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Introducing a New Risk Management Model to the Saudi Arabian Construction Industry

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Abstract

Research has shown that construction projects in Saudi Arabia have exhibited poor performance for the past three decades. The traditional risk management practices have been ineffective at helping contractors deliver projects on time and within budget while meeting quality expectations. Studies have identified that client decision making is one of the main causes of risks that occur on projects in Saudi Arabia. This paper proposes a new risk management model that can minimize client decision making, and enable the client to utilize expertise, thereby improving project quality and performance. The model is derived from the Information Measurement Theory (IMT) and Performance Information Procurement System (PIPS), both developed at Arizona State University in the United States (U.S.). The model has been tested over 1800 times in both construction and non-construction projects, showing a decrease in required management by owner by up to 80% and an increase in efficiency up to 40%.

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Keywords: Saudi Arabia; Best Value; Risk management; risk mitigation; PIPS

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1. Introduction

Saudi Arabia is one of the fastest developing economies in the Middle East [1]. Both urban and rural areas in Saudi are experiencing a rapid growth in their infrastructure developments. The public construction sector in Saudi Arabia is considered as the biggest in the Gulf countries [2] with $575 B spent on public construction projects in Saudi between 2008 and 2013 [3]. The construction market is anticipated to reach $610 B from 2015 to 2020 [1].

Researchers define risk as something unpredicted or from unexpected causes resulting in negative deviation from project time and cost expectations [4, 5, 6, 7, and 8]. Project delays and time overruns are measures and results of risk occurrence.

Through the past three decades, many studies in Saudi Arabia indicated the critical issue of the construction industry with non-performance, inefficiencies, time and cost overruns. Time overrun is considered to be one of the most frequent and serious issues in construction projects in Saudi [9]. Four studies identified that between 60% and 70% of public construction projects in Saudi Arabia faced delay in the completion time [10, 11, 12, and 13]. Survey results showed that the average delay percentage differed from the original contract duration by between 10% and 30% [13]. In recent research, 49 case studies were investigated in the west province in Saudi Arabia and it was found that the average delay of these cases was 39% of the estimated projects schedules [14]. According to Abdul-Ghafour [15], the total value of public projects that fell behind their planned schedules is estimated to be about $147B. Furthermore, the continuous issue of cost overruns in Saudi construction industry has been studied by several researchers [16, 17, 18, and 19]. Al Turkey [20], surveyed 300 project managers from various sectors and stated that 80% of Saudi construction projects were subject to cost overruns.

The lack of efficient risk management practices in Saudi Arabia has been verified by researchers [21]. A study was conducted by Ikediashi [22], to identify and analyze the infrastructure projects' failure factors in Saudi Arabia. This study found that poor risk management practice is the most critical reason for project failure. Moreover, Albogamy and Dawood [23], found there is a clear lack of risk management practices in Saudi Arabia that identify the impact of the risk factors because of the involvement of clients and clients' agents in the construction process.

Clients in the traditional practices do not take accountability of risks and automatically transfer them to other parties [24]. In the Saudi construction industry practices, most of the risks are allocated to vendors and none to clients [25]. However, in a survey conducted by Albogamy and Dawood [23], it was identified that most of the critical risks in early stages of projects are caused by clients. These types of risks are related to insufficient decision making of clients who lack knowledge and experience [26]. Ibn-Homaid [27] concluded in a study on the causes of change orders in the Saudi construction industry that owners are the main source of the risks based on project scope changes and change orders which can cause an average increase of 11.3% of projects' cost. In a recent study of the Saudi construction industry, Kashiwagi, Elawi, Sullivan, and Algahtany found that majority of delays were created by owners [14]. This study analyzed the causes of delay for 49 case studies and found owners responsible for 53% of risks that led to time overruns. Moreover, this study quantitatively analyzed the literature of the main causes of delays in Saudi Arabia and found a similar result with owners causing almost 50% of the delay.

2. Problem

The Saudi construction industry has had difficulty delivering projects on time and on budget, with high customer satisfaction. This has been an issue for the last 30 years. Recent studies have identified that the low performance is being caused by owner decision making, which has been increased due to the traditional practice of owners managing, directing, and controlling, the expert contractor on construction projects.

