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Risk Management in City Rail Transportation System Project: A Case Study of Istanbul

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ABSTRACT

Today, the most important modes of transportation for cities are public transportation. Public transport provides citizens with fast, reliable, timely and inexpensive transportation.Public transportation systems are constructed according to the size of the cities. Bus systems are the most common means of public transport in small-scale cities. However, as cities grow, the rail system becomes an important model for public transportation.

Turkey's largest city of Istanbul has a population of over 14 million. With a 149 km rail system line, it is aimed to create a railway system network of 1.000 km for public transportation in Istanbul.

In this context, 276 km railway system construction is continuing. The completion of the investments financed by the municipality and the government at the targeted time and in the desired qualification is very important in terms of the quality of life of the citizens. For the Rail System Lines, risk management is required to achieve the intended objectives.

In this study; continuing rail system projects in Istanbul; design, engineering services (supervisor) and construction phases. For the study, a risk matrix was created and a questionnaire survey was conducted with 60 senior experts working on the Istanbul rail system projects in the public and private sectors. Survey results and evaluations were given in the study.

Keywords— *risk management;survey;stakeholders management; sustainablity; istanbul; rail system.*

I. INTRODUCTION

Public transportation is the indispensable mode of transport for large-scale metropolises. Due to the high population in cities and the limited volume of roads, the primary transport problem is traffic congestion and therefore high travel times. The basic recommendation of transport analysts in this regard is to increase the capacity and capacity of the public transportation network. Traffic congestion is a continuing problem in large-scale cities.

Transportation; is one of the most important subjects of everyday life in contemporary Istanbul. Railway System Lines are the most important mode of transportation for large cities, providing uninterrupted high-capacity transportation.

Currently, there is a 150 km rail system network in Istanbul under operation and uses an average of 2 million 281 thousand passenger rail systems per day. With the completion of the rail system lines being constructed, the rail system will be 430 km long in the near future and the planned rail system network will finally be available in Istanbul with a 1,000 km rail system network [1].

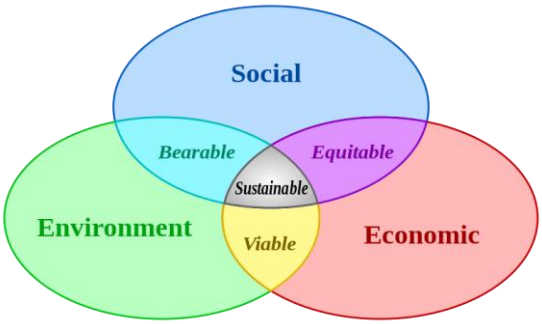
Project and Risk Management in Railway System Construction, construction of 276 km railway system in progress in Istanbul; design, supervisor and construction, all of which are the responsibility of all the public and private sectors.

Literature shows that risk management in construction projects is full of deficiencies that affect its effectiveness as a project management function and in the end, projects' performance [6].

Railway system projects; it is the most important priority of public institutions to live safely in the target time, cost and quality standards.The purpose of the private sector working in project works is to complete the contracted projects with low cost. We can explain these different aims of stakeholders with the concept of sustainability.

Sustainability as a concept; Social refers to a multi-purpose structure in which environmental and economic goals are jointly assessed.A schematic representation of a multi-purpose sustainable project management is given in "Fig. 1,"[2].

Figure 1.Sustainable development of project management.



Stakeholders with different goals need to be managed. The main question of rail system project is how to control stakeholder management effectively.

Each and every stakeholder is a very critical and a very sensitive issue for an organization. As they definitely affect the working of the organization and like said earlier no company or organization would ever exist without the help and support of these stakeholders. One of the most important parts of project management is to develop and control relationships with the stakeholder as they are a very vital part of the organization [3]. The main of effective stakeholder management steps is Purpose of management needs to be defined.

