STUDY OF INTEGRATED RISK MANAGEMENT IN INFRASTRUCTURE PROJECTS

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Abstract : A project manager can accomplish any plan. Integration is important for project managers who essentially schedules task, evaluate resources, buy products, and bring about outcomes for different project activities. ISP consist of distinct elements with strong influence on design and execution: key material is earth or rock, large line works, effect of weather, works under traffic, problematic logistics, separation of design and execution, public tendering and funding, public attention and client monopoly. Key stages of ISP are: practicability, technical design, legal approval, tendering and execution. Infrastructure projects are liable to many risks because of their uncertainties. Cost and time overruns seem to be normal. They are partially caused by disturbances or failures, which may be avoided or reduced by a systematic risk management.

The importance of risk management as integral part of the project planning. They describe the principle of risk management and important risks on the client's and the contractor's side. "integrated risk management approach" (IRM) outlines a standard for a holistic risk management for infrastructure projects with the following 9 elements i.e. a) Holistic risk management, b) Client as process responsible c) Project life cycle orientation d) Minimizing concept e) Risk transparency f) The risk list g) Cooperative risk h) Risk controlling i) Risk audits.

***IndexTerms* - Project Management, Integrated Risk Management, Infrastructure, Risk Management**

I. INTRODUCTION

The procedures & activities desirable to integrate various elements of PM, which are identified, defined, combined, unified and coordinated within the project management process groups is called Project Integrated Management.

- There is no solitary way to manage a project
- Project Management is an iterative progression
- The utmost important thing in any project is to satisfy the stakeholder's necessities and expectations
- Project Integration Management must help classify and define the project expectations set by stake holders.

What Integration Mean in Project Management?

A project manager can accomplish any plan. Integration is important for project managers who essentially schedules task, evaluate resources, buy products, and bring about outcomes for different project activities. Integration in project management means assessing and making trade-offs amongst stakeholders, overlapping processes, or competing activities to successfully reach the goal.

Few projects touch only a single procedure or situation. You need project integration management once processes and people interact. For example, you it in the following situations:

- When project documents from diverse departments must be consistent
- When the project's work must be integrated with the continuing functions of the association
- When deliverables from diverse departments or specialties (such as civil, mechanical and electrical engineering) must be integrated
- When the project's scope and the product's scope essentially be integrated.

Specifics of Infrastructure Projects

ISP consist of distinct elements with strong influence on design and execution: key material is earth or rock, large line works, effect of weather, works under traffic, problematic logistics, separation of design and execution, public tendering and funding, public attention and client monopoly. Key stages of ISP are: practicability, technical design, legal approval, tendering and execution. The public participation in the legal process makes them very problematic to plan. The tasks in ISP are numerous, as shown in Figure

1. Most of the projects are designed and executed in a standard form, where the project proprietor or his consultants do the design of the project in all technical and legal phases. The authorization of work originates after a longsome procedure with involvement of many authorities, citizens and NGOs. It demands a detailed design that belongs to the client's risk sphere. Dependant on this, the financing is provided by the client or by a governmental institution. The customer calls for tenders and assigns it to the most economical offer. A single or a general contractor then executes the project work. After completion the client takes it over for service.

