Yoon et al., 2015). And given the setting of building projects, it is vital to note that human risks should be treated with delicacy (Renault and Agumba, 2016). It is thus, essential to have an effective risk management strategy in the construction industry that prioritizes human safety and development.

When Chileshe and Kikwasi (2014) did their research, one of their objectives was to discover the barriers prohibiting small construction enterprises from efficiently adopting a risk management strategy that works. The following table lists the critical challenges to business development for small construction enterprises around the world:

It is quite evident that risk management is a problem for small enterprises anywhere in the world. The full comprehension of what RM is and what it requires still pose as a barrier to implementing effective risk management, these coupled with risk perception and a budget for RM implementation. There needs to be a more robust and simplistic way in which small enterprises should practice risk management, and a possible solution can be the use of AI software to assist small enterprise owners/managers with risk identification and evaluation. The following

section discusses the concepts of AI and how it can be applied in the construction industry.

Table 1: RM implementation challenges affecting small enterprises around the world.

Region	Barriers
Asia	
Hong Kong	Challenges in getting input estimates and their probability assessment; Time constraints; problems in understanding risk management techniques; IT resources, and managerial support.
Korea	The absence of awareness and expertise in risk management practices; Tangible risk-probability calculations.
Singapore	Competition among SMME contractors; the complication of analytical tools; absence of prospective rewards; budget deficiency; non-existence government legislation; knowledge deficiency; lack of skilled specialists; time constraints; reduced profit margins; and not economical.
America	
United States	Personal prejudices; traditional norms.
Europe	
United Kingdom	Late start to projects; inexperienced employees; attitude towards risk; not robust enough and risk identification incompetency.
Africa	
Tanzania	Risk management awareness; coordination among project team members; risk management styles; effective use of tools and methods; enterprise strategic objectives; internal and external environment; less qualified risk professionals client requirements and cooperative culture.
Ghana	Lack of experience; lack of facts and figures, coordination among stakeholders; accessibility of risk-management specialists; time limitations; lack of knowledge and expertise.

Adapted from: (Chileshe and Kikwasi, 2014)

ARTIFICIAL INTELLIGENCE

Benefits of AI

The definition of artificial intelligence had since evolved from when it formally emerged in 1956. However, AI differs from traditional computer algorithms because of its ability to train itself around its accumulated experiences (Čerka et al., 2015). Rouse (2019) expands on this definition by saying AI is the simulation of human intellect practices by technologies, particularly computer systems. These procedures comprise of: learning the acquirement of data and instructions for using the data, reasoning using instructions to reach approximate or certain conclusions, as well as self-correction. Artificial intelligence has many benefits and compatible with decision making. Mostly decision making will be required where a lot of information is shared amongst groups. Parry et al., (2016) highlight that AI

can de-individualize leadership decision making, especially where trust issues could pose a problem due to a high degree of distance between more senior management and those at the bottom of the organization's structural hierarchy.

Challenges in using AI

AI has been criticized with regards to the loss of a "human touch" in the daily social engagement of human beings. Below is a simplified summary of the trade-offs of AI to human intelligence as adopted from (Jarrahi, 2018):