Managing risk with stakeholders is important. Rail System Projects consist of project stakeholders with different roles and responsibilities, different goals and expectations, different risk-taking capacities and different risk management skills [5]:

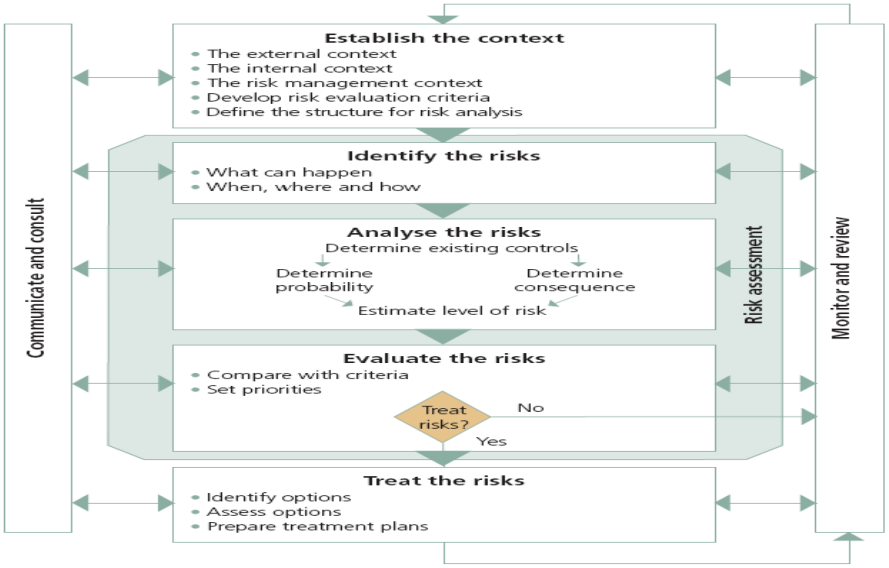
Public Sector (Municipality, State)
Supervisor
Contractors
Project Owner
Sub-employer
Supplier
Citizens

It is crucial for Risk Management to be effective and successful, as it is the mutual exchange of views and determination of risk prevention plans among the Project Stakeholders to identify, mitigate, or reduce risks at various stages of the project. As a result, the whole project is interacting with each other and the success or failure of one will affect others.

In a multi-purpose project management, it is necessary to fully define the obstacles in front of the objectives.

The Risk Management Processconsists of a series of steps that, when undertaken in sequence, enable continual improvement in decision-making.Steps to be followed in risk management are given in figure 2 [4].

Figure 2.Summary of risk management steps.



There are various benefits of risk management on projects. a few of which are given below.

- ✓ It supports the realization of the project objectives,
- ✓ Informed consent of the Project Organization on the identification and prevention of risks,
- ✓ Facilitates compliance with national and international legal requirements
- ✓ It forms the basis for planning and decision-making processes,
- ✓ Improve the efficiency and efficiency of construction activities,
- ✓ Increase cooperation and confidence among project stakeholders.

II. METHODOLOGY

Organizations from many industries have recognized the increasing importance of risk management, and many companies have established risk management departments to control the risks they are, or might be, exposed to. The construction industry and its clients are widely associated with a high degree of risk due to the nature of construction business activities, processes, environment and organization [8].

In the past four decades, research on risk management has grown considerably in the construction industry "Ref.[8]" due to the fact that construction projects are permanently exposed to risks and are perceived as projects with greater inherent risk due to the involvement of many stakeholders [10].

With the effective use of the Risk Management System, risks can be identified before they occur and possible effects can be avoided.In other words, proactive management approach should be adopted instead of reactive management approach. With the proactive approach, it is possible to take action before the risks occur, not after the risks have arisen.It is necessary to identify the risks that can be encountered in the process from the beginning to the end of the projects, to evaluate these risks, to completely prevent the risks or to determine the actions to reduce their effects.

In this study, possible risks of Railway System Projects built in Istanbul have been analyzed.

The Railsystem Projects are long-term, complex, large public projects with high uncertainties and correspondingly high risk diversity. The main risks that may be encountered in the Rail System Projects are distributed to the participants and their responses are given in the requested Risk Assessment

Surveys. For this reason will not be mentioned here again. Categorizing risks can be a good way to manage it more easily.

