

# A Conceptual Risk Management Framework in the Construction of Mega Housing Projects in Egypt

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## Abstract

Recent years have seen an increase in the number of Mega housing Projects around the world. This increase was to cater for increased population and urbanization. Construction of mega housing projects in Egypt faced a lot of challenges during the construction phase. There is no targeted framework that allows contractors to improve their risk management practice and project success during the construction of mega housing projects in Egypt. The aim of the paper is to design a conceptual Risk Management Framework for Mega Housing Projects in Egypt to improve risk practices and project success during the construction phase. The objective of the paper is to design a conceptual risk management framework to guide contractors to an efficient risk management practice during construction of mega housing projects in Egypt. The study is to review risk standards, to recognize developed risk frameworks, and to design a conceptual risk management framework (CRMF). The framework guide contractors' in Egypt towards successful risk management practice. The CRMF included steps of risk identification, assessment, response, and risk control. Risk identification adopted risk principles from the International Standardization (ISO31000, 2018). Principles of risk management included knowledge, risk skills, challenges, and opportunities. Interviews and NVivo analysis are used as a technique of risk identification. Qualitative risk analysis included risks obtained from the identification process as input. Technique of questionnaire can guide contractors to prioritize risks based on their significance. Contractors can use Monte Carlo simulation as a quantitative technique to obtain time and cost contingency before and after adding responses. The technique of Monte Carlo analysis is used in the risk control process to highlight new contingencies after adding responsive strategies. The literature of risk management and standards were used as a backdrop to design a CRMF. The framework recognized contractors' recent knowledge and skills and improves risk management practices during construction of mega housing projects. Contractors can use the designed conceptual risk management framework in reporting and communicating risk activities during construction of mega housing projects in Egypt.

Keywords: Risk Management, Risk Frameworks, Risk Standards, Project Management

## 1.0 Introduction

Egypt population is expected to exceed 120 million by 2050. Egypt is in a massive need for building Mega housing project [1]. Lack of risk management have forced 12,000 contractors in Egypt to fail in meeting their objectives and resulted in the bankruptcy of more than 2000 contractors [2]. The length of time required for mega housing projects construction has increased the projects' exposure to emergent risk [3]. Egypt adopted a supportive strategy proving its interest to overcome construction complexities. The deputy of the National Bank of Egypt (NBE), announced that Egyptian contractors' credit increased to EGP 30 billion from EGP 20 billion in 2016. The risk management framework provided more solid risk management platform. Contractors' in Egypt can update their current risk management skills, knowledge, and successfully deliver of mega housing projects according to their schedule and budget.

## 2.0 Methodology

Fig. 1 illustrates the methodology of the paper. First, the definition of mega projects and mega housing projects is identified. A Review is done for risk management frameworks which are included in Risk Standards. A time line is then developed which included risk management frameworks developed by researchers in the past ten years. A critical analysis is then made to account for the risk processes, context, and stake holder party involved included in risk frameworks developed in the past ten years. A conceptual risk management framework (CRMF) is developed. The CRMF adopts the ISO 31000 risk principles and included the stages of risk identification, risk assessment, risk response, and risk monitoring and control process [4].

