

A Review on Theories Used for Decision Making in Project Management Studies

Khairul Azizan Suda, Nazatul Shima Abdul Rani, Hamzah Abdul Rahman, Wang Chen

Abstract— this paper is a review on theories used in previous studies for decision making in project management studies. A mapping of most frequent theories being used forwarded for discussion. Theories identified are resource based theory, action based theory, utility theory, contingency theory, game theory, fuzzy theory, and reliability theory. Reviews from past studies forwarded from various industry, on strategic risk management, project management and project management were highlighted, and some of the theories being used across the board. Those are the theories that might be relevant to be used for project management studies in order to ensure project success and eliminate project failures in the future.

Index Terms— project risk management, strategic risk management, project management, resource based theory, utility theory, contingency theory, fuzzy theory.

1 INTRODUCTION

Project failures are actually a curse to many company be it construction or non-construction company due to huge capital invested in the project. In Malaysia, few news reports emerged not only this year but also few years back, in recent news, it was reported that two mega projects at Langkawi failed to follow construction regulation, that include employing illegal immigrants, and all subcontractors were not registered with CIDB (Construction Industry Development Board) that will definitely lead to project failures [1]. In a recent report showed that incinerator project approved by Ministry for Urban Well-being, Housing and Local Government incurred losses of RM187.74 million due to awarding the project to a company not having any track record in the technology [3]. In year 2013, it was reported that NFC (National Feedlot Centre) failed due to mismanagement of funds by the company trusted to run the Centre that leads to millions RM of losses [2].

Other than that, even in education industry in year 2011, the Ministry of Education incurred losses of RM 3.71 million due to failure to meet deadline by contractors in Sabah in building computer lab. This incident happened due to poor selection of contractors by the person awarding the construction project [15]. In short, project failures are becoming norms in most industries especially in Malaysia be it construction projects or other types of projects.

In a study conducted by [16] on government ICT pro-

ject failures, it showed that 53% of the symptoms derived from project failures, 36% system failures and 11% user failures. Project failures were due to project management factors, top management factors, technology factors, organizational factors, complexity/size factors, and process factors.

[6] have used a real data in evaluating construction project success and failures database in Belgium, the findings indicated that the variation from planned performance and actual performance showed that most project late by 6.6%, and over budget by 7.3%. Surprisingly 70% of the project finishes behind schedule or with additional cost or both, and only 30% of the project completed on time or earlier than planned. As such a study highly in need to further investigate the factors leads to project delays in order to avoid or eliminate the delays from occurring.

Project failures that are due to poor selection of vendors or suppliers are detrimental to most projects at the expense of business profits [17]. Be it a construction industry or other type of industries, projects are alike in many ways thus, it is highly in need to fully understand the critical factors that will lead to project failures so as to reduce the propensity of project failures that will cause millions of RM to project owner. In this review, the theories from past studies on decision making for project management forwarded for discussion.

2 REVIEW ON PAST THEORIES FOR DECISION MAKING IN PROJECT MANAGEMENT STUDIES

2.1 Game Theory

In a study conducted by [9], they had propose to use game theory for oil and gas decision making during project design. In another research by [8] for LNG, they had used game theory to develop decision making process for LNG processes due to multi-criterion nature of the industry. Further, in a book written by [13], he had men-

- Khairul Azizan Suda is a Lecturer at Universiti Kuala Lumpur, and currently pursuing PhD in project risk management at International University of Malaya-Wales, Malaysia, E-mail: khairul.azizan@unikl.edu.my.
- Dr. Nazatul Shima Abdul Rani is currently a Senior Lecturer in Universiti Kuala Lumpur Business School, Universiti Kuala Lumpur, Malaysia. E-mail: shima.rani@unikl.edu.my.
- Prof. Dr. Hamzah Abdul Rahman, CEO, International University of Malaya-Wales, Malaysia, E-mail: arhamzah@iumw.edu.my.
- AP. Dr. Wang Chen, Associate Professor, International University of Malaya-Wales, Malaysia, E-mail: derekisleon@um.edu.my.

tioned that the game theory for decision making is suitable in a highly complex decision making scenario.

