

# Identifying the variables influencing project construction essay



Ganesh Vishwakarma\*\* and Dr. Manvinder Singh Pahwa\*The Indian Steel Industry stepped down in 1907 with the setup of maiden large scale in Jamshedpur by TISCO (Tata Iron and Steel Company). In last more than 100 years, it has faced many ups and downs. Before liberalization in 1991, there was market insulation and large scale capacity was reserved for PSUs. At that time, SAIL and Tata Steel were the only public and private players respectively. The production and prices were also determined and controlled by the government. Since then, the Indian steel industry has evolved as one of the major core sector in the Indian economy with a significant impact on infrastructure development and there by the economy of the country. The Indian Steel market has total revenue of \$46. 8 billion in 2010 representing a compound annual growth rate of 17. 4% for the period spanning 2006-2010. The performance of the market is forecast to accelerate with an anticipated CAGR of 24% for the period 2010-2015 and is expected to drive the market to a value of \$137 billion by the end of 2015. (Datamonitor, 2011)India is today witnessing growth of large number of integrated large scales both green field and brown field. As on date India is a net steel importer, but in the near future with commitments, for such huge capacity coming up will become a net exporter of steel. With the huge iron ore reserves of very high quality, the country will always have an edge in the world market provided that the production lines are made more and more energy efficient. The liberalized industrial policy and other initiatives taken by the government of India have given definite impetus to the private players. This has led to modernization / expansion of existing plants and a large number of new / green field plants coming up. New modern plants incorporating cost effective, state of art technology are coming up in different parts of the

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country at places close to natural resource supplies. The great challenge now is timely completion and execution of these new projects so that the capitalization of the huge investments starts at the earliest without cost overrun. The last two decades saw the 'development sector' booming worldwide, especially in developing countries that are rich in natural resources which has pressurized the governments to develop large scale projects that can accommodate newly emerging developments (Baydoun, M, 2011). Due to lack of necessary expertise and financing, governments in most developing countries are joint venturing with private sector for developing and commissioning of these projects (Koppenjan and Enserink, 2009). Every project passes through a number of phases and each phase has a unique purpose, duration and scope. Risk and uncertainty are inherent in all the phases through which the construction project passes, from demonstrating the need to do operation and maintenance. Latham (1994) said that no construction project is risk free. Risk can be managed, minimized, shared, transferred or accepted. It cannot be ignored. Risks do not appear only in major projects. Although size may be a cause of risk, complexity, construction speed, site and many other factors that affect time, cost and quality to a greater or lesser degree cannot be overlooked. There are many risk variables associated with construction projects which vary from project to project. Therefore it can be said that the risk variables are unique to the type of project they are associated with. The present study attempts to identify various risk variables which may affect the construction of steel plant in India.

## **Objectives of Research**

The objective of the research work are as follows: To understand the relevance of project risk and its uniqueness associated with each type of project. To identify the risk variables associated with construction of steel plant in India.

## **Research Methodology**

The research methodology used in this research paper is exploratory as the researchers have used the archival method of literature review to fulfill its objectives. The variables affecting the project risks of establishing or construction of steel plants in India have been identified by immense literature review by the researchers. In all there are 73 variables identified, enclosed as Appendix A. A questionnaire was prepared and administered to 30 top level experts involved in construction of steel plants who were identified by judgments method. These experts were asked to rank the variables on the basis of the importance. As a result of ranking, these identified variables have been either merged or reduced. The finally arrived list of variables is the outcome of this research paper which will be utilized for further research.

## **Review of Literature**

Risk is defined by (Collins Concise Dictionary, 2006) as " the possibility of bringing about misfortune or loss" which also bear the same meaning as " danger, hazard, pitfall, peril and uncertainty". Taking this definition into economic perspective, risk is future uncertainty which needs to be managed in order to avoid variety of consequences ranging from negative surprises to