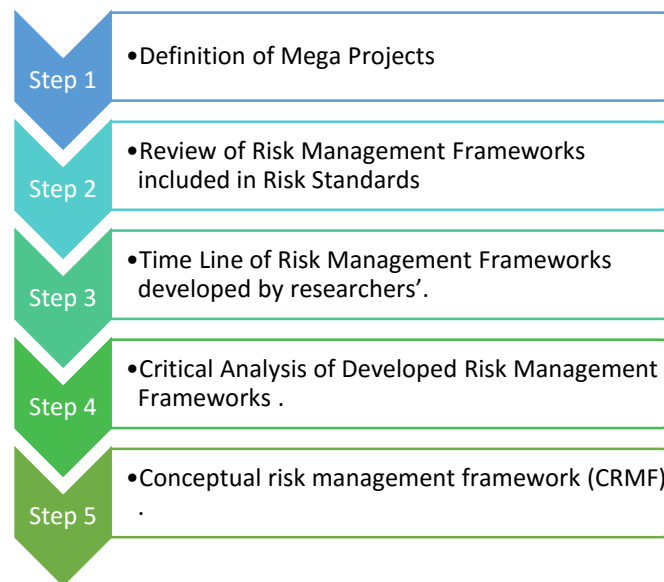


Fig. 1: Paper Methodology

## 3.0 Definition of Mega Projects

Mega projects are facing numerous challenges and extreme project characteristics [5]. Mega projects as difficult to control [6]. Minimizing the complexity in construction of mega projects was a major concern in most mega project researches [7]-[9]. Common attributes: large size, and massive extent of resources are drivers of complexity [10]. Mega housing projects are defined as a large-scale investment project, with colossal use of resources including money, human, and equipment [11].

The length of time required for mega housing projects construction has increased the projects' exposure to emergent risk. There was an anonymous definition as well as agreement on some of the parameters of mega projects and mega housing projects. The commonly agreed parameters regarding mega housing projects include: mass housing, repeated schemes, high level of uncertainty, high number of conflicts, missing interpretation, large number of managed resources, difficult to control, attracts attention for most of the public, larger size, and subjected to economic changes due to long schedule may increase construction risks and impact on project objectives [3].

## 4.0 Review of Risk Management Frameworks in Risk Management Standards

A review of risk management frameworks is presented in Table 1. These frameworks are adopted by risk management standards. The table includes the risk management standard, year of publish, Framework theme, and targeted objectives. Six risk management standards are presented, the review included: [12]-[16] , [4].

Table 1: Review of Risk Management Frameworks included in Risk Standards

| Standard | Framework                         | Objective                          |
|----------|-----------------------------------|------------------------------------|
| [12]     | RM Framework/ Australia           | Overall RM Processes               |
| [13]     | PRAM / UK                         | RM Assessment                      |
| [14]     | MOR Framework                     | RM Process                         |
| [15]     | Risk Management Framework/<br>USA | RM Process                         |
| [16]     | Risk Assessment Framework/ UK     | Strategic and Operational<br>RM    |
| [4]      | IRM RM Framework/ UK              | Included all the features of<br>RM |

Risk management framework is developed by the South Australian Government which includes the overall risk management processes throughout the whole project lifecycle. The Framework, needs to be practically tested for eligibility within large scale projects. The Framework is developed to suit the Australian context with no proof that it would succeed in other contexts. The framework used needs to be accurately tested for application during the construction stage [12]. Risk management framework is more focused on the strategic level not specifically the project level. The pitfall in this framework is that it is more related to the enterprise risk management. It does not include a detailed focus on managing construction risks internally within a contractor organization [14].

Risk Guides provided a framework which interrelates knowledge areas with risk management process. The Frameworks does not include the improvement of on-site practices for large scale projects [13] , [15]. The ISO 31000 included a practical risk management framework for organizations [4]. The standard provided a solid platform for organizations prior commencement of developing their risk framework. The platform consists of risk management principles This standard is set to support practical application of risk management process in the organization level [4]. Frameworks encompass the use of techniques related to qualitative and quantitative processes including their reports forms. These techniques require a suitable framework which suits the knowledge and skills within the context.

PRAM framework dealt with the Risk processes and responsibilities to manage it. The Framework provides risk techniques useful for practitioners, consultants and academics. Risk management practice is related strategic level, starting from governance, through to construction operations [13]. The MOR guide disadvantage included focus only on Strategic Level for public sector organizations [14].

Orange Book framework dissects the core risk management process into elements for illustrative purposes. It aims to draw attention to the range of issues which are involved and to offer some general direction to help organizations. In reality risk processes blend together. The particular stage in the process which one may be at for any particular risk will not necessarily be the same for all risks. The whole model has to function in an environment in which risk appetite has been defined. The concept of risk appetite (how much risk is tolerable and justifiable) can be regarded as an “overlay” across the whole of this model [16].

