Risks and risk management of Kandy City Wastewater Management Project (KCWMP)

Dasanayaka, D. M. T.[a] and De Zoysa, M[b*]

[a,b]*Department of Agricultural Economics, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

[a]mangala@agecon.ruh.ac.lk

Abstract

This research's objectives were to identify the risks related to the Kandy city wastewater management project and apply the risk assessment, risks prioritization, and risks preventive strategies to suggest appropriate mitigation measures, based on the risk management process. A structured questionnaire was prepared and gathered relevant data as primary information with a convenience sampling method. All the collected data and observed information based on risks identification were analyzed and explained the overall risk factors, using three dimensions; risk impact, risk probability and risk discrimination. The progress of risk prioritization and risk preventive action was evaluated by comparing the risk identification steps. According to the risk prioritization the significant risk types are identified as: resource delay, change project design according to the construction site, failure to meet cost estimate, the design is not fit for the purpose and low team motivation. To obtain the project's expected final quality, the major risks should be mitigated withby, choosing stable suppliers, providing resources on time, updating initial agreement, making design according to the project scope and project site, and making fixed-price contracts and motivating project members.

Keywords: project, risk assessment, risk management and risk prioritization

Introduction

Kandy City Wastewater Management Project (KCWMP) is directed towards finding a solution for prevailing the Wastewater issue in Kandy City. The Project attempt develops a wastewater collection system to the central part of the Kandy City, where the population density is very high. The collected wastewater will be treated at a Treatment Plant of capacity 14,000 m3 /day at Gannoruwa, the Main Pumping Station at Getambe and the Solid Sludge Disposal at Gohagoda, all of which will be significant new constructions.

(a) (b)

Fig 1(a). Wastewater treatment plant Fig 1(b). Pump station

The risk factor in constructing the Kandy city wastewater management project is very high because the construction objects are unique and built only once. The construction life cycle of the project is full of various risks. Risks come from many sources, including construction sites, documentation, technology, time, resources, temporary project teams appointed from different companies, etc. Moreover, the size and complexity of construction objects are increasing, which adds to the risks. This is also to the political, economic, and social conditions where the project is to be undertaken. Project risk can be defined as an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one project objective, such as time, cost, and quality. The risks cause cost and time overruns in construction projects. Therefore, risk management in a project is crucial to succeed in the project and obtain sustainable project outcomes.

The study's general objective is to manage risks to mitigate the negative impacts of the Kandy City Wastewater Management Project. And the specific objectives are to identify the risk related to the implementation of the Kandy city wastewater management Project, analyze possible negative impacts based on the risk, and develop the risk management process for the project to mitigate the negative impacts.

Literature Review

Risk assessment is the identification of hazards that could negatively impact on a construction project. Risks are evaluated along three dimensions under risk assessment. They are impact, probability, and discrimination, a point value can be assigned to each risk using the formula (Ssempebwa, 2013):

Overall risk factor = Probability * impact /discrimination

Prioritizing Risks is done by using ProbabilityandImpact Picture. The probability–impact picture offers a flexible format for depicting independent event risks, variability risks and ambiguity risks. When event risks are involved, it allows specification of a range for the probability of occurrence and a range for the impact should the risk event occur (Hwang et al., 2014).

.

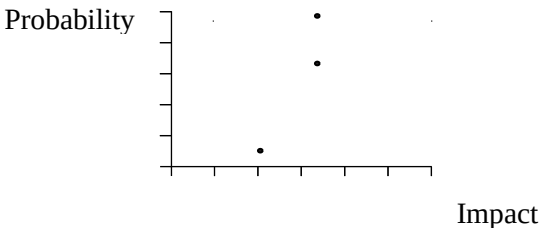

Fig 2. probability–impact picture

A preventive action aims to correct potential problems, which fixed the cause of current issues—it including four main strategies; risk avoidance, risk reduction, risk transferring and risk accepting.

Methodology

From nearly 1000 project actors, 80 project actors were selected as a sample, including project managers, site engineers, planning engineers, and laborers using a convenience sampling method. Primary data were gathered through a questionnaire survey and personal interviews with the project actors. A pre-tested questionnaire was used to administer the survey. Data were analyzed using both descriptive and inferential statistical tools, including Statistical Package for Social Sciences and Microsoft Excel. Mean, mode, median, pie charts, bar charts, and tables used for the data interpretation visually and summarize it. Wilcoxon sign rank test was also used as a non-parametric statistic tool.