permanent loss (Triantis, 2000). Hence, it is important to emphasize risk assessment in managerial activities. Risk is the function of the probability and outcomes of an uncertain happening. Although the concept of " risk" is defined and approached differently by different points of views, within the context of construction projects, it is generally defined as the probability of occurrence of events that may positively or negatively affect the project's predefined objectives (Crandall & Al-Bahar, 1990) ; (PMBok, 2000); (Baston, 2009), and (Edwards, 2009). Even if risk may have both adverse and favourable consequences according to this definition, risk-based approaches are mostly concentrated on its negative outcomes. Risk management process is generally defined as an iterative process that starts with identification of risk factors, followed by qualitative and/or quantitative assessment of risk impacts on the project, and finally, development of risk mitigation strategies to maintain an optimum risk-return structure between the project participants (H. Zhi, 1995); (Wang, 2004); (Han, 2008), and (Edwards, 2009). Project Risk Management (PRM) is the systematic process of identifying, analyzing, and responding to project risks PMI (PMBok, 2000). Supporting the integration of PRM processes with companies' routines and with project environments, (Sanchez, 2005) claims that the main objectives of risk management are oriented toward the above mentioned three tasks. For the purpose of feasibility assessment and strategic decision making, is important to identify the most probable risks at pre-construction stage of the candidate project. Also, exhaustive identification of potential risks that may significantly affect project and corporate objectives will lead to proactive management decisions rather than corrective responses to raised problems.

On the other hand, subsequent phases of risk management process  
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(assessment, analysis and responding) are carried out based on the identified risk factors. (Al – Bahar and Crandall, 1990; Wang et al., 2004). Risk management practices will be beneficial for the companies only if the products of its initial stages (identification and assessment) are reliable and inclusive. (Bajaj et al., 1997; Chapman, 1998). Risk identification and assessment phases are considered as most important phases of systematic risk management process (Crandall & Al-Bahar, 1990) (Ward, 1999); (Bajaj et al., 1997); (Russell A. D., 2003); (Wang, 2004); (Maytorena, 2007); (Baston, 2009); (Edwards, 2009)ICRAM-1 model (International Construction Risk Assessment Model) is another systematic approach toward the assessment of potential risk factors in international projects. It categorized 73 tangible and intangible risk indicators under three interrelated levels, namely " macro environment", " construction market" and " project" levels (Hastak & Shaked, 2000).(Baloi & Price, 2003) identified several global risk factors affecting cost performance of construction projects through detailed literature review. Assessment and management issues of such identified risks were examined for further modeling purposes. Claiming global risk factors to be the most critical ones in international projects, they classified potential risks under the headings of " organization-specific" (internal environment), " global", and " acts of God" (external environments). (Zoysa and Russell 2003) have developed a knowledge-based approach for identification of possible risks associated with a new large infrastructure project by means of two types of knowledge structures, namely a reusable document comprising of stored past experiences, and rule sets defined for reasoning and similarities used in determination of project attributes and characteristics of the environment.

As an outcome, a project-specific updatable risk register is developed  
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comprising of a list of probable risks under diverse categories. They have mentioned " process", " physical", " socio-economic" and " organizational" factors to be the most dominant risk areas in infrastructure projects. (Choi and Mahadevan 2008) have proposed an updating approach for identification of a limited number of most critical project-specific risks which are obtained referring to large amount of data available. These project-specific identified risks will be used as the inputs for their developed risk assessment methodology. (Tserng et. al., 2009) developed an ontology-based process-oriented risk management framework. It is claimed that reuse of risk-related knowledge and past experiences of the experts through this validated knowledge extraction model can enhance the performance of various risk management processes. The large scale projects, the efforts of identification and assessment of risks normally done at the pre-construction or pre-contract stages of the large scale projects, in which very limited data and information are available about the upcoming project condition. Therefore, it is highly uncertain to make predictions which may make the decision process quite subjective. (Choi & Mahadevan, 2008)The study done by (Oko John Ameh & Emeka Emmanuel Osegbo , 2011) shows relationship between time overrun and labour productivity. The study concludes by recommending that early appointment of project managers could ensure proper management of both the human and material resources that could guarantee improved productivity and ultimately save projects from time overrun. Time overrun is the time during which some part of construction project is completed beyond the project completion date or not performed as planned due to unanticipated circumstances. (Bramble and Callahan , 1987)(Pinto and Mantel 1990) identified the risk variables through their research study viz. <https://assignbuster.com/identifying-the-variables-influencing-project-construction-essay/>