TABLE-1.IMPACT ANALYSIS

Impact Level	*Impact Band*	*IMPACT Financial*	*IMPACT Schedule*	*Performance /Quality*
1	Low	X <=%1	It will not prevent you from being in the process of working, or it will not affect you for more than 3 months.	Jobs that are abundant in the work schedule and that are possible with the actions to be taken to close the delay during the program
2	Medium	%1< X<%5	The completion of the work will last between 3 and 6 months.	Work that does not interfere with the provisional acceptance, which is available in the program of work and which can be delayed by the actions to be taken to close part of the program during the program
3	High	%5< X<%10	The work can be completed between 6 and 9 months	Jobs that have an effect on the work schedule, which can delay the admission.
4	Very High	%10< X<%20	Affecting completion of work for 9 to 12 months	Delays ad hoc acceptance, affects the work schedule, and requires a change of method.
5	Extremely High	X>=20	Having completed the work more than 12 months	Risks that require re-planning for the delivery of the work, that require action to be taken seriously, proposed action and presented with a set of solution planning proposals

When assessing the likelihood of risk occurrence, the following evaluation table will be used.

TABLE-2.PROBABILITY ANALYSIS

Level	*Band*	*Minimum %*	*Maximum %*	*Likelihood*
1	Low	%0	%5	The possibility of coming to the plaza requires extraordinary conditions, and it is not expected to occur even in the long run.
2	Medium	%5	%40	It is not expected to appear and may appear over the years.
3	High	%40	%70	A short chance to come up in the short term may arise in months or years.
4	Very High	%70	%95	It may occur in weeks or months.
5	Extremely High	%95	%100	They are almost certainly the risks to be encountered.

The risk level, also called "Risk Score" value, is analyzed by the following sample matrix.

TABLE3.RISK SCORING MATRIX

Risk Scoring &PrioritisationMarix							
Probability / Likelihood	5	Ex High	11	16	20	23	25
	4	Very High	7	12	17	21	24
	3	High	4	8	13	18	22
	2	Medium	2	5	9	14	19
	1	Low	1	3	6	10	15
		Band	Low	Medium	High	Very High	Ex High
		Impact / Consequance					

Risk effects can be handled in two categories as direct effects and indirect effects. Direct effects are those where the effects can be detected immediately or in a short time when the risk is realized and these effects can be measured. An example of direct effects; Expiration of project duration, cost increases, quality problems (faulty, incomplete manufacturing, etc.). Recognition of indirect effects and results (effects) take place depending on time. It is difficult to measure these effects. Examples of indirect effects; Prestige loss, disputes, claims, user complaints, business difficulties, etc "Ref [11]".

III. Application And Analysis

The purpose of risk identification is to identify risk,to classify the possible risks that a large infrastructure project may face [7].

The following risks were used in the survey study:

1. DESIGN RISKS
   a) Design Errors (incorrect design entries and assumptions, design oversight and lack of verification activities)
   b) Delays in the Design Business Program (Design, behind schedule)
   c) Interdisciplinary Design Coordination Failure
   d) Lack of Communication Between Designers and Administrators, Consultants and Contractors
   e) Design Changes During Construction

2. INTERNAL RISK
   a) Incorrect and incomplete forecasting of budget (uncertainties etc.)
   b) Cash Balance for receipt (payment difficulty)
   c) Contractor Cash Balance (payment difficulty)
   d) Risks Caused by Contractual Conditions
      i. Project Scope (uncertainties, changes)
      ii. Project Time
      iii. Costs and Payment Model (unit price, lump sum, etc.)
      iv. Sharing of responsibilities (do, design-build, build-operate-transfer) to.
      v. Guarantees
   e) Prolongation of decision-makingperiod

3. EXTERNAL RISK
   a) Change in InterestRates, CreditRequirements
   b) Exchange Rate Changes
   c) PriceIncreases (inflationandcommoditypriceincreases)
   d) LegislativeChangestoaffecttheproject (tax, accounting, import, laborlawandotheradministrativeand legal legislation)
   e) Communicationwiththepublicandthepublic (criticismandreactions)