3. Proposal

This paper will use the Information Measurement Theory (IMT) developed by Dr. Dean Kashiwagi at Arizona State University to identify the reason why owner decision making is decreasing the performance of the construction industry. IMT is the theoretical backing of the Best Value (BV) approach. The BV approach was identified as the only construction method to have repetitive documented results showing its ability to improve performance on construction projects. IMT will justify why the current risk management model of making decisions and applying

management, direction, and control practices results in increased risks and lower project performance. It will also be the backing for a new risk management model (a decision-less system) which has the ability to minimize risk by utilizing contractor's expertise.

4. Methodology

The methodology in this research is literature review and deductive analysis. The methodology will proceed in the following steps:

- Identify the main characteristics and activities in the traditional risk management in the Saudi Arabian construction industry through a literature search.
- Use IMT to explain how the traditional risk management (owner decision making) system creates project risk.
- Prove through literature review and deductive analysis that decision making increases risks.
- Identify the characteristics of a new risk management model that is a decision-less system.

5. Traditional risk management model

In the traditional risk management model, the owner's team and project manager (PM) must [28, 29, 30, and 31]:

- Be able to assess the impact of the service with regard to expectation, supervise the service, and evaluate the value and performance of the service.
- Know more than the contractor with regard to quality, technical requirements and details, cost, and delivery.
- Write a contract/specification that identifies the owner's expectations with regards to technical requirements.
- Be able to regulate/inspect the contractor to deliver the contract requirements.
- Make sure that they constantly know what is happening through continuous coordination, inspection, measurement and information and ensure they have a thorough project cost breakdown of the contractor.
- Be capable to minimize and manage the risk of change orders while giving the owner the best price.

To explain the traditional risk management model Information Measurement Theory will be used. IMT uses the event diagram to explain projects. Each project has initial conditions and final conditions. The more information and expertise a person has at the beginning of a project the more they can predict the final conditions of the project. The traditional risk management model is shown in combination with the event diagram in Figure 1. The client's PM identifies an expected service, duration of delivery and project budget. The difficulty is that the clients' PMs do not have sufficient information to know if their time of delivery and budget are accurate unless they have current technical expertise and they are actually doing the work. Other issues include not having dominant measurement of past similar projects, not having knowledge of the current industry capability and costs [32]. The clients' PMs rarely have the accurate information of the initial conditions. Instead, they make decisions based on incomplete information and, then, the designer makes more decisions to make expectations true. Because the clients' PMs' lack of information and unawareness of technical issues, they hire a technical expert professional who specifies how the owner expectations can be met by a contractor [33, 23]. The buyer's procurement agents assume all contractors are the same and can meet the specifications. Then, the procurement agents create competition among contractors based on price, and select the lowest priced vendor. The owner's team then attempts to manage, direct and control the risk by supervising and inspecting the contractor's work [28].

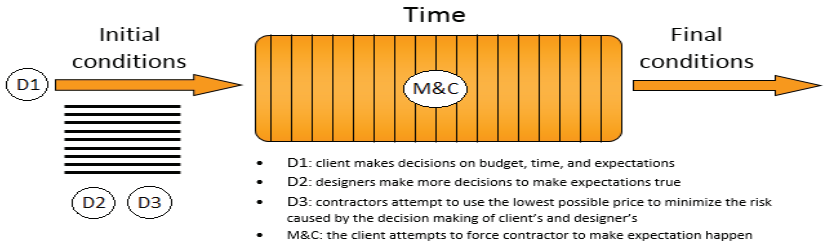

Figure 1: Existing risk management model [28].

The previous traditional risk management activities have been frequently identified as causes of risks in the Saudi construction industry in many studies as shown in Table 1. The studies included are classified as: general risk factors' identification, causes of delays, causes of costs overruns, and causes of risks in projects' initial stages.

Table 1: Frequent risks in the Saudi construction industry.

Risk Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Freq.
Specifications changes	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*				15
Mistakes in design		*	*	*	*	*	*	*	*	*	*		*	*	*	*		*		15
Change of scope	*	*		*	*	*	*	*	*	*			*	*		*	*	*		14
Owner's team lack of experience	*	*		*	*	*	*	*		*	*		*		*			*		12
Design changes by owner or consultant		*	*	*	*	*	*	*	*	*				*		*	*			12
Unrealistic contract duration	*	*	*	*	*	*	*		*				*			*	*			11
Change orders	*	*				*						*	*		*			*	*	8
Sources	34	13	35	36	37	33	21	17	18	38	39	40	41	42	43	44	19	22	45	

The problem with this risk management model is that the client, client's PM, procurement agent and client's technical experts are making decisions to determine the requirements and expectations of the vendor service. These expectations of the vendor's services are usually inaccurate and based on incomplete perceptions of the initial conditions (reality of projects). The client's team then attempts to manage the vendor to meet these expectations.