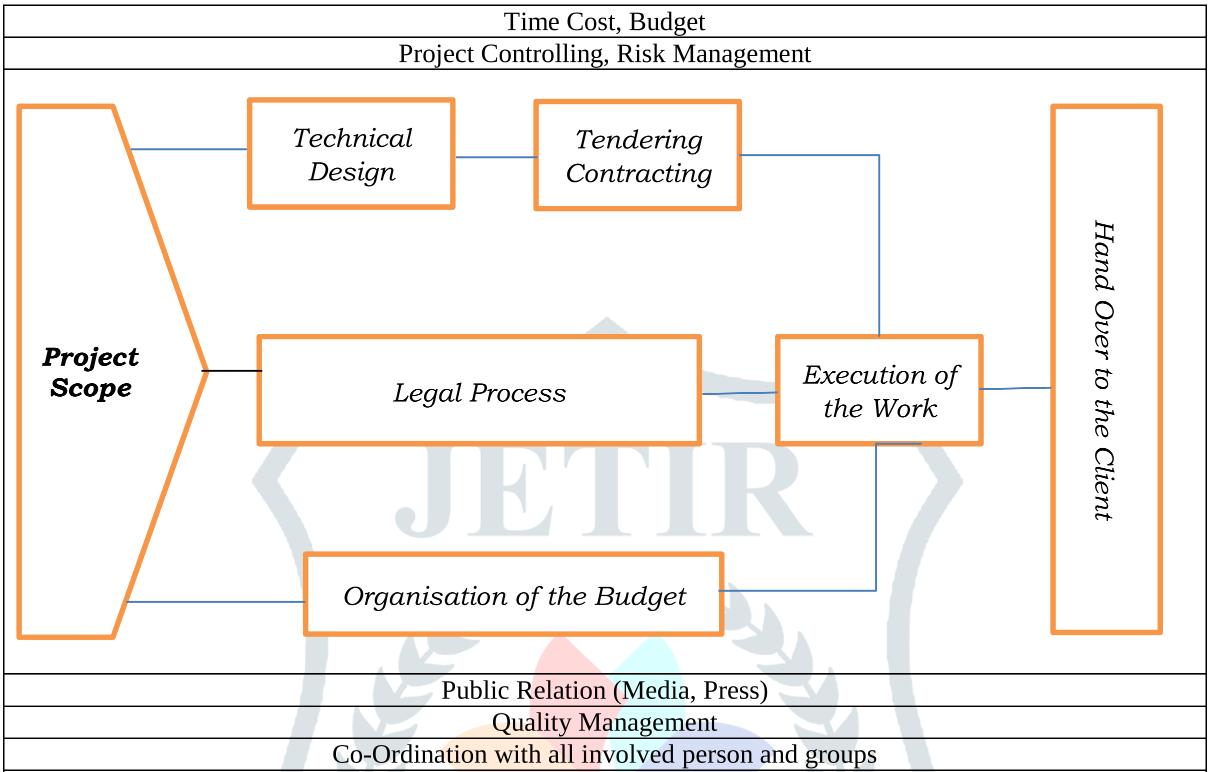

Fig. 1. Project tasks in infrastructure projects

This technique separates client and contractor in two parties with the same working direction, but with different objectives — optimizing the profit. This form is strongly influenced by the governmental regulations and by the specified legal process.

Infrastructure Projects and costs

ISP prerequisite is lot of public money and so they are for public. Or, they become public, when the costs run over. There are numerous examples for cost overruns in big ISP. Hartmann and Ashraf (2004) mention to an international inquiry that about 50% of the examined construction projects had cost overflows of 40 up to 200%. Flyvberg et al. (2009) indicate between 25% and 196%; they assume that a substantial risk for overrun exists and cannot completely be eliminated, but moderated. Schach et al. (2006) analysed large railway projects and state cost overflows until 350%. Hertogh et al. (2008), concluded, that cost overrun start's during the design phase.

The costs are influenced by many and various risks and by the quality of risk management in a project from its birth to the start of service. The handling of risks influences the total cost of a project as well as the cost reliability. Therefore, it is critical to identify all risks and to minimalize them as much as practically possible.

Risks in infrastructure projects

Infrastructure projects are liable to many risks because of their uncertainties. Cost and time overruns seem to be normal. They are partially caused by disturbances or failures, which may be avoided or reduced by a systematic risk management (Hertogh et al. 2008, Flyvberg et al. 2009). Hertogh et al. (2008) state that large infrastructure projects exist in a very dynamic and complex environment which causes various risks, which are hard to calculate. They state as well that the application of new solutions or new technologies demands adapted risk analysis and particular supplements on costs and time.