Results and Discussions

By using the frequencies of risks impact, risks probability and risks discrimination, calculate the overall risk factor of the project. (Overall risk factor = Probability * impact /discrimination)

Table 1. Overall risk factor

Risk Type	Probability	Impact	Discrimination	Overall risk factor
Timeframe forecasts is inaccurate	3	3	3	3
Failure to complete the project in specified time.	3	4	1	12
Failure to meet the cost estimate.	5	4	1	20
Exchange rate variability	3	2	5	1.2
Construction occupational safety	1	2	5	0.4
Damage person or property	3	3	3	3
Lack of training	1	3	3	1
Low team motivation	5	3	3	5
Lack of knowledge & skills	3	3	3	3
Project member with a negative attitude	3	3	3	3
The conflict between project members	3	3	3	3
Lack of infrastructure	3	3	3	3
Soil problems	1	2	5	0.4
Environmental pressure	1	2	5	0.4
Lack of facilities & sanitation for project members	3	3	3	3
Low-quality infrastructures and services	3	3	3	3
Design is not fit for the purpose	5	4	1	20
Inflation	1	2	5	0.4
High rainfall	3	3	1	9
Misunderstanding about project	1	2	5	0.4
Resources Delay	5	5	1	25
Change project design according to the project/construction site	5	5	1	25
Project actor's turnover	3	3	1	9

According to the overall risk factor of a project, the highest frequencies of risks are resource delay, change project design according to the project scope as well as project site/construction site, the design is not fit for purpose, failure to meet cost estimate and failure to complete the project in the specific period.

By using Probability-Impact Picture, the risk prioritization was done. The most prominent risks related to the project are Resource delay (H), Change project design according to the project/construction site (H), Failure to meet cost estimate (G), Design is not fit for purpose (G) and Low team motivation (F).

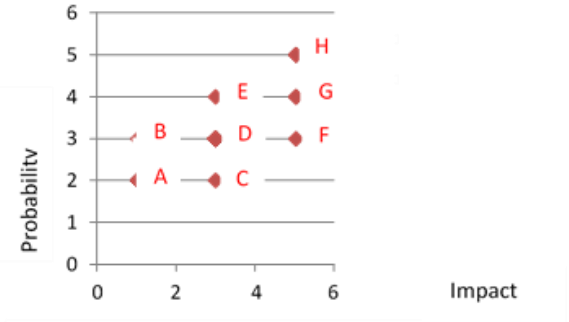

Fig.3. probability–impact picture

There are four main risks of preventive strategies in a risk management process. They are risk avoidance, risk reduction, risks transferring and risks accepting. To identify the risks preventive strategies, five-point scales are used. Strongly disagree (-2) to strongly agree (+2) is used as the scale. According to the one-sample Wilcoxon signed-rank test, significant strategies have a positive relationship with risk preventive action out of twenty-two risk preventive strategies.

Table 2. Risks preventive strategies

Null Hypothesis	Mean	*T	P
Shortening the schedule equals	-2.00	-8.944	0.315
Changing the project strategies	.60	2.963	0.001**
Reducing the project scope.	-1.54	-8.024	0.153
Improving communication between stakeholders	1.59	8.044	0.000**
Changing the scope of the project activity	-0.93	-5.240	0.525
Extending the project schedule	1.23	6.846	0.002**
Safety training	1.56	8.032	0.004**
Simplifying process	-0.66	-3.415	0.253
Choosing a stable supplier	1.91	8.615	0.003**
Use of advanced technology or best practices	1.70	8.149	0.004**
Recruit skillful & knowledgeable persons as project actors	1.72	8.184	0.002**
Select well-trained person for the construction field	1.26	6.698	0.004**
Arrange awareness programs for the community	.88	5.414	0.003**
Supply insurance	1.64	8.080	0.004**
Making performance bonds	.80	4.332	0.000**
Provide warranties	1.31	7.724	0.003**
Making fixed-price contracts	.10	0.964	0.000**
Provide guarantees	1.27	7.789	0.001**
Making technology partnerships	-1.56	-8.032	0.519
Accept the positive impact of risks	1.66	8.110	0.003**
The project plan is left unchanged	.26	0.744	0.001**
Accept the weather risk and the time and cost are retentions by a particular organization	-1.42	-7.933	0.135

**Significant level is 0.05 *One Sample Wilcoxon Signed Rank Test

Conclusions and Recommendations

Within the main three types of risks related to the Kandy City Wastewater Management Project, the internal risks and project risks are the most prominent risk types than external risks. According to the risk prioritization the significant risks types are identified as resource delay, change project design according to the construction site, failure to meet cost estimate, Design is not fit for the purpose and low team motivation. To obtain the expecting final quality of the project, the significant risks according to the risk's prioritization should be mitigated with choosing a stable supplier, provide resources on time, updating the initial agreement, design made according to the project scope and project construction site, making fixed-price contracts and motivate project members.

References

Hwang, B. G., Zhao, X., & Toh, L. P. (2014). Risk management in small construction projects in Singapore: Status, barriers and impact. *International Journal of Project Management*, *32*(1), 116–124. https://doi.org/10.1016/j.ijproman.2013.01.007

Ssempebwa, R. K (2013). Project Risk Management, Atlanta International University, file:///C:/Users/User/Downloads/Risk_management_By_-_Eng_Ssempebwa_Kibuuka_Ronald-libre.pdf.