

PROJECT RISK MANAGEMENT: A CRITICAL FACTOR FOR  
PROJECT SUCCESS

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PROJECT RISK MANAGEMENT: A CRITICAL FACTOR FOR  
PROJECT SUCCESS

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## **ABSTRACT**

### **PROJECT RISK MANAGEMENT: A CRITICAL FACTOR FOR PROJECT SUCCESS**

Under the Supervision of Professor Wendy A Brooke

The study presented in this paper shows that project risk management is a critical factor affecting a project's success. Project risk analysis and management systems play a very important role in project organizations; therefore, we need to determine the relationship between project risk management and project success.

With sustained economic development, project competition has become increasingly intense, this competition has resulted in increased higher demand for project organizations to have increased efficiency, stronger budget processes, lower transaction costs, and better capture of project funds, and so on.

Under this competitive backdrop, project risk analysis and management strategies are extremely important to the project organization. Project teams who have excellent project risk management techniques find they are beneficial for the project organization.

The relationship between project risk management and project success within an organization was not known until the latter half of the 20th Century. For most project organizations, project risk management was an individual responsibility of the project manager. With increased research, more organizations realize that project risk management is a very important factor contributing to project success. This study conducted a review of literature of project risk management, a review of project risk analysis and management literature as well as a literature review about project success and project success factors.

**Keywords:** project risk, project risk management, project risk analysis and management, risk identification, project success

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## INTRODUCTION

In the current economic climate, especially the financial crisis in 2008, competition has increased among project organizations. This competition results in increased higher demand for project organizations to have increased efficiency, stronger budget processes, lower transaction costs, and better capture of project funds and so on. Under this competitive backdrop, project risk analysis and management strategies are extremely important to the project organization. Project teams who have excellent project risk analysis and management techniques find they are beneficial for the project organization.

After reviewing the literature on project success factors, we find that many researchers neglect project risk management as a critical factor impacting a project organization's success. Traditionally project success factors focused on the three dimensions of cost, time and quality attributes. However, cost, time and quality attributes are not sufficient to measure project success, there are other dimensions such as the project stakeholders' expectations, and the project's risk assessment and management also need to be considered.

The relationship between project risk management and project success is not a new field of investigation. Research has investigated the factors that impact project success in project management, but little research detailed the relationship between project risk management and project success factors.

Chan et al (2001) researched project success factors and concluded that

successful project risk management strategies contribute to project success.

According to Albert et al (2001), there are six-project success factors that can impact the project's success including the project team's commitment, contractor's competencies, risk and liability assessment, client's competencies, end-users needs, and constraints imposed by end-users.

According to Rockart (1978, pp. 11-20) the Critical Success Factors (CSFs) method provides an efficient method based on the "key variable" or "critical success factor", it zeroes in on informational needs. Additionally, it recognizes fully that informational needs vary from manager to manager, and also will change with time for a particular manager. He has isolated four prime sources of critical success factors. These are:

1. The structure of the particular industry.
2. The organization's strategy, position within the industry, and geographical location.
3. Environmental factors.
4. Temporal organizational factors.

In recent years, we find that more research has focused on this topic. With the development of project success theory and as more research is conducted, the relationship between project risk management and project success will be better understood. Project organizations with a better understanding of this relationship may be able to use this understanding to choose the best project management strategies.

## Statement of Problem

Project risk as a very important factor affecting the project organization, project risk analysis and management can contribute to the success of the organization (Chan & Ho & Tam, 2001). In discussing the topic of risk management, it is apparent that there are many aspects to risk, including financial risk, technical risk, commercial risk, execution risk and contractual or legal risk and so on. Project risks exist in the project in all phases of its life cycle. In the project management process, project risk strategies are one of the keys to lead the project organization to success. There are different types of projects, and each project organization has developed different project risk management strategies. Therefore, understanding how the project risk management affects the project success, will lead the project organization to different management strategies.

