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A Review on Assessment of Project-Related Factors for Major Construction Projects

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Abstract: ***Major Construction projects are unique construction projects known for their complexity, vast size, expensive cost and long time frame compared to conventional construction projects. They may lead to cost overruns and lower-than-predicted revenues that hinder economic growth instead of advancing it. For ameliorating the performance of the construction industry and delivering successful projects, that satisfies their users, it is imperative to ascertain various project-related factors for Major Construction projects. From the literature analysis, it was found that the type of project, size of project, project complexity, innovations and uniqueness were important attributes under project-related factors. Due to limitations in past researches regarding project-related factors of Major construction projects, this paper aims to study the various project-related factors affecting Major construction projects through literature analysis and emphasizes the important factors among them that are crucial for project success in order to reduce costs overruns and project failures and to forecast the performance level of Major project before it commences.***

Keywords: Major Construction projects, Project related factors, Costs Overruns, Complexity, Economic Growth

I. INTRODUCTION

Major Construction projects can be seen as the wild beasts in the project world, they are hard to tame, known for their complexity, vast size, expensive cost, and long time frame compared to conventional construction projects. These projects bring big changes in the geography of countries and life of people. Some of these Major Construction projects become landmarks for a country and bring significant prosperity, but some become unforgettable catastrophes. Uncertainty and complexity due to their huge size and long time duration are commonly seen in Major Construction projects. The large scale engineering projects are described on the basis of five attributes: (i) “high” capital cost, (ii) “long” duration but program urgency, (iii) technologically and logistically demanding, (vi) requiring multidisciplinary inputs from many organizations, and (v) leading to a “virtual enterprise” for the execution of the project. Also, they lead to cost overruns and lower-than-predicted revenues that hinder economic growth instead of advancing it. The Federal High Way Administration (FAHWA) defines Major Construction projects as: “Major infrastructure projects that cost more than US$ 1 billion or projects of a significant cost that attract a high level of public attention or political interests because of substantial direct and indirect impacts on the community, environment, and state budgets” (Youcef J.T. Zidane et al., 2012). Major Construction projects are expensive projects that require the management of numerous, concurrent, and complex activities while maintaining tough schedules and tight budgets. The size and complexity are reflected by a price tag that exceeds one billion dollar and by a time frame that may exceed the five year limit. The technological innovation is associated with high risk and characterized by conflict, uncertainty, and poor cooperation between partners [5].

Execution of construction projects in an efficient and effective way is a core competency of project-based organizations. The lack of an agreed definition and a set of criteria for construction project success have long been the reasons for failing to evaluate success. Unfortunately, the researches on Major Construction projects seldom cover all project related factors. Towards ameliorating the performance of the construction industry and delivering successful projects, that satisfies their users, this study aims to investigate various project related factors for Major Construction projects through the past studies.

II. LITERATURE ANALYSIS

According to Abdulaziz Ali M. Albishri et al. (2015), the Major projects around the globe have encountered difficulties in delivery. Over-time, cost overruns starting from the design phase, through start-up, the construction phase, and then delivery have categorized major-project progressions; delay stemming from the planning phases and implementation during construction phase are particularly problematic. The main aim of his research was to evaluate Major-project management processes applied at the pre-planning, design, construction phases and design, to clarify the process and management approaches used in order to recommend improvement to the process for future projects and to reduce project issues from derailing deadlines resulting in budget inaccuracies beyond the preplanning phase. [1]