All risks reason's to consequences in cost, time, quality and investor satisfaction. Cooke and Williams (2009) categorized risks into feasibility, design, financing, tender, time, commerce and methods. Girmscheid and Busch (2008) categorize into legal, time, finance, technique, management and environment. Chapman (2001) diverges amid the classes environment, industry, client and project. In this study we have tried and classified risk into seven clusters in order to treat them in design (d) and execution (e): technique (d, e), legal approval (d), society (d), management (d, e), weather (d, e), contractor risks (e) and complexity (d, e).

1. Actual State in Risk Management

1.1 General review

Cooke and Williams (2009) indicates the importance of risk management as integral part of the project planning. They describe the principle of risk management and important risks on the client's and the contractor's side. Harris and McCaffer (2006) consider that losses and wastage from uncertainty in a project can be moderated by rigorous application of risk management techniques as a

part of production process improvement. They mention the principal elements of risk management. For Girmscheid and Busch (2008) systematic risk management is a key competence for successful contractors. They describe all aspects and elements of risk management with focus on the contractor's aspects. Their methodical project risk management is a managing skill, which reinforces the company. Dayyari (2008) developed an approach for a feedforward- and feedback-oriented risk management for contractors. Chapman (2001) states that project risk management can provide a decisive competitive advantage to building sponsors. He defines the main steps of the process of risk identification and valuation for design projects.
Akintoye and MacLeod (1997) observed that formal risk analysis and management techniques are rarely used due to a lack of knowledge and to doubts on their suitability. They showed that risk analysis of construction projects is seldom and formally invited by clients. Walewski and Gibson (2003) found out that only few project participants have an understanding of all the risks involved. Often individuals do not know to whom the risks are allocated and there is no mutual view of risk since owner, designer, and constructor have differing project goals and objectives, and historically adverse relationships are usual. Flyvberg et al. (2009) describes that too many feasibility studies adopt projects to exist in a predictable world of cause and effect where things go according to plan. German regulations and codes for design and planning of ISP (HOAI 2009, BMV 1985) contain no standards for risk management. Codes as ISO 31000 give solitary overall recommendations for the risk managing process.

1.2. Results from the practice

In addition to the above-mentioned literature, results of field studies, details about the use of risk management in the German construction world. In a study about cooperation (Spang et al. 2009/2) half of the participants (clients and contractors) see the actual condition as not cooperative and 44% do not see a winner.

Fig. 2. Tender risks (Spang et al. 2009/2).