## Purpose of the Research

Based on the literature review, the purpose of this research is to explore and attempt to answer how a good project risk management strategy contributes to project success.

## Significance of the Study

Today, we find that project risk management is becoming increasingly more important in project organizations; project organizations though develop

different risk strategies to achieve project success. According to research, we find that project success can be attributed to many success factors, including the reduction and mitigation of project risk, etc. Thus, research about the relationship between project risk management and project success will become particularly important.

### Delimitation of the Research

All of the research for this paper was focused on the relationship between project risk management and project success. Although there are many factors that impact project success, this paper's research will include the topics "project risk management strategies", "project risk analysis and management" and "project success and project success factors".

### Methods of Research

The literature review for the introduction of project risk management and project success was conducted first. A second review of literature related research and studies of project risk analysis, management, and their influence on project success was conducted. Finally, the findings were summarized, and conclusions and recommendations were made.

### Key Definitions

***Project risk*** (PR) "Can be simply defined as any possible event that can

negatively affect the viability of a project” (Pinto, 2007, p. 221)

***Project risk management*** (PRM) “A structured approach that can guide a project team in identifying the risk levels of threats, the severity of potential failures and the uncertainties” (Vincent, 2003, p. 2)

***Project risk analysis and management*** (PRAM) “A process designed to remove or reduce the risks which threaten the achievement of project objectives.” (Norris & Perry & Simon, 2000, p. 3)

***Risk identification*** (RI) “an organized approach for determining which events are likely to affect a program, and for documenting the characteristics of the events that may happen with a basis as to why this event is considered a risk” (Nevada, 2001, p. 4)

***Project success*** (PS) “involves a ‘quadruple constraint,’ linking the basic project metrics of schedule adherence, budget adherence, project quality (functionality), and customer satisfaction with the finished product.” (Pinto, 2007, p. 13)

## **REVIEW OF RELATED LITERATURE**

### **Project Risk Management**

Risk is defined as the presence of potential or actual threats or opportunities that influence the objectives of a project during construction, commissioning, or at time of use. (Walewski & Gibson, 2003, p. 7)

According to Pinto (2007), all risks could be appraised by two distinct elements: the probability of occurring in the project and the consequences to the project, it also can use the simple equation:

$$\text{Risk} = (\text{probability in project}) (\text{consequences to project})$$

Project risk was identified as early as research in 1792; Laplace provided quantitative risk analysis prototypes to analyze the probability death after smallpox vaccination. In 1964, Hertz first used the term “risk Analysis” was used to describe the probability of return rates for investment projects. (Arrow, 2008)

More than five decades years, project risk theory research has been developed; more people have realized the importance of project risk management. Nowadays, risk management awareness is considered a very important quality to a project manager. However, in practice, not all project participants have good risk management awareness, even project organizations don't consider the portfolio of risks that can occur across the life cycle of a project. (Alpha, 1991; Walewski & Gibson, 2003, p. 10)

When project risks arise, there can be many unexpected situations beyond the project manager's anticipation and control. These situations have the capacity to seriously affect the success of a project. According to Walewski and Gibson (2003), project risks exist in the project life cycle in

every phase, so the structured process for project risk management is needed across the entire project life cycle. In the process, some questions that should be asked, includes:

- What is likely to happen?
- What can be done to minimize the probability or impact of these events?
- What cues will signal the need for such action?
- What are the likely outcomes of these problems and my anticipated reactions? (Pinto, 2007, p. 222)

In recent years, systematic project risk management strategies have been developed; a four-stage process that suggests which project risk management strategies is appropriate in different circumstances. Pinto (2007) defined four distinct steps of project risk management, including:

1. Risk identification.
2. Analysis of probability and consequences.
3. Risk mitigation strategies.
4. Control and documentation.