project scope, managerial goals, time planning and management, communication with owner etc. Zhi(1995) through his study identified country environment, characteristics of company and project conditions. Wang et al. (2000) identifies variables such as Political risks as major variable and further classified risks into six groups such as regulation and law changes, corruption, delays of permit, force majeure, etc. (Chan et al 2001), provided for performance of design build projects as critical success factors for the project. (Baloi & Price, 2003) identified international risk in more detail, by grouping them into design, competitiveness, customs and cultures, construction, economy conditions. The existing approaches to risk management have many shortcomings, namely failure to capture uncertainty effectively , they are prominently quantitative and neglect the qualitative side of risk; they build on statistical decision theory which is largely prescriptive and does not take experience and judgement into account; most decision making problems in construction incorporate judgement and experience. (Daniel Baloi and Andrew D. F. Price, 2001)Okpala and Aniekwu (1988) considers factors like Price fluctuations, additional works, delays, inaccurate estimates, fraudulent practices and kickbacks, shortening of contract period and insurance. Kaming et al., (1997) considers factors like Tender price increase due to inflation, change orders, financial constraints, owner's lack of experience, materials, weather, labour, contractor and combination, unpredictable weather conditions, cost increased by inflation, inaccurate quantity take-off, labour cost increased due to environmental restrictions, lack of experience of project location, lack of experience of project type and lack of experience of local regulation.

Jackson (2002) identifies factors like Poor project management, unexpected  
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ground condition, design development, information availability, design brief, estimating method, design team performance, time limit, claims, commercial pressure, procurement route, external factor and people. Frimpong et al., (2003) identifies factors like Planning and scheduling deficiencies, deficiencies the prepared cost estimates, inadequate control procedures, delays in work approval, waiting for information, mistakes during construction, delays in inspection and testing of work and cash flow during construction, frequent breakdowns of construction plant and equipment, shortages of technical personnel, labour shortage, monthly payment difficulties, poor contract management, shortage of materials, plant/equipment parts, contractor's financial difficulties, low bid, material procurement, imported materials, late delivery of materials and equipment, escalation of material prices, slow decision-making, inflation, difficulties in obtaining construction materials at official current price, ground problem, bad weather and unexpected geological conditions. Reedy (2005) Design/project scope change, contract tender price higher than original estimate, design scope change - drainage, quantity increased measure, design scope change - pavement materials/depth, latent condition - remove and replace unsuitable material, design scope change - environmental issues, constructability - under traffic, services relocation costs, material cost increase - pavement materials, constructability difficulty costs, resumption/accommodation works, project administration cost increase, wet weather effects/rework, latent condition - rock encountered, remote location costs, specification change, extras unspecified, project acceleration requirement, design scope change - safety audit requirement, cultural heritage issues, latent condition - requires design change, material cost

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increase - principal supplied components or materials, government initiative - contribution by developer, latent condition - additional stabilizing, material cost increase - earthworks, design scope change - design error, material/process quality issue, design - reduced scope change saving money, design preload requirement, design change to sub-grade, government initiative - employment continuity, government initiative - contribution by local. Koushki et al., (2005) Government, government initiative - contribution by rail, material cost increase - asphalt, material cost increase - bitumen price, contract failure - new contract establishment costs and contract. Omoregie and Radford (2006) identified price fluctuation, financing and payment for completed work, poor contract management, delay, change in site condition, inaccurate estimate, shortage of materials, imported materials and plant items, additional works and design change. Azhar et al.,(2008) fluctuation in prices of raw materials, unstable cost of manufactured materials, fraudulent practices and corruption, mode of financing and payment for completed work, improper planning, high interest rates charged by bankers on loans received by contractors, frequent design changes, long period between design and time of bidding/tendering, lack of coordination between design team and general contractor, lack of coordination between general contractor and subcontractors, high machineries costs, high cost of skilled labour, high transport costs, domination of construction industry by foreign firms and aids, contract management, inadequate duration of contract period, inappropriate government policies, inadequate production of raw materials in the country, poor financial control on site, absence of construction cost data, inappropriate contractual procedure, additional works, wrong method of cost