#### 5.0 Benefits of Risk Frameworks adopted by Risk Standards

Table 2 presents the benefits of developed risk management frameworks in risk standards to the targeted conceptual risk management framework in Egypt. The table presents the risk standard, year of publish, benefits of the risk frameworks which supported the development of a conceptual risk framework in Egypt. And the cons observed after reviewing previous risk frameworks. The review included [12]-[16] , [4].

Table 2: Benefits of Risk frameworks developed by risk standards

| Standard | Benefits   | Cons  |
|----------|--|---|
| [12]     | Guided RM process.<br>Outline RM responsibilities. | To be tested with mega projects.<br>Australian context. |
| [13]     | Provided risk analysis techniques.                 | No risk control & reporting.                            |
| [14]     | Recognized RM Application.                         | More focused on enterprise RM.                          |
| [15]     | Dealt with complex project operations.             | No solid platform.                                      |
| [16]     | Development of a risk policy to application.       | Not a detailed for RM.                                  |
| [4]      | Solid platform to improve RM efficiency.           | Challenge is to align with other context.               |

The most useful framework in terms of improving the efficiency of risk practices within organizations [4]. Information provided by the framework included governance, strategy, identification of objective, communications and reporting. Risk management practice improved contractors’ performance. The ISO 31000 is beneficial in developing the study framework [4]. Risk activities are to be developed in a way that aligns with the current risk platform and risk management status within contractors in Egypt.

6.0 Timeline of Risk Management Frameworks developed by Researchers

Risk management studies included target oriented frameworks. A time line of risk management frameworks adopted by researchers is illustrated in Fig. 2. The timeline included a review of developed risk frameworks in the past ten years. Three main themes are highlighted in figure 2. From 2003 to 2010 risk frameworks included risk areas of IT, Safety, Decision making, and risk knowledge. From 2011 to 2014, risk maturity, IT, and data base were a concern. From 2015 to 2018, risk management knowledge and enterprise frameworks were developed. The literature highlighted risk areas which are a concern in application. The major issues included risk data base to improve risk management reporting and control process, providing efficient risk policy, and improving risk knowledge.