The first step: The risk identification strategy of project risk (Hillson, 2007, p. 3) was through creating a classification scheme for likely risks, and

then recording all foreseeable risks which could affect project objectives including the causes and possible effects. Successful risk identification strategy determines what might happen that could affect the objectives of the project, and how those risks might happen. The research related to risk identification strategy is focused on five main classifications: financial risk, technical risk, commercial risk, execution risk and contractual or legal risk. There are also techniques that can be used for risk identification.

Brainstorming is a qualitative idea-creation technique; it is a good choice as a preferred method because of its flexibility and capability. Other techniques also to be considered are: theoretical analysis, empirical data and analysis, historical data, informed opinions of the project team and other experts, the concerns of stakeholders and so on. (Hillson, 2007; Pinto, 2007; Walewski & Gibson, 2003)

The second step: An analysis of the probability and their consequences trying to attach a reasonable estimate of the likelihood of each of these risks occurring in the project. Hillson (2007, p. 3) gave a clear definition describing the process of risk analysis strategies, it contains:

- Estimating the probability of occurrence;
- Severity of impact for each identified risk;
- Prioritizing risks for further attention;
- Grouping risks into categories to identify causes;

- Analyzing the combined effect of risks on objectives.

In recent years, matrix method has been developed as a means of analysis of the probability and their consequences. According to Pinto (2007), creating a detailed matrix of analysis of probability and consequences should be completed, giving the project team a full understanding about the sorts of risks, the project performance is subject to. Clearly, the most relevant of project planning's risks types have both a high likelihood of occurring and a high potential for harming the project. In order to adequately protect the project's development cycle, risks that fall into this category require detailed contingency planning. The project might be classified on the basis of the potential risk impact using the matrix; the matrix uses high-low-moderate classification scheme. We also need to create a project score according to the dimension of the consequences of failure, the scores for each individual dimension of probability and consequence are added and the number of factors used to assess them divides the sum.

The degree of risk can be described by two characteristics: one is the risk's probability; another is its influence to the project. The risk's degree is the simplest category; the most effective method is to classify as high, medium, low, or to classify as serious, moderate, or slight. Pinto (2007) tries to use the three assessed elements to divide the scores, and the number is divided by 3 to

arrive at the probability score under the probability of failure; the probability score can show “low risk”, “medium risk”, and “high risk”.

The third step of project risk management is to define risk mitigation strategies, a critical component of risk management. When a successful risk mitigation strategy can be correctly implemented, it can reduce adverse impacts. Under well-planned and properly managed risk mitigation strategy uncertain and volatile events are replaced with a more predictable or controlled response. (Walewski & Gibson, 2003; Pinto, 2007)

According to Walewski and Gibson’s (2003, p. 9) discussion of risk mitigation strategies, all identified risks can be mitigated through selecting the appropriate risk mitigation strategy. There are four possible alternatives a project organization can adopt in deciding how to address risks:

- (1) *Avoidance risk*– when a lower risk strategy can be available with alternatives.
- (2) *Acceptance risk* – when the likelihood of risk occurrence is small or the consequences of the impact are very minor, they may be judged as acceptable risks, and ignored.
- (3) *Reduce or Mitigate risk*– when a process involves the development of a risk reduction plan and then tracking the plan. This kind of risk mitigation strategy is the most common risk management and handling

technique.

- (4) *Transfer or Deflect risk*– when it is impossible to change the nature of the risk, either through elimination or minimization, it may be possible to shift the risks bound up in a project to another party. (Walewski & Gibson, 2003)

There are other risk mitigations strategies that can be used:

- (5) *Mentoring* –junior or inexperienced project personnel are paired with senior managers in order to help them learn best practices.
- (6) *Cross-training* – requires that members of the project team learn not only their own duties but also the roles that other team members are expected to perform. (Pinto, 2007)

The fourth step of project risk management is to develop a reporting and documentation system. This will be used for cataloging and future reference. The report's contents would include an effective comprehensive analysis of the problem, a target date, and the expected outcome and so on.

According to Crouhy et al's (2004) research, the risk management report has two main uses. First, the report and documentation provide better risk information to management for use in improving risk management decisions.