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Albert P. C. Chan, David Scott, and Ada P. L. Chan (2004) identified a number of variables influencing the success of project implementation thorough review of articles. All the critical success factors were grouped under 5 main categories and a conceptual framework including these factors was introduced by them that included human-related factors, project-related factors, project procedures, project management actions, and external environment. The attributes used to measure the Project-Related Factors factor are type of project, nature of project, number of floors of the project, complexity of project, size of project and project scope.
To study how these factors affect project success separately and collectively, it was hypothesized that, ''Project success is a function of project-related factors, project procedures, project management actions, human-related factors and external environment and they are interrelated and intra-related.'' It was further hypothesized that the project will be executed more successfully if the project complexity is low; if the project is of shorter duration; the overall managerial actions are effective; if the project is funded by a private and experienced client; if the client is competent on preparing project brief and making decision; if the project team leaders are competent and experienced; and if the project is executed in a stable environment with developed technology together with an appropriate organization structure. [2]
Neringa Gudienea, Audrius Banaitisa and Nerija Banaitienea (2013), developed a conceptual critical success factors model for construction projects in Lithuania. The model consists of seven groups of critical success factors: external factors, institutional factors, projects related factors, project management/team members related factors, project manager related factors, client related factors, contractor related factors. The variables within each group are interrelated. A variable in one group can influence a variable in the others. Project related factors include such factors as project value, size, type, complexity, goals, risk and etc. Project characteristics are important factors and they influence the success of any project. Construction project success is very variable and influenced by unpredictable factors. A conceptual model that includes the grouped critical success factors affecting project success was developed. In order to select the most successful project a decision-making matrix and a multiple criteria analysis of alternatives required were done by comparing the alternative criteria values and weights as well as analysing the conceptual information. [3]
Md. Asrul Nasid Masroma, Mohd Hilmi Izwan Abd Rahima, Sulzakimin Mohameda (2015) depicted that the major construction projects have been recognized as a high complexity project with numerous construction risks, large cost involvement, highly technical requirements and divers of resources. Beside these they claimed that development of large infrastructure such as highway, railway, Mass Rapid Transit (MRT) and airport are also needed a large investment of public and private sector. To accomplish the development successfully, they determined several challenges prior the project commencement. This paper aims to explore the potential success criteria that would be useful in gauging overall performance of large infrastructure implementation particularly in developing country. They used previous successful criteria studies to develop a conceptual framework that possibly suitable for measuring large infrastructure performance. The analysis showed that successful criteria of infrastructure projects implementation could be grouped according to several key elements as it seems significant to the participants in prioritizing project challenges more systematically. There are several factors that affect to complete the project success. According to them, the criteria's that require much effort tends to be perceived as more successful when the project are achieved and the criteria that requires less efforts are perceived as less successful when they are achieved. They implied that different project participants will have different perceptions of achieved success dependent on what criteria have focused most on. [4]
According to Youcef J.T. Zidane et al. (2012), though several pitfalls and challenges have been pointed out with respect to managing megaprojects, the relevance and the need of carrying out this kind of projects attract both the industries (practitioners) and academics. There are many significant issues that must be addressed in connection with managing megaprojects. This paper focuses on the different initiatives taken to date, presents them and tries to find the area of the missing expertise to understand the characteristics and the management of megaprojects. He concluded that there are three trends that will drive the project management field forward in the future. And in future there will be more Megaprojects as the trend in Norway showed that those projects are becoming larger and more complex over the decade. The second trend is that the project owners expect more flexible solutions that give a high delivered functionality. They demand that the projects should be delivered as effective as possible. According to Youcef J.T. Zidane et al. (2012), in future it will not be acceptable to just deliver the result within the time, cost and quality - project managers must also understand the business case and deliver the required effects and functionality. The third trend was more rapidly changing demands from project owners - not one, but many owners in the megaproject. Also there will be more global competition - not one company but many companies deliver inputs and share responsibilities to achieve the objectives from and of megaprojects. [5]
S. Pretorius, H. Steyn & T.J. Bond-Barnard (2017) provided a framework to the practitioners with novel insights into the role of different project-related factors in determining the correct balance of leadership styles for a particular situation. It is widely accepted

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that project leaders should adapt their behaviour to meet the unique leadership demands of a variety of situations. Several factors are believed to play a role in determining an appropriate balance between these leadership styles. They explored the influence of project types, the stage in the project life cycle, organizational project management maturity, and the level of trust and collaboration between project team members on the appropriate balance of leadership styles in projects. They established a conceptual model for project-related factors that influence leadership styles and their effect on project performance. These factors include the type of project (novelty, technology, pace, and complexity); the stage in the project lifecycle; the level of organizational project management maturity; the level in the hierarchy of a project-orientated organization, from portfolio through program, project, and sub-project, down to work package and activity level; the level of trust and collaboration in the team. [6]

Odesola et al., (2013) concluded that the building craftsmen and project supervisors'/engineers' perceptions of the relative effects of project-related factors on construction labour productivity are the same ($p = 0.646 > 0.05$). The project-related factor significantly and insignificantly affects construction labour productivity. Specification and standardization, availability of material, project goals and milestones, high quality of required works and availability of drawings were considered to be the first five significant project-related factors affecting construction labour productivity respectively. Also the effects of project specifications, availability of material and high quality of required works on construction labour productivity are significant enough for appropriate measures to be taken at the preconstruction stage in order to enhance project performance. Therefore, they recommended that the construction managers should make more explicit project specifications; address the effects of availability of materials, high quality of required works and non-availability of project documents on construction labour productivity with clients and motivate craftsmen with realizable goals and milestones. A field survey involving a stratified random sample of 146 building craftsmen and 81 project supervisors/engineers was conducted by them. Data was collected through structured questionnaires and analysed using Mean Item Score and Mann-Whitney U-test. [7]

Ivana Burcar Dunovi et al. (2014) paper's purpose was to explore the current views on project complexity and its development through history. The perception and elements of complexity were investigated in this paper. The research is based on in-depth analysis of large infrastructure projects and project manager's perception of complexity. They proposed a new model of project complexity for a large infrastructure projects and depicted a direct connection between the type of complexity of a project and the management approach. Also essential characteristics of major construction projects that contribute to their complexity as basic characteristics were confirmed, as well as the relationship between the complexity and uncertainty of a project was interpreted by authors. [8]