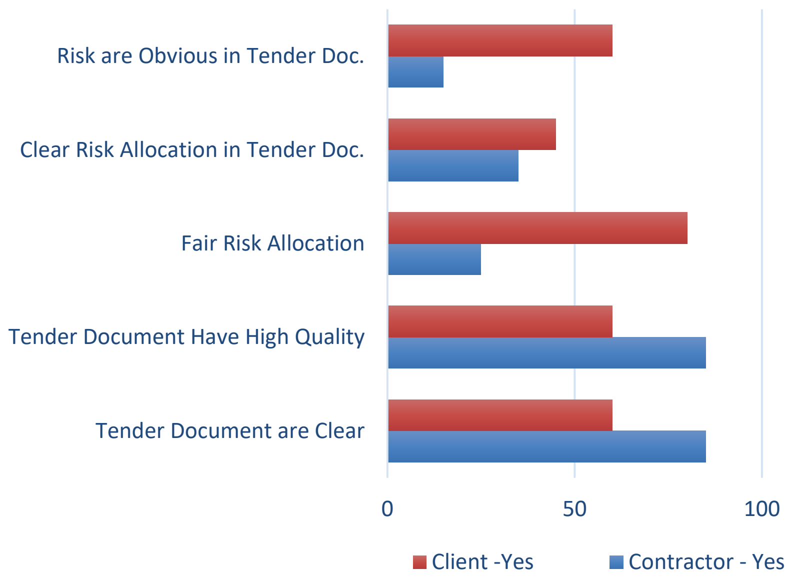

Fig. 2 Demonstrates typical critical points about risk allocation in the relationship client-contractor.
To resolve the cited risk problems contractors and clients recommended better descriptions and allocation of risks, clear and fair tender documents and better-quality design.
A study with contractors (Spang et al. 2009/1) demonstrations that only 43% of them have a project risk management and 65% of these do it methodically. Problems are a lack of culture (36%) and organizational faults (29%).
In a study with consultants and clients 74% of the participants see medium up to high need for changes in the design regarding risk management (Spang and S ¨oz ¨uer 2009).
The study of 15 large infrastructure projects in Europe (Hertogh et al. 2009) resulted in best practices to control risks: (a) project changes lead to new risks, (b) cooperation between client and contractor facilitates risk control, (c) risk management must be an obligatory element in all phases of an ISP, (d) an holistic risk approach is necessary, (e) proactive stakeholder management reduces environmental risks, (f) uncertainties must become transparent and must be discussed with all participants, (g) open communication and adequate organizational culture are predominant for a successful risk management.

1.3 Conclusions in the current situation

With respect of the study in the above, the subsequent deductions can be drawn for design and execution of ISP:

(a) The state of the arts for the basic risk management elements is well researched and known.
(b) Various publications describe risk management in the execution phase by contractors.
(c) No general standards for risk management exist for the design or for the execution phase.
(d) A life cycle oriented holistic risk management with client, consultant and contractor does not exist.
(e) Risk management is not a usual component of the design phase of ISP.
(f) Cost pressure often inhibits risk management and risk buffers.

(g) Clients and contractors try to reduce their risks by everchanging them to the each other.
(h) Contractors use risk management in the bidding phase, but they have no knowledge of risks in the design phase.
(i) Clients often have no systematic knowledge about the risks in their projects.
(j) In the design phase, as the most important project phase in respect of risk minimizing, risk management must be obligatory and standardized.

2. Integrated Risk Management Approach

The preceding illustrates that there is good knowledge about the elements of risk management and for risk management in the execution phase. Nevertheless, no general standard is there in the design phase and no holistic, life cycle orientated risk management exist. So, this approach tries to fill this gap and aims at the following objectives:

1. Reduce project cost and time by avoiding risks or reducing risk probability.
2. Minimize cost and time overruns by reducing the consequences from risks.
3. Improve cost and time steadiness by a risk management standard for the project life.

This "integrated risk management tactic" (IRM) outlines a standard for a holistic risk management for infrastructure projects with the following 9 elements.

Holistic risk management means integration and participation of all relevant parties (client, consultants, contractors) in the above-mentioned objectives. Every party must respect all the elements of the IRM. The IRM must be applicated in all project phases, to all relevant structural elements and from one phase to another. The application of IRM, as a compulsory standard in every project, must be assured by the project owner. By this means, risk shifting becomes impossible and all project risks will be minimized on behalf of all participants.
Client as process responsible. The customer as the owner of the project has the utmost interest to minimize the risks of their project. He is the only one attending the project from its start to the end. Hence, they must play the dominant role in risk management, i.e. coordinate all players and control the processes. He describes the standards, gets and examines reports, opens the gates at the end of each phase and operates the risk list. He defines the lower limits for the included risks and the risks, for which other participants are responsible.

Table 1 gives an overview of the various tasks
(pr = process responsible, rb = risk bearer, d = decider, a = adviser, ri = influence on risk)

Table 1. Tasks of the participants of an ISP.

	design	tendering	execution
Client	pr,d,rb	Pr,d,rb,ri	Pr,(d,rb)
Consultant	ri	ri	--
Contractor	--	ri,rb,(d)	ri,rb,d
Expert	a,ri	a	a,(ri)

Project life cycle orientation. RM essentially be done as process oriented in an end-to end process from the feasibility to the start of operation. Risks must be minimalized from the start because suggestibility decreases with project progress. The knowledge about identified and treated risks must be transferred from one phase to another, to assure an optimal risk treatment. In the design phase prevention is predominant. Singular risks must be avoided or reduced. At the end of each phase a decision about how to continue must be made in terms of a risk audit. In the tendering phase the remaining risks and joined actions must be defined with the help of the bidders. In the execution phase a risk management team takes a central role. Risks must be an imperative component in deciding alternatives.