Second, they improve the allocation of project resources to better reflect the extent that risk strategies are being taken by the project organization.

The risk management report responds to potential risks and the outcome of its response strategies by classify and codify the various risks the project organizations faces. Pinto (2007) developed a risk management report form as a useful control document; it identifies the following key information:

- *What ?*-It clearly identifies the source of risk that has been uncovered.
- *Who ?*-It assigns a project team member to be directly responsible for issuing and maintaining ownership and its resolution.
- *When ?*-It establishes a clear time frame, including milestones.
- *Why ?*-It pinpoints the most likely reasons for risk.
- *How ?*- It creates a detailed plan for how the risk is to be abated.

When risk management reports have been codified and introduced as part of standard operating procedures, they can become the most effective factor in the risk management process. The goal of a risk management report is to create systematic and repeatable strategies for project risk management.

(Crouhy & Galai & Mark, 2004; Pinto, 2007)

Project Risk Analysis and Management (Norris & Perry & Simon, 2000, p. 3) is a process designed to remove or reduce the risks that threaten the achievement of project objectives.

The Project Risk Analysis and Management (PRAM) as an integrated approach produced by the Institute of Civil Engineers and the Institute of Actuaries in the United Kingdom (PRAM 1998). It is a generic methodology that can be applied at all stages in the project life cycle, it can be concerned with very complex issues and multiple project environments, and it offers a nine-phase structure model to creating a comprehensive method for analyzing and addressing project risk. (Chapman, 1997; Walewski & Gibson, 2003)

The PRAM mainly uses a project framework to identify and mitigate risk. According to Walewski and Gibson (2003, p. 7) regarding the framework definition, we know PRAM uses an accepted framework, in which risks can be managed effectively, it promotes a risk mitigation strategy and provides a system for the control of the risks, it gives the project team a template for getting the most out of risk management, and at the same time, it could help them improve their efforts in the most productive manner.

The PRAM methodology has three main features. Pinto (2007) found effective PRAM usually follows its own life cycle, tailors different strategies

at various life cycle stages and integrates multiple approaches into a coherent, synthesized approach.

Chapman (1997, p. 274) shows PRAM methodology through a flowchart process including the following nine sequence phases:

1. Project define phases- all of relevant existing information about the project need to be well defined and consolidate, including project scope, deliverables, activity plans, stakeholder's interests and so on.
2. Project focus phases- there are two processes at this phases including: define PRM scope and strategy process and plan the PRM in operational terms process. It would clarify all relevant key aspect of the PRM, and determining the best methods for addressing project risk.
3. Project identify phases- it requires that we are employing a range of techniques to search for all sources of risk and responses, and then provide a suitable structure to classify these risks in some prioritize manner.
4. Project structure phases- this phases involves three specific tasks including refine classification, explore interactions, and develop orderings. It will develop an analysis structure to test simplifying assumptions, and then offer a more complex structure when appropriate.

5. Clarify ownership of risks phases- these phases will distinguish different risks and associated responses between the project organization and the clients, and then allocate responsibility for managing risks and responses owned.
6. Project estimate phases- it is a phases that concerned with cost, time and other appropriate performance measures. It will develop a reasonable estimate and judgment about the impacts on the project.
7. Project evaluate phases- this phases target is synthesis and evaluate the results of the project estimate phase, as well as determining the most likely plan for realizing potential risks.
8. Project plan phases- this phases target is ensuring all of plans are complete and appropriate. It will try PRM best effort to produce a project plan and then offers some risk mitigation strategies for the project.
9. Project manage phases- it is concerned with monitoring actual progress and related PRM plans, as well as responding to any variances in the process and developing more detailed plans for the future.

At each of phases, specific project deliverables will be identified, these deliverables are important because they indicate to project managers exactly the types of information they should be collecting at different phases and the materials they should make available to relevant stakeholders. The PRAM process contains two embedded feedback loops: one following the project

evaluate phase to the project define phase or to the project estimate phase, and the other after the project manage phases return to the project define phase.