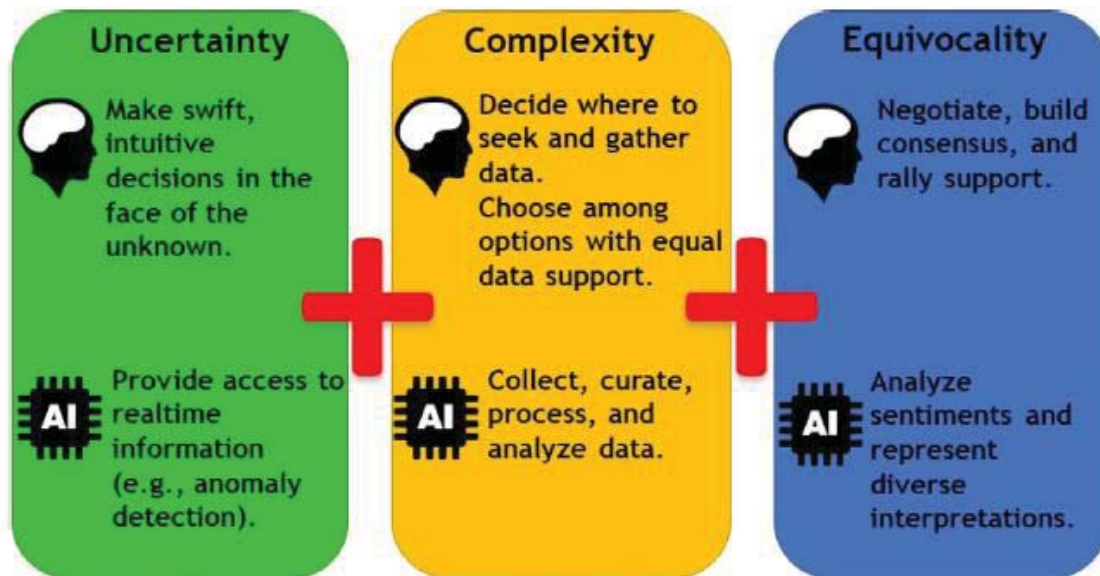


Figure 2: Relationship between AI and humans in decision-making situations. Source: Adapted from Jarrahi, 2018.

Source: Adapted from (Jarrahi, 2018)

Jarrahi's research focused on AI and the future of work. And as such, established an ideal symbiotic relationship between AI and humans, especially where uncertainty, complexity, and equivocality are of concern. AI cannot make intuitive decisions nor build a relationship amongst team members. Another issue with AI is that it reduces people's skills as they no longer need to do much. In extreme cases, jobs are lost (Čerka et al., 2015). These downfalls of AI will need to be understood by an organization that wishes to integrate AI concepts in the running of their businesses. The relationship of the abovementioned is depicted in the following table. The table gives a task that the owner/manager of a small enterprise will need to do when developing an AI risk management strategy.

The table above presents a guide into embracing AI, especially where estimates and decision making are required. Schoemaker and Tetlock (2017) provide a common approach of innovative advances and human capital building in an enterprise. In the table, we see the importance of having a defined strategy that every business aspect will need to answer to. We also get to understand that such a strategy will need to complement the advancement of human skills and innovation in the enterprise. In this regard, the enterprise/business strategy needs to take the technological leap and ensure its collaborative adoption.

Table 2: Strategies for Small Construction Enterprises to Embrace AI

Task	Description
Categorize the strategic edge of the enterprise	When handling prior enterprise's forecasts, identifying areas requiring improvement, particularly where subjective predictions pose a threat, is crucial in implementing an enterprise's strategies.
Assessment and Evaluation of predictions.	Regulate competitive estimating methods by allowing experimentation, innovative thinking, and competition within enterprise employees.
Identify specialists in the business structure.	This has to do with identifying employees/managers that show knowledgeable insights on crucial business structures, and leverage their knowledge when brainstorming or effective technologies to use for the business.
Embrace artificial intelligence.	Use BIM in restricted assignment areas to outperform human specialists and increase value
Expand the enterprises' business goals	Encourage an innovative culture that constantly looks for improved ways to combine the skills of humans and machines/technologies.

Source: (Schoemaker and Tetlock, 2017)

IDENTIFICATION OF THE GAP

Lechner and Gudmundsson (2014) discuss that an enterprise's advancement depends on its entrepreneurial behavior and the application of competitive strategies in its business planning. With enterprises facing various risks in their business operations, such competitive strategies will define each enterprise's risk strategies for mitigating business and financial risks (Investopedia, 2019). Risk management helps enterprises manage their risks and making sure that their business objectives are met. Unfortunately, Small and medium enterprises fail in this regard as stressed by Yoon et al. (2015). While the need to adopt more business supporting technologies is advocated in the wake of the fourth industrial revolution (Makridakis, 2017), research in technologies such as AI has grown in the past decade. However, there is a scarcity of research on AI implementation in risk management strategies for small enterprise. Therefore the current study is purposed to identify important benefits of AI and how they can be incorporated into risk management for small enterprises in construction.