Minimizing concept means that each identified risk has to be minimized as far as possible (technical, legal, temporal) and reasonable (economical, life protective). First, risks have to be avoided, as far as not possible they have to be decreased in the sense of risk incidence and risk consequences, they may be shifted (to another party or to an assurance) and finally the resting risks have to be taken.

Risk transparency is a vital base for risk minimizing. It means that knowledge and information around risks (livelihood, boundary conditions, consequences, activities) must be exchanged between the participants during the project. This transparency demands an open and cooperative communication in the project. Periodic reports and meetings are included as well as event reports and meetings and a central IT based information centre. All risks (above has a defined limit) must be listed in a dominant risk list. Finally, all residual risks must be impartially allocated in the contract. It is a vital aspect of the IRM that all related parties are informed about risks and discuss consequences and treatment.

The risk list contains all risks, consequences and measurements, which have been identified along the project life. The list is moved from one phase to the other and passing the risk audit. At the end of the design phase the list contains information about all risks in the project life. For the remaining risks it is completed by proposed measurements and risk allocation and is part of the tender documents. Each bidder has to assess the risks and the measurements and to accept, to change or to complete them and add prices to the measurements. The risk list with intended measurements becomes part of the contract. It is continued in the execution stage by the risk agency. The risk list is completed by an activity matrix according Table 2.

Cooperative risk management amid client and contractor during the execution phase is an important element for a successful handling of project risks. It starts with transparency in the tendering phase. The client informs about all remaining risks in the tender documents and the bidders must mention all risks they see in the project and the measurements to be done with. These may be events to be done by the contractor and to be paid by the customer as well as a risk surcharge to be paid by the client. Next step is a fair risk apportionment in the contract according to the principle: each party takes the risks it can manage best. The client makes a proposition in the tendering documents, which can be discussed between bidders and client before fixing the contract.

Table 2. Activity matrix for risk categories.

		Additional fee	Decision activities	new price agreement
A	Risk Domain (Contractor)	--	Con	--
B	Risk Domain Client (list)	+	Con + cl	--
C	Risk Domain Client (Not List)	+	Con + cl	+
D	Allocation Open	?	Con + cl	?
E	Force Majeure (List)	+	Con + cl	--
F	Force Majeure (Not List)	+	Con + cl	+

All known risks, the joined measurements and surcharges and the allocation must then be listed in the contract. Based on this list a risk committee, consisting of client and contractor is responsible in the execution phase for controlling known risks, identifying new risks and fixing measurements and responsibilities. For solving conflicts, a conflict resolving system is useful, consisting of decision steps, a steering committee and eventually an adjudication system

Risk controlling is a principal task for the project owner, supported by the other participants, to be done continuously during all project phases. It is based on the risk lists which have to be modified and completed continuously by all parties. Periodically (e.g. weekly) the known risks and the measurements have to be checked and intended activities have to be analysed in order to identify new risks. In the design phase risk controlling is an element of the risk audits. Special singular risks have to be supervised.

Risk audits should be mandatory elements for every project execution phase. At the end of a phase the customer, aided by his partners, must prove the risk management process and the remaining risks and to decide if he will give clearances for the next phase (with or without requirements) or not. Another job of the risk audits is to choose about risk measurements and costs, or time buffers related to known risks.

Conclusion:

We can reduce risks, risky activities and risky techniques systematically. The need for standards, for an obligation for systematic risk management and for a holistic risk treatment is evident. The presented method will be an important first step. Further investigation is necessary to define and develop the comprehensive processes, devices and guidelines. Simultaneously, changes in organizational culture are necessary in client and contractor organizations for assuring the transparency we need. Cooperative relationships between client and contractor may contribute to a joined risk treatment.

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