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estimation, poor relationship between management and labour, stealing and waste on site, labour/skill availability, dispute on site, adverse effect of weather, bureaucracy in bidding/tendering method, lowest bidding procurement method, litigation, numerous construction activities going on at the same time, scope changes arising from redesign and extensive variation occasioned by change in brief, inadequate site investigation, inadequate preconstruction study, work suspensions owing to conflicts. Finally, inadequate quality/Ambiguity of contract documents, inappropriate contractual policies and poor project (site) management/poor cost control. Kaliba et al., (2009) identified bad weather, inflation, schedule delay, scope changes, local government pressures, strikes, technical challenges and environmental protection and mitigation. Enshassi et al., (2009) showed increment of materials prices due to boarder closures, delay in construction, supply of raw materials and equipment, fluctuation in the cost of building materials, project materials monopoly by some suppliers, unsettlement of local currency in relation to dollar value, design changes, contractual claims (such as, extension of time with cost claims), inaccurate quantity take-off; lack of cost planning/monitoring during pre- and post-contract stages and resources constraints - funds and associated auxiliaries not ready as major variables. Kasimu, M. A(2012) described that incomplete design at the time of tender, additional work at owner's request, changes in owner brief, lack of cost planning/monitoring during pre-and-post contract stage, site/poor soil conditions, adjustment of prime cost and provisional sums, re measurement of provisional works, logistics due to site location, lack of cost reports during construction stage, delays in issuing information to the contractor during construction delays, technical omissions at design stage, contractual claims, <https://assignbuster.com/identifying-the-variables-influencing-project-construction-essay/>

such as, extension of time with cost claims, improvements to standard drawings during construction stage, wrong decision by the supervising team in dealing with the contractor's queries in delays, delays in costing variations and additional works, omissions and errors in the bills of quantities, ignoring items with abnormal rates during tender evaluation, especially items with provisional quantities, some tendering maneuvers by contractors, such as front-loading of rates as the cost overrun variables. Alagbhari et al.,(2007) elucidated financing and payment for completed works, schedule delay, inaccurate estimate, long period between design and time of bidding/tendering, lack of coordination between design team and general contractor as variables affecting cost overrun. Sweis et al.,(2008) identified financing and payment for completed works, frequent breakdowns of construction plant and equipment, shortages of technical personnel, labour shortage, monthly payment difficulties, poor contract management as major variables for cost overrun. Fugar and Agykwah-Baah (2010) showed owner's lack of experience, materials, weather, labour, contractor and combination, logistics due to site location, lack of cost reports during construction stage as variables. Ogunlana et al.,(1996) shortage of materials, poor contract management, information availability, design brief, estimating method, design team performance as variables. Mansfield et al., (1994) identified changes in site condition, delays in issuing information to the contractor during construction delays, technical omissions at design stage, contractual claims as variables. Al-Momani (2000) claimed variations and changes in the site conditions, delays in costing variations and additional works, omissions and errors in the bills of quantities, ignoring items with abnormal rates during tender evaluation as cost overrun variables for projects. Xiao and <https://assignbuster.com/identifying-the-variables-influencing-project-construction-essay/>

Proverbs (2002) tell about weather conditions, design changes, changes in site conditions, shortage of materials as variables. Chalabi and Camp (1984) said that act or failure to act by the owner, breaches in owner's obligations stated in contract, failure of owner or its representative to furnish the contractor with relevant information were also the factors of cost overrun. Rowlinson (1988) identified project owners delay in issuing approvals, signing contracts and allowing site access as variables, Long Le-Hoai et al., (2008) told poor site management and supervision, poor project management, assistance, Financial difficulties of owner, Financial difficulties of contractor, design changes were variables for cost overruns. Sambasi-Van (2007) Improper planning, Site management, Inadequate contractor experience, Finance and payments of completed work, Subcontractors; Acharya et al., (2006) identifies factors like Public interruptions, Changed site conditions, Failure to provide site, Unrealistic time estimation, Design errors. Lo et al., (2006) identifies factors like Inadequate resources due to contractor/lack of capital, Unforeseen ground, conditions, Exceptionally low bids, Inexperienced contractor, Works in conflict with existing utilities. Faridi (2006) identifies factors like Preparation and approval of drawings, Inadequate early planning of the project, Slowness of the owner's decision-making process Shortage of manpower, Poor supervision and poor site management, Aibinu (2006) identifies factors like Contractors' financial difficulties, Clients' cash flow problem Architects' incomplete drawing, Subcontractor's slow mobilization, Equipment breakdown and maintenance problem, Joshua and Jagboro (2007) identify factors like changes in work, delayed payment on contract, financial failure of owner, labour disputes, labour, equipment and material availability, productivity of labour, defective