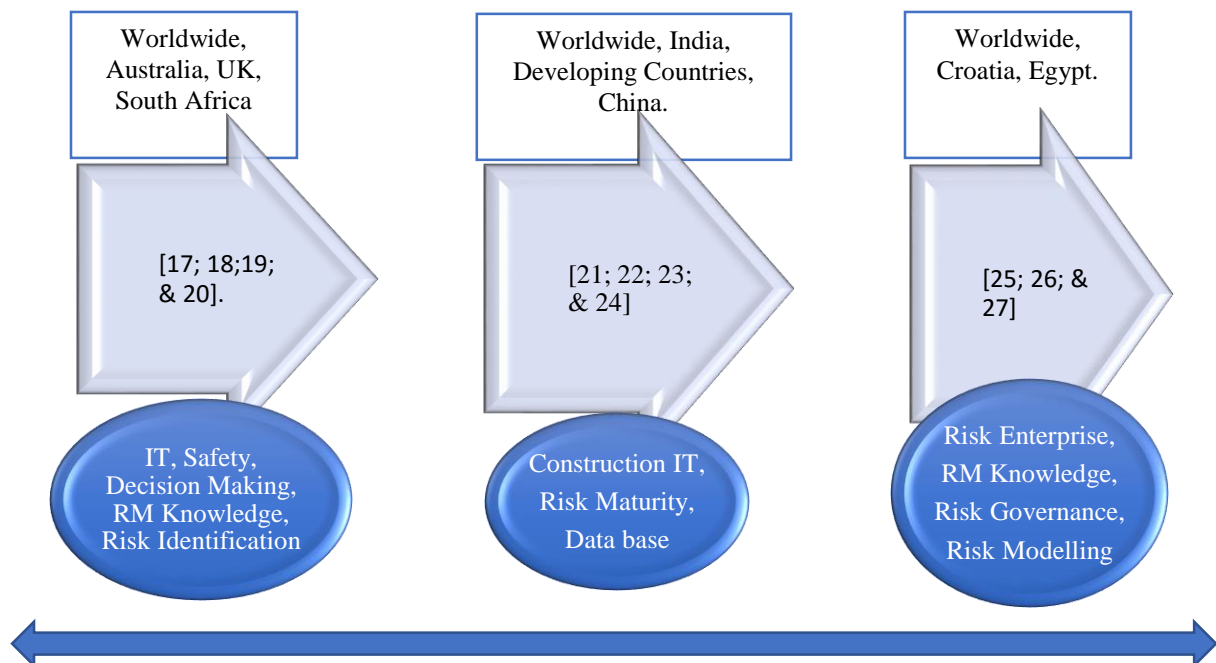


Fig. 2. Time line of Risk Management Frameworks

The least presented process in risk management frameworks is the quantitative risk process. This is followed by the risk assessment, and the least process included was the risk responsive strategies. There is a recognized gap in presenting the risk monitoring and control process. Risk identification was the most explored since the weakness in risk management practices always starts by identifying the problems accurately. Identified risks must be responded correctly, monitored and controlled during execution. Most of the risk management frameworks which have been adapted from the literature are said to be modelling and programming. These approaches are the unpractical solution for contractors' on-site due to its high complexity. Thus, a practical risk management framework is to be developed to guide contractors in developing their risk management practice. The framework is to be also validated in the means of maintaining success in delivering construction of mega housing projects.

### 7.0 Critical Analysis of Risk Analysis Frameworks

Table 3 presents a critical Analysis of Risk Management Frameworks, adopted risk management process, and targeted objectives. The table included the adopted frameworks in the past ten years, stage of the project, party involved in using the framework. The contractor was the main stakeholder involved in using the framework. The most stages were the risk frameworks was used are the construction and planning stages.

Table 3: Critical Analysis of Risk Management Frameworks

| Framework Ref. | Project Stage      | Project Party Involved |
|----------------|--------------------|------------------------|
| [15]           | Project            | Contractor             |
| [14]           | Project            | Public Sector          |
| [13]           | Planning           | All Parties            |
| [28]           | Construction       | Contractors            |
| [12]           | Project            | Stakeholders           |
| [17]           | Project            | Contractors            |
| [26]           | Project            | Stakeholders           |
| [28]           | Project            | Stakeholders           |
| [23]           | Planning           | Contractor             |
| [19]           | Project Life Cycle | Stakeholders           |
| [29]           | Construction       | Contractors            |
| [22]           | Construction       | Contractors            |
| [18]           | Construction       | Contractors            |

### 8.0 Conceptual Risk Management Framework (CRMF)

Fig. 3 presents the developed conceptual risk management Framework (CRMF). Risk management processes are organized in an input output pattern. Risk management principles adopted from the ISO31000 [4] are used as the inputs of the CRMF this includes: risk management knowledge, skills, construction challenges & opportunities. Using risk management techniques, qualitative and quantitative results are obtained from each risk management processes. The risk management processes work in a cyclic process. Risk assessment includes risk identification, qualitative risk analysis, and quantitative risk analysis process. After the response process, residual risks are triggered back to the analysis stage. Secondary risks are reassigned probability and impact scales. Other risks are controlled during the construction of mega housing projects. Monitoring and Reporting risks are done in each phase of risk management were as reports are updated by the projects team during construction.