From the above discussion we know that PRAM as a generic PRM method that offers a model for the project organization or project team, it contains nine distinct steps, each step present phase of the process and its associated deliverables. It covers the project's entire life cycle, from initial conception to eventual termination. It can be applied to multiple project environments and encompasses the key components of project risk management; it is a widely accepted methodology.

#### Project Success and Project Success Factors

It is very difficult to define the project success, because the different projects differ depending upon the very nature of project. Traditionally project success factors focused on the three dimensions of cost, time and quality attributes. However, as will be discussed further, it is not sufficient to only use these factors to measure project success.

According to Pinto (2007, p. 13) the definition of project success, takes into consideration the four dimensions, including: time, budget, functionality or quality and customer.

- Time. All projects need to meet the specified time frame constraint for completion.
- Cost. Projects are constrained by limited budgets therefore resources must be used as efficiently as possible to stay within budget.
- Performance. The final product can be operated and meet the defined needs according to specifications.
- Client acceptance. The project's strategy should satisfy customers' needs and stakeholders' expectations.

The second definition of project success offered by Baccharini (1999, p. 25) consists of two separate components, namely project management success and project product success.

Project success = project management success + project product success.

Historically, studies of project success began in the early 20th century. In these studies the measurement of project success mainly focused on the iron triangle of cost, time and quality attributes. For over 50 years, many projects have continued to fail in their efforts to achieve this "Iron Triangle". The next approach measured project success focusing on time, cost and functional improvement. Throughout the 1970s and 1980s, the measurement of project

success mainly focused more on management techniques and control. Today, project success factors includes project efficiency, stakeholder satisfaction, business success, organization benefit, risk mitigation, impact on the customer, future potential and team development, and so on. (Jugdev & Muller, 2005; Wan Maimun & Ahmad, 2006; Pinto & Slevin, 1987)

What constitutes project success? Although the topic has been frequently discussed for over five decades, it is rarely agreed upon. In recent years, there are two research methods that have been developed as a means of assessing project success. These are:

- (1) Critical success factors (CSFs);
- (2) Success criteria and success factors (SCSF). (Wateridge, 1995; Cooke-Davies, 2002)

The importance of definitions and measurement of project success was identified as long ago as 1969 by the Project Management Institute (PMI). Since then, the literature on project success factors grew rapidly; some researchers tried to make a correlation between project risk management and project success. Rockart (1978, p. 18) developed seven critical success factors (CSFs) methods. The seven CSFs include image in financial markets, technological reputation with customers, market success, and risk recognition in contracts, profit margin on jobs, morale, and performance to budget on

major jobs. “Since many of the jobs accepted are near-or at-the state of the art, controlling the company's risk profile is seen to be critical. A variety of factors contribute to risk. The measurement process designed involves a computer algorithm to consider these factors and to highlight particularly risky situations.” (p. 29). He found that a good risk control strategy is necessary to a project organization; it enables its clients to succeed in complex business environments. Varieties of risks emerge in the project management process, which require the project organization to develop different risk measurements to reduce the risk associated with a hazard. Therefore, understanding project risk management’s significance to project success, will lead the project organization to a better performance.

Chan and Ho and Tam (2001, p. 96) conducted a study of project success and identified six factors (project team commitment, contractor’s competencies, risk and liability assessment, client’s competencies, end-users needs, and constraints imposed by end-users) for success. Part of the statistical data is found in figure1. The data collected information of 31 items of project success factors for a sample of 53 responses. Six factors were extracted and altogether accounted for 78% of the variance in responses. The first three items (factors) including the project team commitment, contractor’s competencies, risk and liability assessment factors accounted for 26.185%, 16.401%, and 10.094% of the variance, respectively. The three items (factors)

total loadings were  $>0.5$ , and 18 of them were  $>0.7$ .