4. ENVIRONMENTAL RISKS
   a) Problemsexperiencedduringtheexpropriationprocess
   b) Preservation of HistoricalandCulturalHeritage (archeologicalexcavationnecessity, projectchangeetc.)
   c) Negativeenvironmentalimpact of theproject (damagetopublicareas, trafficjams, damagetothirdpersons, security of goodsand life, dust, noisepollution, etc.)
   d) Construction of infrastructuredisplacements
   e) Dependence of the Project (permits, instructions, protocols, approvals, etc. to be obtainedfromtheofficialinstitutionandthirdpartiesforstartingandfinishingtheworks)

5. ORGANIZATIONAL RISKS
   a) RapidStaffCirculation (staffentry-exit)
   b) Communicationbreakdownbetweenprojectstakeholders (Administration, Consultant, Contractor, Designer) (Documentandinformationflow, coordinationmeetings, accurateandtimelyreporting, etc.)
   c) Delays in vehiclesupply
   d) Disruptions in thesignalingsystem
   e) Lack of test andcertificates

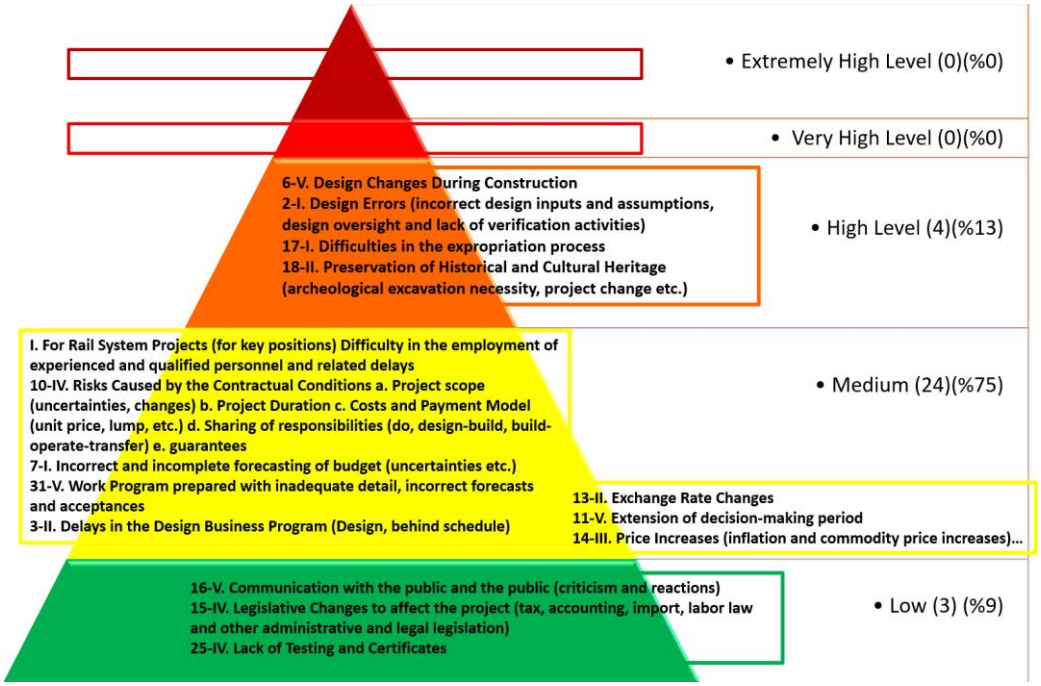
6. PROJECT MANAGEMENT RISKS

a) ForRailSystemProjects (forkeypositions) Difficulty in theemployment of experiencedandqualifiedpersonnelandrelateddelays
b) Effectiveoperation of OccupationalHealthandSafety Management System
c) Inadequatequalityconditions (insufficientqualityassuranceandqualitycontrolsystems, qualitydocuments, recurringnonconformities, etc.)
d) Inabilityto define qualityrequirements (incompleteanduncertainties in technicalspecifications)
e) Work Program preparedwithinaccurateforecastsandacceptancesthatare not in sufficientdetail
f) Adaptation Issueto New Technologies (lack of experiencedstaff, additionalcosts, changeresistance, etc.)