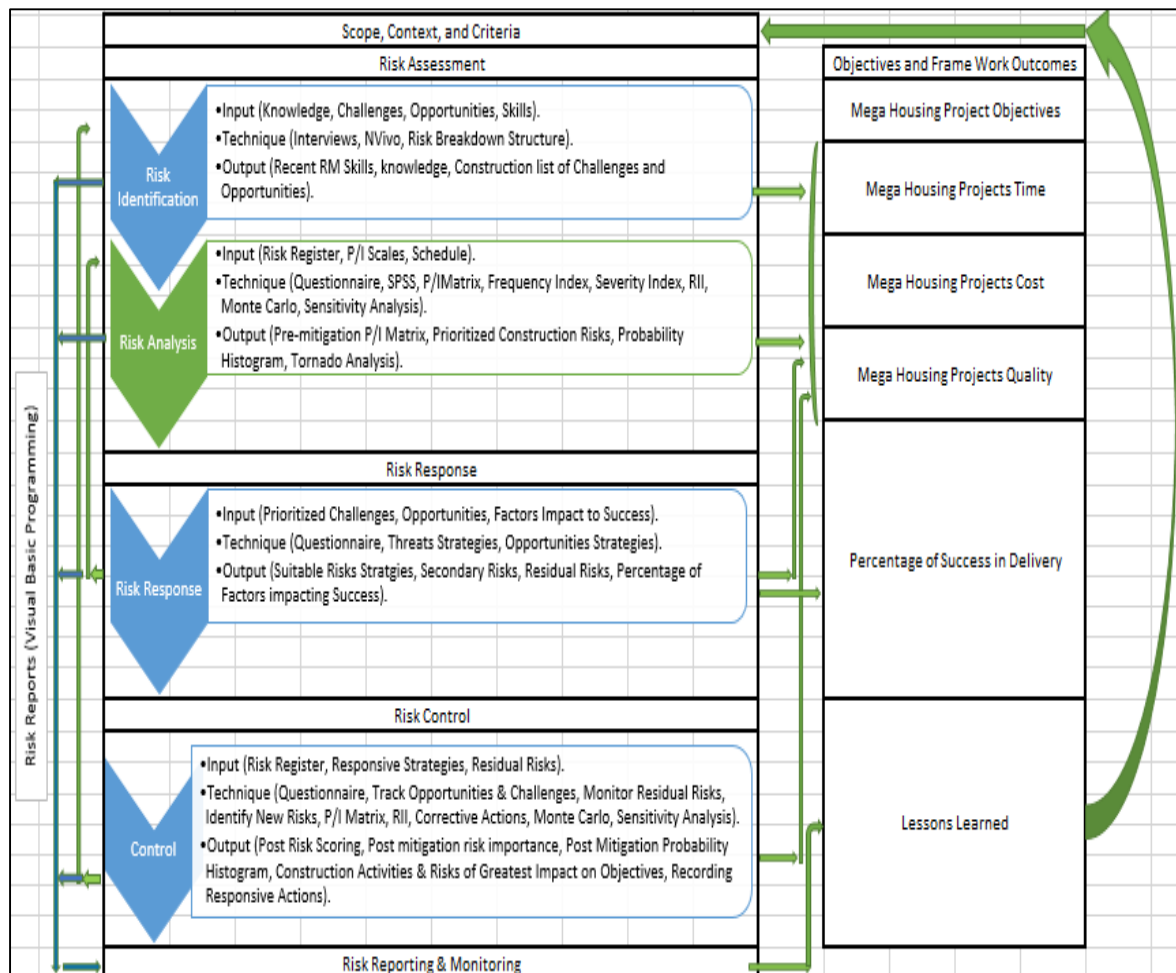


Fig. 3: Conceptual Risk Management Framework (CRMF)

## 6.0 Conclusion and Recommendations

The paper reviewed the literature of risk management framework developed by researchers and risk standards. Quantitative risk analysis, and risk control processes were the lowest risk processes explored by researchers. The most practical risk framework which can improve efficiency in practicing risk management within organizations is the ISO 31000 [4]. A conceptual risk management framework is developed which adopts the risk principles from the ISO 31000 as a backdrop [4]. The framework guided contractors in Egypt to improve risk management practices and success in delivery of mega housing projects in Egypt.

Most of the risk management researchers recommend the improvement of risk management practice knowledge and transparency in identifying construction challenges for the contractors. Qualified workforce seems to be another issue. Stakeholders practicing risk management based on an efficient risk management code of practice and a solid data platform. Contractors in Egypt need to plan and track financial expenditures regularly and to ensure owner cooperate and support the cash flow frequently. Bank Loans seems to be an issue for large complex mega projects. Authors urge contractors to continuously upgrade and support employee's knowledge with modern technical equipment's and improve their skills. (Appendix Lessons Learned from Risk Management and Mega Projects Studies).

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