Christian Brockmann and Horst Brezinski interpreted that often the construction industry is criticized for a lack of innovation but the same industry designs and builds the largest projects of the world, major construction projects such as bridges, tunnels, dams, harbours, airports and industrial plants. They distinguished between product (design) and process (construction) innovation. Participant observation was used to detect, define, analyse and categorize innovations at the BangNa Expressway Project in Thailand, with 54 km one of the longest bridges in the world. In a highly competitive industry, process innovation must lead to a decrease in price and therefore only a sufficiently large project can carry the investment cost associated with some innovations. In addition, the analysis showed that many innovations are so small that they hardly can be detected although they are ongoing continuously. According to them, the approach to innovation is through problematic search and emergence. The project nature and the uniqueness of the construction industry seemed to be wise approach as people drive the innovation that gets feedback from implementation. Also the innovation on the world level is abundant. This seems to suggest a capability and willingness to innovate on the side of the contractors. There was also evidence for much entrepreneurial courage when betting on the success of innovation at the signature of the multibillion dollar contract. There are a number of barriers to innovation in construction. Separation of design and construction, project size and the necessity to reduce costs have been discussed in this paper. [9]

III.DISCUSSION

This paper aims to present literature relevant to assessment of project-related factors with special reference to Major Construction projects. Major projects success has significant impact not only on the operation of the participants, but also it will affect the local community and the State as well. The positive or negative results of large infrastructure projects are shared by the entire society. Therefore, the study of project-related factors in Major Construction projects is of crucial importance. The project related factors are nothing but the project characteristics classified as type of project, no. of floors, size of project, complexity of project and nature of project. Also value of project, clear and realistic goals/objectives, procurement, complexity and uniqueness, realistic schedule, urgency, planning, innovations, materials and equipments, supervision, construction methods, accidents, profitability, risks and adequate funds/resources are grouped under the project-related factors. During the construction phase the contractors must focus on

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factors such as project complexity, technological requirements, project information, project team requirement, contract requirement, project duration and market requirement. From the literature analysis it is found that due to complexity, interests, significance, role and level of uncertainty in Major projects, a new management approach is required. Mega-infrastructure projects are carried out under conditions of high uncertainty, ambiguity and complexity with extreme tight deadlines and budgets and are managed in the context of very complex operations, paradoxes, uncertainties, influences and ambiguities which surround these projects. Understanding the complexity of the project is important for project management because it is associated with difficulties in decision-making and goal attainment. The project manager, team members, client, sponsor, or associated stakeholders often recognize the complexity of their undertaking far too late to effectively address it in order to gain control. Therefore, the project director, sponsor and/or manager need to be aware of project complexity from the beginning of the project in order to develop appropriate strategies and assign competent team members. The scope of project can be described as the sum of the products, services, and results to be provided as project. A change in project scope almost always requires adjustment to project cost and schedule. Mostly, cost overruns on large public-private projects occur due to under-estimation of large scale projects cost at pre-planning phase. The complexity and advancement of technology can complicate the project design at preplanning/planning phase. Change in the project scope of work over time and delay in any construction activity in project can affect the project budget. Most of the Major projects faces cost overrun as a result of the poor planning and misinformation in the preplanning/planning phase.

TABLE I
PROJECT-RELATED FACTORS FOR MAJOR CONSTRUCTION PROJECT AND THEIR DESCRIPTIONS [5]

Factors	Characteristics and Descriptions
Size	• Major project (huge scope) • Technologically and logistically demanding.
Cost	• Exceeds one billion US dollar
Time	• Exceeds five years long duration • Program urgency
Success	• Different objectives • Fail to meet cost estimations, time schedule, and anticipated project outcomes. • Goal-orientation (technical, financial, time) • Poor performance in terms of economy, environment, and public support. • Leads to cost over-runs and lower than predicted revenues that hinder economic growth instead of advancing it.
Complexity	• Requires management of numerous, concurrent, and complex activities. • Contains large elements of technological innovation.
Impacts	• Impacts on community, environment, state budgets. • Socio-political impacts
Singularity	• Unique, no megaproject looks like another.
Stakeholders and shareholders	• Attracts a high level of public attention or political interests. • Nature and number of project owners. • Conflicts, poor cooperation between partners.
Uncertainty	• Associated with high risks
Implementation owner	• Requiring multi-disciplinary inputs from many organizations. • A “virtual enterprise” for the execution of the project.
Knowledge	• New subject of research.

Table I shows 11 project-related factors and their respective characteristics and descriptions for Major Construction projects, depicted by Youcef J.T. Zidane et al. (2012).