According to the questionnaire, 31 Risks determined by the participants and the results obtained by the participants are given below according to "Risk Score: In this study, "qualitative risk" analysis method was used to determine the risk perception using the 5-point indicator as the risk assessment method.

The risk map at the end of the trial is presented in Fig. The four major risk parameters identified as high level risk by experts participating in the trial are shown in the figure.

Figure 3.Risk Assessment Map for Railway Systems



IV. Conclusion

With this work, we analyzed which phases of a Railsystem Project passed. We have exchanged views with all stakeholders. We have included all practitioners who face risks in their work with expert assessment.

When we analyze the risks; problems related to design change, site delivery and expropriation, archaeological excavations, design delays, infrastructure failures, problems with the work program and similar risks were assessed in the high risk group.

Solution suggestions for reducing these risks have been discussed with experts. Several suggestions have been made in this context. First, the concept of "the results of uncertain projects can not be predicted" has been developed. This term can provide an opportunity to develop a correct approach for the projects. The right design and plan will reduce the risks that can occur. Birth. Working with Supervisor for the correct coordination of the workings should be started from the first step. Supervisor must work at all stages of the project, which will be important in terms of sustainability of the work. Uncertainties in the projects should be reduced. In the construction phase, only the main project should be found and project changes should not be accepted. Innovative innovation practices like building information modeling should be continued.

In the whole of Istanbul, it is necessary that all of the project management processes for the turn-key delivery of the Rail System projects, which are under construction and planned to be carried out, are carried out in the target time, under the predicted cost and quality standards,

The main objective is to define and evaluate the risks that we may encounter in the timeframe from initial to delivery of the Project with Risk Management which is one of the project management information fields and to determine the actions to prevent or mitigate these risks and thus reach our targets as we have anticipated.

Another important issue is that all project stakeholders receive adequate support from their affiliated Senior Management staff so that Project Management practices can be implemented effectively and efficiently at every level.

Dissemination of web-based management portals for Project Management applications; it will provide access to and sharing of important information about the project and the project as well as archiving the information.

REFERENCES

[1] Istanbul Metropolitan Municipality (IMM), "Annual Report", 2017, Istanbul, Turkey.

[2] Johann Dréo, "Sustainable development", 9 March 2006. *https://en.wikipedia.org/wiki/File:Sustainable_development.svg*

[3] J. Shethna, "Effective Stakeholder Management", Sept. 2016, *https://www.educba.com/effective-stakeholder-management/*

[4] Rusul M. Kanona, Arab Academy for Banking & Financial Sciences, Fall 2007

[5] Istanbul Metropolitan Municipality (IMM), Department of Rail Systems "Rail System Projects", unpublished.

[6] A.F. Serpellaa, X. Ferradaa, R. Howarda and L. Rubioa, "Risk management in construction projects: a knowledge-based approach", Procedia - Social and Behavioral Sciences 119 (2014) 653 – 662, 2014, [27th IPMA World Congress]

[7] T. Wang, S. Wang , L. Zhang , Z. Huang, and Y.Li, "A major infrastructure risk-assessment framework: Application to a cross-sea route project in China", International Journal of Project Management 34 (2016) 1403–1415, 2015

[8] A.S. Akintoye, M. J. MacLeod, "Risk analysis and management in construction", International Journal of Project Management Vol. 15, No. 1, pp. 31-38, 1997.

[9] Chapman, C., & Ward, S. (2011). How to manage project opportunity and risk. Jonh Wiley and Sons Ltd.

[10] A.F. Serpellaa, X. Ferradaa, L. Rubioa and Sergio Arauzoa , "Evaluating risk management practices in construction organizations", Procedia - Social and Behavioral Sciences 194 (2015) 201 – 210 , [28th IPMA World Congress, IPMA 2014, 29 September – 1 October 2014, Rotterdam, The Netherlands].

[11] N. Banaitiene and A. Banaitis, "Risk Management in Construction Projects", 2012 Banaitiene and Banaitis, licensee InTech., Chapter 19, http://dx.doi.org/10.5772/51460.