6. The event model

Any activity that takes time is defined as an event [46]. The event model shown in figure 2 has the following features [47]:

- It has initial conditions that change over time into final conditions.
- Natural laws, and laws of physics, for example, regulate the change in conditions.
- If all information of initial conditions is known (e.g. people, physical surroundings, and laws) all final conditions can be predicted.
- The more someone accurately perceive and identify information of the initial conditions, the more simple an event becomes and the more he or she could accurately predict the future outcome [46].

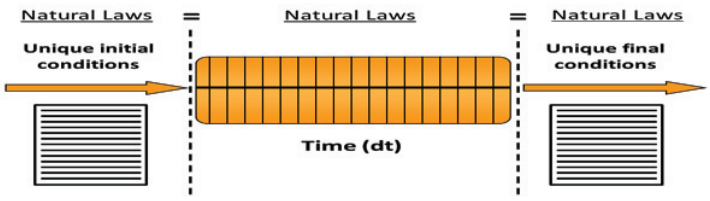

Figure 2: Event Chart [47]

Dr. Dean Kashiwagi proposes that all events outcomes are singular, predictable, bound by natural laws, and are constrained by initial conditions [48]. Once the initial conditions are set, the events cannot be impacted, influenced, or controlled to change the final outcomes to something different that is not linked to the initial conditions. Furthermore, Dr. Jacob Kashiwagi proposes that the idea of randomness is caused by lack of information and is correlated with insufficient management practices [49]. It is been identified using the event model that risk occurs because all information of the initial conditions is not perceived [30]. Human nature leads people to have unrealistic expectations, make decisions, and attempt to control the event.

7. Decision-making as a source of risk

According to Kashiwagi [28], risk is defined as when people inexactly perceive the initial conditions. The need for decision-making in this situation is maximized to recover from the lack of information and choose from various options [48]. Based on the inaccurate perception of the initial conditions, expectations of the final conditions are formed [30]. People make decisions and create inappropriate expectations and they are then unable to accurately predict the outcome [48]. Decisions are usually made when [28-30]:

- The condition seems complex to the decision maker.
- Experts are needed to make decisions.
- Disagreement on perceptions of the initial conditions.
- Critical information is lacked by decision makers.
- People who make decisions do not have accountability and liability for what happens.
- People who make decisions are generally management personnel, not the ones who perform the service.

When situations are complex, the need for decision making is maximized. People in this situation use their own experience to decide upcoming actions. These actions increase risks. According to Kashiwagi "*risk and decision making are related. People who are more dependent on decision making, have higher risk* [48]." A study was conducted to test the validity of the theory that the minimization of decisions throughout construction phases indeed increases the ability to minimize risk [46]. The study participants were project owners who had experienced a traditional low-bid procurement system and a decision-less system called performance based procurement system (PIPS). The results showed that the ability of a process to minimize risk is strongly correlated to the ability of a process to minimize decisions. When decision making goes down, risk goes down.

Risk is continually caused by clients and their agents who lack information and make decisions. While the event is happening, risks appears when created expectations are perceived based on inaccurate conditions and differ from the actual conditions of an event at a specific time [30]. This situation worsens when reactive client PMs, designers and consultants, constantly make decisions and attempt to manage risks to meet the expectations of the client [50]. Clients and their representatives make more decisions when they don't accurately identify the contractors' capability to deliver. Risk is decreased through the following [28-30]:

- Finding the expert who can precisely identify the initial conditions.
- Allowing the expert to identify if client's expectations can be done.
- Reducing attempts to direct, manage and control the event by using experts and preplanning.
- Allowing the expert to have control over their own event because they are the best in identifying the initial conditions, knowing what to do, and how to achieve a realistic final outcome.

Risk is maximized because of the clients' misunderstanding of risks, how minimizing that is also a source of risk, along with their decision making, management, directing, and control approach. The authors propose that the traditional risk management model of making decisions, directing, managing, and controlling is the cause of risks and low performance of the services delivery in Saudi Arabia. A different risk management approach is required.