RESEARCH DESIGN AND METHODS

A systematic literature review was conducted, which relied on purposively sampled literature. A systematic literature review is based on a deliberate and organized method of identification, assortment, and assessment of previous academic research (da Silva Etges and Cortimiglia, 2017). A significant advantage that a systematic review has is that it allows for a rigorous and unbiased assessment of research outcomes, especially where research quality is of importance (Piper, 2013). In this study, a systematic literature review refined results assisted in answering the research question. The following diagram illustrates the step by step process performed from the Wits online library on the Scopus database. The process is broken down into two tables, the first table gives a search breakdown of related

articles on Scopus, and the second table discusses the steps followed to analyze the content of the papers selected as well as accessing additional papers. In the Scopus database, keywords from the research question and research aim were used to locate the relevant papers/articles. The papers/articles generated were extensive and certain limitations, i.e., publication year, subject area, document type, and research field, had to be used to filter the search. The rest of the steps are explained in the tables below.

Table 3: Scopus Database search entries

Database: Scopus	Search Limitations/Filters
First step: Login TITLE-ABS-KEY (keywords Input) risk AND management risk AND perceptions small AND enterprises OR SMEs Total papers generated: 132	Year, Subject Area, Document Type. The first set of the search was limited to research dating back to the last ten years (2019-2009). To broaden the scope of knowledge, articles in the following subject areas were selected: Business, Management and Accounting, Engineering, and, Decision science. Further to these parameters, the following document types were chosen because of their reviewing system: Article, Conference Review, Book Chapter Refined papers generated: 43
Second Search: TITLE-ABS-KEY (Keywords Input) risk management AND Risk perceptions AND small enterprises OR construction industry Total papers generated: 473	Subject Area Limit: Business, Management, and Accounting Decision Sciences Economics, Econometrics, and Finance Refined papers generated: 171
Third Search: TITLE-ABS-KEY (Keywords Input) business strategic AND planning, small AND enterprises OR construction industry Total papers generated: 864	Subject Area, Document Type The papers selected for this search were reviewed from the following disciplines and journal publications: Construction Management And Economics Journal Of Construction Engineering And Management Journal Of Small Business And Enterprise Development Engineering Construction And Architectural Management Document Type: Article and Conference Review Refined papers generated: 66

Table 4: Paper content selection process**Paper Selection**

Scopus produced a final set of available papers based on the abovementioned filter inputs. Articles with titles addressing the focus of this study were carefully identified. Their abstracts were read to confirm their relevance. The final stage was downloading the articles above. Scopus searches its sources to download the articles, and where permission was required, it would state so. The natural step henceforth was to search for the remainder of the articles on Google Scholar.

Google Scholar Search

Article titles and/authors were typed in to locate the papers that Scopus could not download. To broaden the scope of information studied, an integrative literature review was conducted on google scholar. The following keywords were used for searching through databases: Challenges affecting SMMEs, business enterprise, business strategy, risks, risk management, risk management adoption, risk management in SMMEs, risk management in construction, systematic risk management, strategic risk management in small enterprises in construction, market niche, and market niches in construction. The research time limitation for the papers was five years (2014-2019). The staged approach to the integrative literature review is as follows: A quick perusal of abstracts was conducted to assess the relevance and currency of the papers. The findings in the studied articles demonstrated poor risk management as a barrier to business development and effective running of small enterprises.

Following the first step, a search for articles discussing how enterprises can effectively practice risk management was conducted. The stated approach assured alignment to the broader focus of risk management and strategy. The two main knowledge areas were combined to get a more unobstructed view of the challenges around strategic risk management implementation in construction.

Summarizing papers downloaded in preparations of writing the final paper

An annotated literature review table with the following headings was used to summarize essential information from the reviewed papers: Full reference, research problem, consequences of the problem, methods, findings, theory, and relevance of the study. Following an analysis of the information extracted from the review template, available information was grouped under the given headings and resulting sub-headings. As the final step, paraphrased summaries were fitted into the chronological order of the final study paper.

KEY FINDINGS IN LITERATURE

- Small enterprises still fail to comprehend RM strategies, let alone defining their risk strategies as per their risk culture; these derail their business success (Gao and Banerji, 2015; Ajibade, 2016)
- Small enterprises struggle with identifying and ranking risks that affect their business, thereby failing to mitigate such risks holistically (Yolande Smit, 2012; Hyder and Lussier, 2016). However, the inherent nature of small enterprise gives them the advantage to explore with innovative ways to handle risks and as such, adopting AI to analyze business risks can significantly improve the current poor RM practices among small construction enterprises (Makridakis, 2017; Jarrahi, 2018).
- The notable barriers to the successful implementation of RM strategies in construction are: problems in understanding risk management techniques, the absence of awareness and expertise in risk management practices, lack of prospective rewards, personal prejudices, risk identification incompetency, less qualified risk professionals and time limitations (Chileshe and Kikwasi, 2014; Dabari and Saidin, 2014; Ajibade, 2016)
- Integrating AI in business risk management strategies of small construction enterprises can see them achieve a systematic approach of handling risks

which be beneficial in ranking risks, identifying opportunities to improve project performance, and making informed decisions on mitigation plans (Mills, 2001; da Silva Etges and Cortimiglia, 2017).