Factor 3: Risk and Liability Assessment (Item)		Factor Loading	Percent of variance Explained	Cumulative percent of Variance explained
9	Prequalification of potential tenderers was thorough	0.758		
17	All project participants accepted the risk and legal liability they had to face	0.685		
11	Little change in client's requirements during construction had been made	0.608		
10	Assessment of contractor's proposals was thorough	0.591		
16	All project participants understood fully how great the risk and legal liability they had to face	0.528	10.094	52.681

**Figure 1:** Factor Structure for Principal Factors Extraction and Varimax Rotation on Project Success Factors Items (Source: Chan & Ho & Tam, 2001)

Chan and Ho and Tam (2001) recognized the correlation of the relationship between project risk management and project success. In order to prove the relationship between the project risk management and project success, they performed the factor statistic analysis. An analysis of risk factors showed five independent factors: prequalification of potential tenderers; all project participants accepted the risk; little change in client's requirements during construction; assessment of contractor's proposals; all project participants understood. The five items related to risk assessment and management to project success effect. Chan and Ho and Tam (2001) stated the correlations between risk management and project success factors. They found the five risks assessment dimensions were statistically related to project performance, and each project dimensions varying degrees of impact on the

success factors. Therefore, there is a correlation relationship between project risk management and project success, and risk management as a critical factor affect project success.

Wan Maimun and Ahmad, (2006) tried to build a model statement about the relationship between the success criteria and success factors (SCSF).

They stated:

Success criteria relate to users and sponsors and are the set of principles or standards by which judgment is made as to whether the project is successful or not and thus it became the benchmark to measure success or failure. In brief, success criteria are the result area of what are to be achieved thus termed the 'What'.

Success factors are those elements that are required to deliver the success criteria and they are the set of circumstances, facts or influences which contribute to the result or the achievement of the success criteria. According to these success factors are the influential forces that either facilitate or impede project success, however the success factors do not form the basis of judgment. Success factors as the management inputs and systems would lead to project success, success factors as the organizational areas which the terms as the 'How'. (p. 7)

This study conducted literature review on success criteria and success

factors in Figure2:

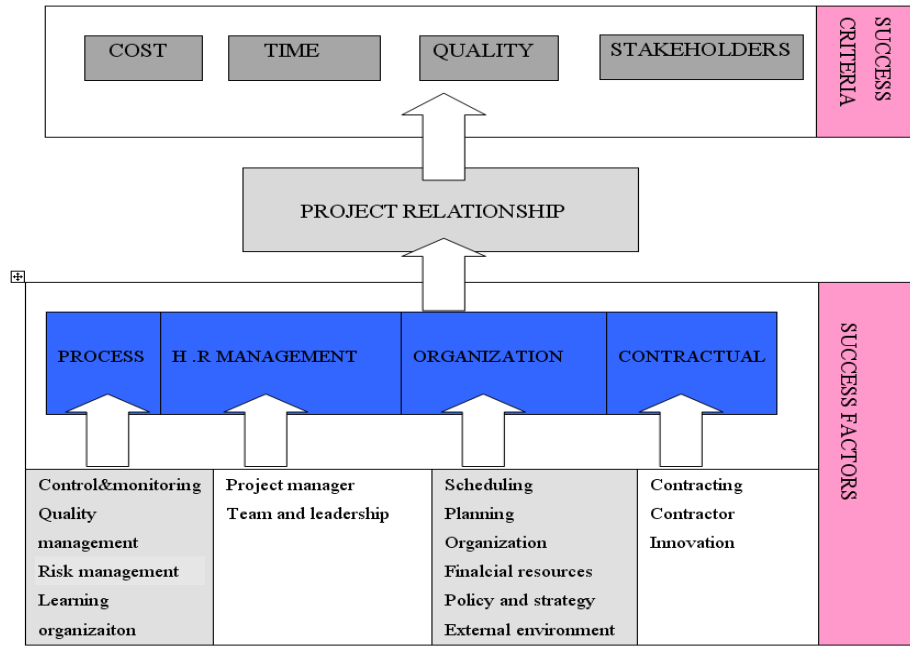
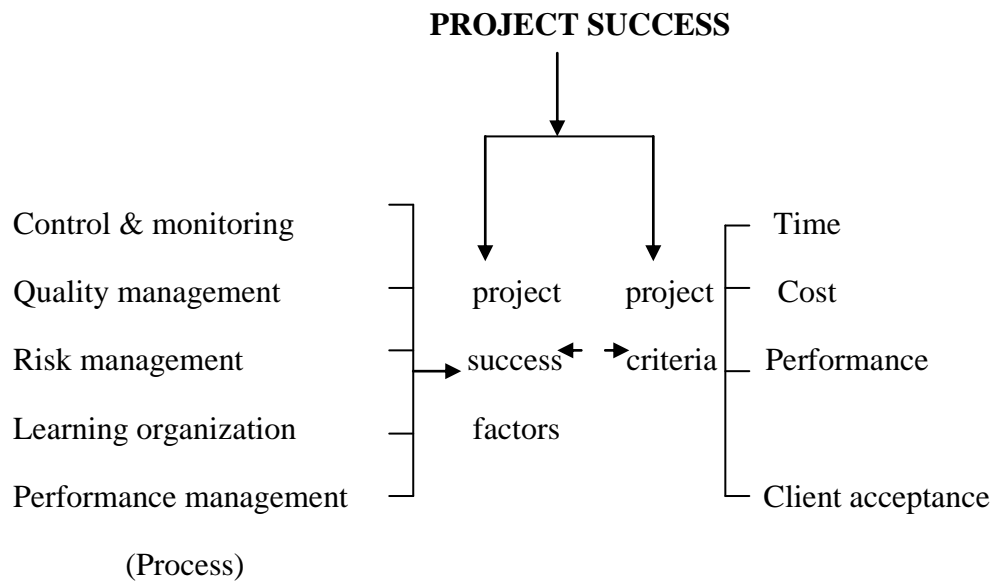


Figure 2: Success Criteria and Success Factors (Source: Wan Maimun & Ahmad, 2006)

Wan Maimun and Ahmad (2006) reviewed the contribution of project risk management to project success, they described that relationship between risk management and the project success factor follow certain interaction:



They found that there are a set of circumstances, factors or influences which contribute to the result or the achievement of the success criteria. These success factors are the influential forces which either facilitate or impede project success. They realized that the need for effective risk management is a part of the project management approach which results in successful project implementation.

Based on the literature of project success factor analysis, many researchers have recognized project risk management as a critical factor affecting project success.

## **SUMMARY**

### **Conclusions**

Project risk management is a very important factor affecting the success of the organization. Project risk management has four key stages including (1) risk identification, (2) analysis of probability and consequences, (3) risk mitigation strategies, and (4) control and documentation. Project risks can be managed in the variety of ways, including avoidance risk, acceptance risk, reduce or mitigate risk and transfer or deflect risk. PRAM as a generic methodology, offers a model for the project organization or project team; it offers a nine-phase structured process creating a comprehensive method for analyzing and addressing project risk.

Through a literature review on project success factors, research results supported the viewpoint that project risk management is a critical factor affecting project success, and project risk management is receiving increasing attention by the project organization. With the strengthening of risk management awareness, it will result in more research focused on the field.

### Recommendations

Multiple research studies have pointed out that project risk management is a critical factor affecting the project's success. Therefore, it is important to choose an appropriate project risk management strategy. The project team that has knowledge of the PRAM technique can contribute to the project's success.

With further development of the research, three topics should be considered: (1) Project risk management development trends to project successful influence. (2) How the project risk is produced for different kinds of projects; (3) which risk mitigation strategies will be the best choice to the project success? Each of these three topics represents future research direction in our understanding of PRM.

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