2.2 Fuzzy Theory

In a study conducted by [23], fuzzy theory has been applied for risk analysis of a construction engineering. They had divided construction risk system into three categories which are risk derived from corporation internally, risks derived from owner, and risk derived from society and environment. Table 1 lists down the details of those risks. Similar categorization can be adopted for oil and gas industry, because the nature quite similar to construction industry. The fuzzy system theory was proposed by [23] for developing construction engineering risk fuzzy forecast model for the purpose of risk analysis of the engineering project contract planning phase before bidding and construction or implementation phase.

TABLE 1
 CONSTRUCTION ENGINEERING SYSTEM

Risks System	The first level risks	The second level risks
Construction engineering system	Risks derived from corporation internally	Cost risk Quality risk Duration risk Contract and information risk Safety construction risk Technology and management risk
	Risks derived from owner	Beating down price risk Claim risk Settlement and payment risk Design risk Intervention risk Legal risk
	Risks derived from society and environment	Political risk Policy risk Natural risk Cooperation units and competition units risk Moral risk Safety and civilization of construction risk

Source: [23]

2.3 Utility Theory

In a study conducted by [12] on construction management, the utility theory is used to assess the risk attitude by the decision maker. The data used for risk evaluation is based on data such as economic situation (supply and demand, seasonality), historical data, conditional probability, and utility function. Cost benefit analyses should be conducted in order to utilize Utility Theory in decision making [18]. A survey was carried out to find relationship between creativity and attitude towards risk. The result showed that a decision maker with aversion to risk taking will be cautious in decision making therefore the utility will be higher. Those who have a preference towards risk taking will have the tendency to take double risk than the risk aversion decision maker, will lead toward lower utility in decision making [12].

2.4 Reliability Theory

In an earlier study by [10], they had integrate Reliability Theory to design reliable economic systems whereby to improve the reliability by omission and commission errors are reduced.

[20] had integrated reliability theory towards logistics park construction project risk control in order to avoid risk and increase the reliability of the project with a minimum total investment. At decision stage the factors identified are function orientation, location and investment decision. As for construction preparation the factors that considered as important risk will be land acquisition, survey and design, tendering and bidding, and financing and preparation.

For construction phase the factors identified are construction, facilities install and commissions, contract management, equipment and material management, security management, and supervision. Final phase, which is the handout and operation consisted of acceptance and handover, merchant and operation management.

2.5 Resource Based Theory

According to [4], Resource Based View or Resource Based Theory originated from economic disciplines, however the application of the theories has extended towards management, sociological, information management and knowledge management. From the analyses conducted by them from compilation of various literatures on Resource Based Theory, about 73.8 percent in the area of general management and strategy from 1992 to 1994, and 57.7 percent in year 1998 to 2000.

The latest analyses of theories indicated that it had evolved from economic towards management fields such as marketing, organizational studies, production operation and management [4]. Other than that, accord-

ing to [11] resource based theory focuses on: 1. performance differences between firms highly dependent on the measure whether the firm owns unique inputs and capabilities, 2. the level of the resources whether at reputation level or dealer loyalty, 3. Acceptable proxies for firm resources (R&D capabilities or management proclivities), and 4. New IO game theoretical approach (3 forces: 1. Own assets, 2. Competitors assets, 3. Constraints from broader industry and public policy environment).

Further, according to [5], Resource Based View is actually a strategic management theory that has been used extensively by managers in project management. It is used to examine how resources can increase competitive advantage by being able to create added value than rivals and simultaneously gained higher return from investments.

2.6 Action Based Theory

According to [14] a project management is equivalent to temporary organization. From the research, they proposed that 'action' is not necessarily the consequence of decision, whereby a decision can be made after the action in order to legitimate the earlier action. Action might supersede decision when 1. Time is crucial; 2. Task, 3. Team, and 4. Transition.

2.7 Contingency Theory

In early study, contingency theory is used to address environmental fit or fit of organizational structure with environmental conditions, however, it was enhanced by taking into account the internal conditions such as structural formalization and specialization or technology as the contingencies [21]. According to [7], contingency theory is based on a fit between certain components of a managerial organization and contingencies that might improve organization's performance.