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materials, productivity of equipment, safety, Laryea and Dontwi (2007) identify factors like poor quality of work, unforeseen site conditions, financial failure of contractor, political uncertainty, changes in government regulation, permits and ordinances, delays in resolving litigation/arbitration disputes, inflation, cost of legal process and force majeure. Perry and Hayes (1985) identify factors like Physical risk, environmental risk, logistics risk, financial risk, legal risk and political risk. Hegazy and Ayed (1998) identify factors like season, location, type of project, contract duration, and contract size had a significant impact on individual contract costs, Herbsman (1986) In addition to input costs of materials, labor, equipment, and the total volume of contracts bid each year the so-called bid volume all influence project costs, Minato and Ashley (1998) External risk due to modifications in the scope of a project and changes in the legal, economic, and technologic environments; technical complexity of the project; inadequate project management due to the control of internal resources, poor labor relations, and low productivity; and unrealistic estimates because of the uncertainties involved Akinci and Fischer (1998) considered design and project-specific factors to be the key factors affecting the cost estimate of a project, including vagueness in scope, design complexity, and project size. Barrie and Paulson (1992) engineering designs have a high level of influence on project costs and sometimes a non-satisfactory design performance can lead to cost overrun. Anderson and Tucker (1994) reported that their survey found about one-third of architectural/Engineering projects miss cost and schedule targets; Chang (2002) There have been few instances where an engineering design is so complete that a project could be built to the exact specifications contained in the original design documents ; Bramble and Cipollini (1998) many

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construction problems are due to design defects and can be traced back to the design process; Keil et al., (1998) identifies factors like Lack of top management commitment to project, failure to gain user commitment, misunderstanding the requirements, lack of adequate user involvement and failure to manage end user expectations. Montek S Ahluwalia (2010) identifies factors like Technical, quality or performance risk such as employment of inexperienced designers, changes in the technology used, or in the industry standards during the project. Organizational risks such as cost, time and scope objectives that are internally inconsistent, lack of prioritization of projects, inadequacy or interruption in funding, and resource conflicts with other projects in the organization. External risks such as shifting legal or regulatory environment (including institutional changes), poor geological conditions, and weather-related force majeure risks such as earthquakes and floods. Project management risks such as poor allocation of time and resources, inadequate quality of the project plan, and poor use of project management disciplines. Nevitt and Fabozzi (2000) identify factors like Country risk, political risk, sovereign risk, foreign exchange risk, inflation risk, interest rate.

## **Conclusion**

From the above literature review, following conclusions can be derived:

There is a variety of construction projects considered under the study for identifying the variables of project cost overrun. These are civil construction, groundwater, pipelines, highway project, private construction projects, infrastructure construction projects, dam construction, mining plants, etc. going on in countries like Nigeria, Ghana, Indonesia, U. K., Australia, Kuwait,

Pakistan, India, Zambia, Malaysia, Jordan, Thailand, Japan, U. S. A., Hong Kong, Vietnam, South Korea and U. A. E. It has been found that the risk associated with each type of project is unique in nature and can be distinguished with each other. There are some common risk factors also which may affect the project cost overrun in all the projects. Out of the literature review, in all 73 variables were identified (which are given under Appendix A) of this paper, in all 32 variables were found relevantly affecting project cost overrun in construction of steel plant in Indian context. Out of these 32 variables, 17 were found highly relevant to affect project cost overrun in establishing steel plant in India as these were identified by all 30 respondents. These include: high level of bureaucracy, unavailability of local material, unavailability of equipment, unavailability of local skilled labor, unavailability of local skilled sub-contractors, unavailability of infrastructure, poor / incomplete design, design errors, strict environmental regulations, vagueness of contract clauses, contractual errors, contractors lack of financial resources, poor project risk management, rebellion / terrorism, delays / interruptions, increase in work and increase in unit cost of work. There were 8 variables which were identified as relevant to affect the project cost overrun as out of 30 respondents; these were identified as relevant by 26 to 29 respondents. These comprise of: instability of economic conditions, poor site supervision, lack of site facilities, contractors' lack of experience in similar projects, poor project cost management, poor project scope management, poor project time management and change in availability of material. Five more variable were found nearly relevant which include: instability of government, complexity of construction method, strict project management requirements, poor human resource management and change

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in site / project organization. The study was done to identify the key variables which will be further reduced using factor analysis in order to identify the factors affecting project cost overrun in construction of steel plant in India. The geographical scope of the study is limited to India only. The socio-cultural, economic, political and legal scenario of the countries widely varies there for the results of the study may carefully be used for other countries.