8. New risk management model

The new risk management model shown in figure 3, will have to meet the following conditions:

- Decision making must be reduced.
- If there is a lot of decision-making and expectations, this must be corrected by the service experts who can state a clear difference between reality and expectations and can be accountable for delivering the outcome.
- Experts should be given authority and responsibility to control and manage the risk that is out of their control. If any party tries to alter requirements of initial conditions or interfere in preplanning of delivering the service, the contractor should have control to identify the risk, document it, and to reduce its impact.
- The new risk management model must allow all parties to have the initial conditions thoroughly understood which will motivate the participants to be accountable for what they have agreed upon.
- The qualified experts must not be directed by the managers.

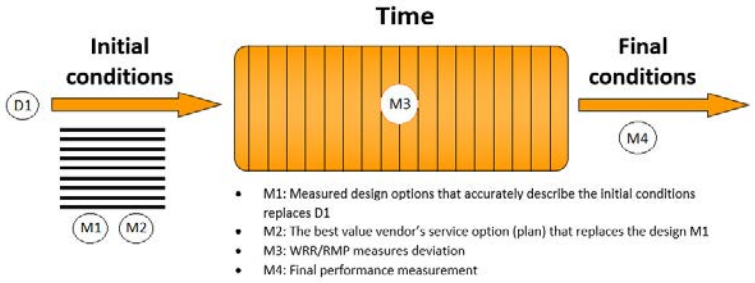

Figure 3: New Risk Management Model

Therefore, the expert vendor, in the new risk management model reduces risks with the use of expertise through a risk management/quality control model. The buyer's PM minimizes risks by understanding that:

- The perception of the buyer regarding the constraints and requirements is not entirely accurate.
- Expert contractors have a more accurate understanding of the initial conditions (constraints and requirements).
- Expert contractors have no technical risk.
- The only risk that expert contractors have is the risk that is out of their control (from other stakeholders).
- Contractors have no control over other stakeholders and use transparency to reduce the risk they cannot control.
- Selecting the best value contractor must be based on the level of expertise.
- The best value expert contractor will preplan, identify the risks they do not control, and minimize the risks.
- The expert contractor is the only party who can effectively perform risk management by documenting the deviations in weekly risk reports from the baseline plan, by justifying all time and cost deviations.
- The buyer's best guess requirement must be replaced by the best value contractor's accurate project perception.

In this new risk management model, the buyer's PMs do not need to be technical experts, only the vendors. Therefore, there will be a minimization of the decisions and the decisions' impacts. New responsibilities of PMs will include identifying the buyer expectations and identifying the best value contractor. The PMs should assist the selected contractor in preparing the documents of final contract. Quality assurance must be carried out by PMs to make sure the contractor performs risk management and quality control to minimize all deviations.

This risk management approach is derived from a delivery structure called the Performance Information Procurement System/ Performance Information Risk Management System (PIPS/PIRMS). The concepts of the risk management model in the PIPS/PIRMS system have been tested over 22 years with more than 1800 tests in both

construction and non-construction projects in six different countries (developed and developing) and 31 states in the U.S. with 98% customer satisfaction. Test results showed a decrease in required management by owner by up to 80% and an increase in efficiency up to 40%.

9. Conclusion

Using a literature search and deductive analysis, this paper recognizes how the buyer and the buyer's representatives are considered the main source of risk in the construction industry. It identifies that risks are caused by decision making based on a lack of information which leads to unrealistic expectations. The generation of risks through decision making is aggravated when the buyer's PM attempts to control, manage and direct the contractor which would not only intensify the situation but confusion would also occur.

It is assumed in the new risk management model that the client's perception regarding the project constraints and requirements is not entirely accurate and should be replaced by the expert contractor's knowledge base which provides a more accurate understanding of project requirements. The following must occur within the new risk management model:

- The best value expert contractor will preplan, identify the risks they do not control, and minimize the risks.
- The expert contractors are the only party who can effectively perform risk management by documenting the deviations from the baseline plan using weekly risk reports, by justifying all time and cost deviations.
- The buyer's best guess requirement must be replaced by the best value contractor's accurate perception.

This new risk management model is considered as a paradigm shift in the Saudi construction industry as the buyer's PM shifts from being considered the expert, to deciding who the actual expert is and establishing the appropriate accountability. It is recommended to adopt this model with using a delivery structure that hires expert contractors through using dominant measurement that justifies their expertise. Contractors in this delivery structure should be able to explain those risks out of their control: buyer's unrealistic expectations, existing constraints, and other stakeholders' risks. Contractors should present how they plan to reduce these risks for which they would be held responsible. The model presented in this study is being implemented in an ongoing case study in Saudi Arabia to test and evaluate its practical significance to the current environment in Saudi construction.

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