In a research conducted by [22] on risk management for management accounting in a public sector, the contingency theory has been applied. Previously contingency theory has been utilized in private sector due to the key risks that will be ranked in terms of the way the risk impact is measured against the core financial statements. Since, public sector highly driven towards organizational objectives rather than financial objectives, hence this theory is not suitable for public sector.

In another study, conducted by [19], they had re-examined on the failure of project failure by using contingency theory, as most studies pointed that project failures are due to technical rather than managerial. They had used NASA's Mars Climate Orbiter loss as a case, and it showed that the policy of 'better, faster, cheaper' had lead to the project failures, which is actually resulted from managerial decision making. Under contingency theory, in every projects the company must

identify the fit between certain components or a managerial organization and contingencies that will improve organization's performance. Hence, the contingencies could be the critical elements or critical success factors that are highly critical to a project success that should be taken into consideration during the decision making stage by project owner or manager.

3 ANALYSIS ON THE THEORIES FOR DECISION MAKING IN PROJECT MANAGEMENT

3.1 Project Management Decision Making Phases and Theories for Decision Making

From review of literatures on decision making for project management, it shows that during pre-planning (including planning) for a project the utility theory, reliability theory and resource based theory normally being used. However, for a more complex decision making that involves multi-criterion decision making then the game theory and fuzzy theory normally were used to ensure project success.

At the implementation phase, after project approval for a normal decision making usually it might involve contingency theory in the case of emergency, and action based theory will be utilized when an action might supersede decision. Whereby, the 'action' is not a consequence of decision however the decision is made after the action in order to legitimize earlier action when time is crucial for task, team and transition [14]. Table 2 summarizes the phases for decision making with relevant theories.

TABLE 2

PROJECT MANAGEMENT PHASES AND THEORIES FOR DECISION MAKING

Project Management Phases	Theories Relevant for Decision Making at Different Phases
Pre-Planning Phase	Game Theory, Fuzzy Theory, Utility Theory, Reliability Theory, Resource Based Theory.
Implementation Phase	Action Based Theory, Contingency Theory

4 FUTURE RESEARCH

For future research, more extensive research should be done to further investigate the best theories or approaches to be used at pre-planning phase decision making in order to reduce project failure.

5 CONCLUSION

As a conclusion for project management decision making, whether the same theories could be applied for all industries especially oil and gas industry is yet to be discovered. Hence, more in depth studies should be done to enhance decision making accuracy at various levels for all industries to ensure project success.