- Two distinctive forces guide most adaptive businesses: One is the increasing power of computers coupled with big data, which serves as the basis for operation research, artificial intelligence (AI), and projection models. The second force lies in the increasing understanding of an individual's cognitive, judgment, and choice (Schoemaker and Tetlock, 2017).
- Mostly the concept of risk lies in a person's knowledge and valuation of risks, thereby making risk perception a strong factor for risk interpretation and management (van Winsen et al., 2016). It is crucial that small enterprise owners/managers be aware of any personal biases or cultural background that could be affecting their willingness to adopt alternative practical RM approaches as this can be the determining factor of a successful RM adoption or its failure (Yates and de Oliveira, 2016).

DISCUSSION OF FINDINGS

The importance of risk management to a company's success cannot be overemphasized. Findings show that small enterprises are still struggling with grasping the fundamentals of RM and as such limit their business development and growth. This is proven in the literature to be due to problems in understanding risk management techniques, the absence of awareness and expertise in risk management practices, absence of prospective rewards, personal prejudices, risk identification incompetency, less qualified risk professionals and time limitations. There needs to be a feasible solution to assist small enterprises in resolving their inadequate risk management style that will not be time-consuming and financially constraining. Artificial Intelligence (AI) proves to be an effective way for small construction enterprises to identify potential risks for their business and strategically identify financial opportunities through certain risks. Most industries are currently in the wave of the fourth industrial revolution, and a balance between human intelligence and technology is required if companies wish to remain competitive in their line of business. In the construction industry context where small enterprises get their business through construction projects, artificial intelligence comes in handy in this regard because the project information shared is central, meaning every stakeholder has access to the same information at the same time. The more significant advantage of implementing artificial intelligence is its precision in calculations and data handling. It can thus be a crucial tool for businesses to be able to predict flaws in their calculations, which if not seen, would cost the enterprise significant financial losses. These advantages are compelling reasons for incorporating AI in risk management decisions among small enterprises. And as such, the study recommends that small construction enterprises show eagerness to uptake AI to achieve a systematic and efficient RM approach.

CONCLUSION

There has been extensive research on risk management practices of small enterprises which suggest that such practices are flawed (Ekwere, 2016; Aven, 2016). However, specific research on the actual practices and what informs them is

scarce. There is not enough evidence available on technological alternatives to assist the small enterprise in managing their business risks. The purpose of this study was to identify the nature of risk management in small construction enterprises, and how can they integrate AI in their business risk management strategies to achieve business goals. Findings from this stage of the research can be summarized as thus; small enterprises fail to practice systematic risk management because of limited qualitative and quantitative data from previous projects that could enable them to establish a proper risk response strategy for their enterprise (Serpell et al., 2015; Ekwere, 2016). Surprisingly, small enterprises across the globe experience common barriers to implementing an effective and innovative RM strategy, these barriers according to Chileshe and Kikwasi, (2014) are risk attitude of owners/managers, RM budget and adequate skills to derive an effective RM strategy.

Nevertheless, the booming research on AI highlights the advantages of using AI as a means to manage business risks. The construction industry relies on a great exchange of information, of which in most cases decisions need to be based. There needs to be a balance between human understanding and the help of technology, and AI allows for that integration (Yates and de Oliveira, 2016). It is advised that small construction enterprises start thinking of feasible ways to integrate AI in their risk planning strategies, particularly where business risks are involved. This stage of the study is a literature review, and there is, therefore, an opportunity to explore other relevant theories and bodies of knowledge, beyond the current research. There is a great need for research on the current RM practices of small enterprises and what informs their decision making when handling business risks. Further research can explore those mentioned above and test the success rate of managing risks when AI software is used to identify and analyze risks.

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