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IV. CONCLUSIONS

This paper focuses on the study of literatures regarding project-related factors in the context of Major Construction projects. It is seen from the literature analysis that Major Construction projects are high complexity projects with numerous construction risks, large cost involvement, highly technical requirements and divers of resources. The literature study shows that the uncertainty and complexity due to their huge size and long time duration are commonly seen in Major Construction projects which lead to delays and cost overruns. It also affects the labour productivity. Project related factors are the project characteristics that include factors such as project value, size, type, complexity, realizable goals and milestones, risk, etc. Project characteristics are important factors and they influence the success of any project. The influence of project types (novelty, technology, pace, and complexity), the stage in the project life cycle, organizational project management maturity, the level of trust and market value are essential attributes for management of any Major project. Therefore, the study of this factors should be given due consideration for forecasting the performance level of a Major Construction project before it commences in order to gain desired quality levels and achieve project success.

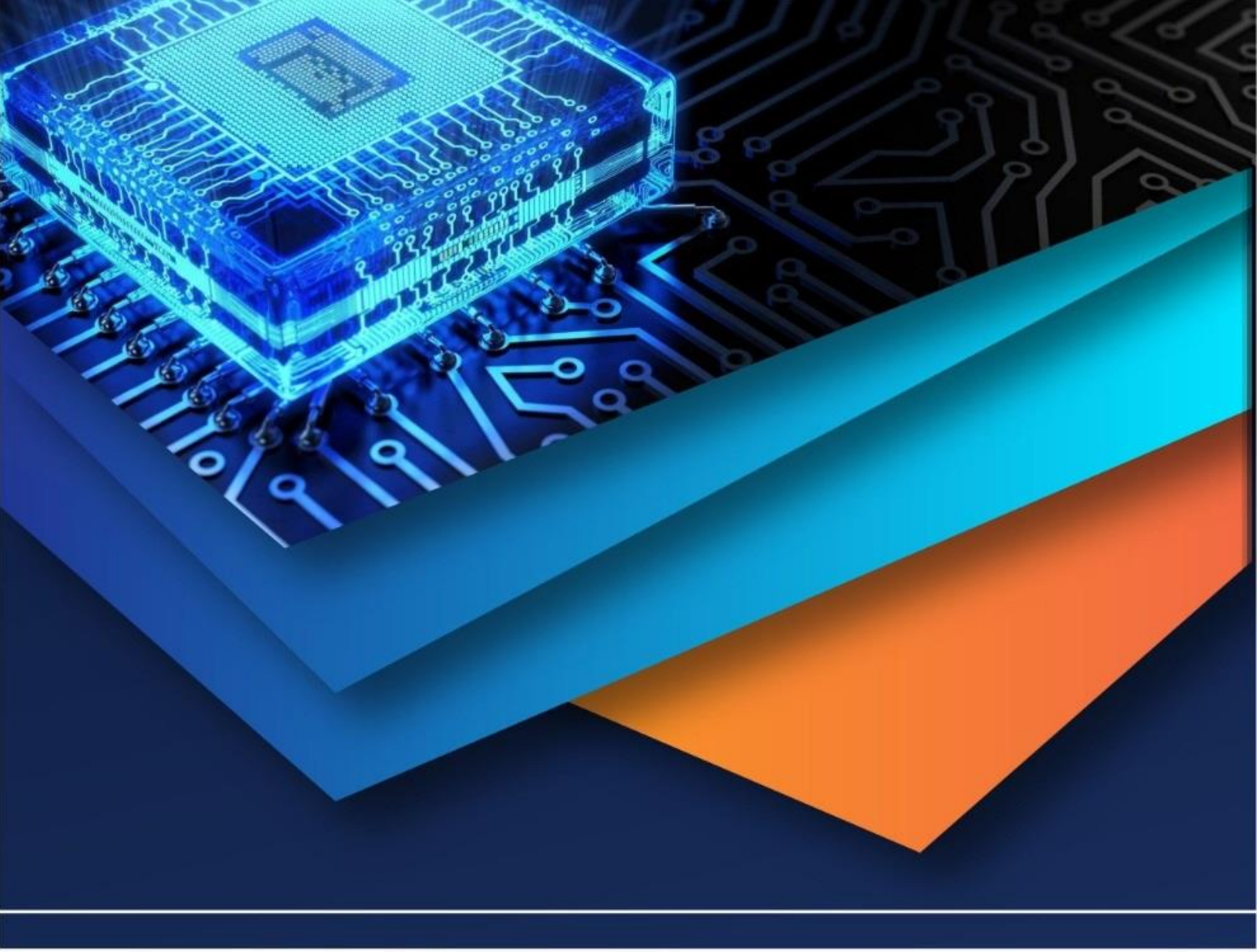
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