REFERENCES

- [1] _____ "2 Mega Projects at Langkawi Failed to Follow Construction Regulations.", *Malaysia Chronicle*, February 26, 2014, Wednesday. (http://www.malaysia-chronicle.com/index.php?option=com_k27view=item&id=232702:2-mega-projects-at-langkawi-failed-to-follow-construction-regulation's&Itemid=2#axzz3LOZgaOTH). Retrieved: December 9, 2014.
- [2] M. Chi, "Still no takers for NFC project, Putrajaya reveals." *Malaymail-online*, October 23, 2013, (<http://www.themalaymailonline.com/malaysia/article/still-no-takers-for-failed-nfc-project-putrajaya-reveals>). Retrieved: December 9, 2014.
- [3] A. Hani, and R. Kamalavacini, "Incinerator project not a failure, says minister.", *The Malaysia Reserve*, November 13, 2014, (<http://themalaysianreserve.com/main/news/corporate-malaysia/7507-incinerator-project-not-a-failure-says-minister>). Retrieved: December 9, 2014.
- [4] F.J. Acedo, C. Barroso, and J.L. Galan, J.L., "The Resource-based Theory: Dissemination and Main Trends", *Strategic Management Journal*, vol. 27, pp.621-636, 2006.
- [5] K. Almarri, and P. Gardiner, "Application of Resource-based Views to Project Management Research: Supporters and Opponents". 27th IPMA World Congress. *Procedia-Social and Behavioral Sciences*, vol. 119, pp. 437-445, 2014.
- [6] J. Batselier, and M. Vanhoucke, (2014), "Construction and Evaluation Framework for a Real-Life Project Database", *International Journal of Project Management*, 14 pages, 2014, (<http://dx.doi.org/10.1016/j.ijproman.2014.09.004>).
- [7] A.E. Cakir, "Applying Contingency Theory to International Organizations: The Case of European Integration." *Journal of International Organizations Studies*, vol. 3, no. 1, March, pp. 7-24, 2012.
- [8] L. Castillo, and C.A. Dorao, "Consensual Decision-making Model Based on Game Theory for LNG Processes." *Energy Conversion and Management*, vol. 64, pp. 387-396, 2012.
- [9] L. Castillo, and C.A. Dorao, "Decision-making in the Oil and Gas Projects Based on Game Theory: Conceptual Process Design." *Energy Conversion and Management*, vol. 66, pp. 48-55, 2013.
- [10] M. Christensen, and T. Knudsen, "The Human Version of Moore-Shannon's Theorem: The Design of Reliable Economic Systems." *DRUID Working Paper No. 07-08*, Danish Research Unit for Industrial Dynamics, 19 pages, 2007.
- [11] K.R. Conner, "A Historical Comparison of Resource-based Theory and Five Schools of Thought Within Industrial Organization Economics: Do We Have a New Theory of The Firm?" *Journal of Management*, vol. 17, no. 1, pp. 121-154, 1991.
- [12] O. Kaplinski, "Risk Management of Construction Works by Means of The Utility Theory: A Case Study." 11th International Conference on Modern Building Materials, Structures and Techniques, MBMST 2013, *Procedia Engineering*, vol. 57, pp. 533-539, 2013.
- [13] A. Kelly, "Decision Making Using Game Theory: An Introduction for Managers." *Cambridge: Cambridge University Press*, 2003.
- [14] R.A. Lundin, and A. Soderholm, "A Theory of The Temporary Organization." *Scand. J. Mgmt*, vol. 11, no. 4, pp. 437-455, 1995.
- [15] S.S. Maria, "Sabah Computer Lab Project a 'failure'", *Free Malaysia Today*, October 24, 2011(<http://www.freemalaysiatoday.com/category/nation/2011/10/24/sabah-computer-lab-project-a-failure/>).
- [16] H.S.A. Nawli, AA. Rahman, and O. Ibrahim, "Government ICT Project Failure Factors: Project Stakeholders' Views." *Journal of Research and Innovation in Information System*, vol. 2, pp. 69-77, 2012 (ISSN: 2289-1359).
- [17] J.T. Pfaff, C. Dienst, J. Konig, and W. Ortiz, "A Cross Sectional Review: Impacts and Sustainability of Small-scale Renewable Energy Projects in Developing Countries." *Renewable and Sustainable Energy Reviews*, vol. 40, pp. 1-10, 2014 (<http://dx.doi.org/10.1016/j.rser.2014.07.16>).
- [18] C.M. Sherve, and I. Kelman, "Does Mitigation Save? Reviewing Cost-benefit Analyses of Disaster Risk Reduction.", *International Journal of Disaster Risk Reduction*, vol. 10, part A, pp. 213-235, 2014. (<http://dx.doi.org/10.1016/j.ijdrr.2014.08.004>).
- [19] B.J. Sauser, R.R. Reilly, and A.J. Shenhar, "Why Projects Fail? How Contingency Theory Can Provide New Insights-A Comparative Analysis of NASA's Mars Climate Orbiter Loss." *International Journal of Project Management*, vol. 27, pp. 665-679, 2009.
- [20] Y. Wang, "Research on Risk Control of Logistics Park Construction Project Based on Reliability Theory." 13th COTA International Conference of Transportation Professionals (CICTP 2013), *Procedia-Social and Behavioral Sciences*, vol. 96, pp. 2194-2200, 2013.
- [21] K. Weber, B. Otto, and H. Osterle, "One Size Does Not Fit All-A Contingency Approach to Data Governance.", *ACM J. Data Inform. Quality*, vol. 1, iss. 1, 27 pages, 2009.
- [22] M. Woods, M. "A Contingency Theory Perspective on The Risk Management Control System Within Birmingham City Council." *Management Accounting Research*, vol. 20, pp. 69-81, 2009.
- [23] Y. Zhao, X. Liu, and Y. Zhao, "Forecast for Construction Engineering Risk Based on Fuzzy Sets and Systems Theory.", 2011 International Conference on Risk and Engineering Management (REM), *System Engineering Procedia*, vol. 1, pp. 156-161, 2011.

IJSER