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## Success Factors in Mega Infrastructure Projects (MIPs): Developing Nations Perspectives

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# Success Factors in Mega Infrastructure Projects (MIPs): Developing Nations Perspectives

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**Abstract.** There is a common understanding that megaprojects are important drivers of societal change. Their impact is an important phenomenon because of the influence on both society and economy. Despite the best practices all around the globe, numerous challenges can move a megaproject from a programmed success to a failure scenario. It can create an uncertainty over the result, impact as well as over the justification of the enormous amount of resources spent. Despite much research done so far, it is still not clear what are the causes of megaproject success. However, there seems to be no clear understanding as to what are the major success factors on which a project is judged in developing nation. Hence, this study aims to analyse the most vital success factors that would label a megaproject as being a complete accomplishment. The research was conducted using quantitative survey. The questionnaires were distributed to different stakeholders who have participated in previous megaproject. The questions were based on a Likert's scale rating and analysed using relative important index (RII). The result from the analysis was then used in establishing the main success factors in mega project whilst focusing on what is regarded as the most important success factors as projects are unique with certain needs. The key finding from the study is the Project Managers experience and co existence with other stakeholders which was found as vital factor for the successful delivery of MIPs. Therefore, the research demonstrates the implication of the role of the project managers in terms of coordination of other parties in achieving stakeholders goal..

## 1. Introduction

According to Gomes, et al.'s [1] Mega Infrastructure Projects (MIPs) are the projects that manifest themselves in high-risk exposure, high complexity with lasting effects on the economy, climate, and society. Such projects include the development/creation of cultural activities such as power plants, construction of extractive plants, stations and commuting projects, railways, highways, dams and even the Olympic Games or large-scale exhibitions [2]. What MIP have in common is that they must coordinate and control significant and complex financial, professional, and social resources to implement them into the real world [3]. However, MIPs could be a failure if there is an ineffective project management methods and concepts in their development [4].

Data from the McKinsey Global Institute [5] suggest that global infrastructure will cost approximately \$3.4 trillion per year between 2013 and 2030. In addition, The Economist [6] estimates that countries will need to invest \$2.2 trillion in infrastructure projects within 10years. To ensure the success of the MIP, which is the basis for the development of a prosperous country, a better understanding of the key factors contributing to the success of the project is therefore essential [1]. The factors causing project successes and failures have been widely studied in past literature [7, 8, 9, 10]. However, the definition of project success or failure is still subjective depending on the context and the perceptions of stakeholders involved [11]. The project management iron triangle of cost, time and quality is widely accepted as a model of project management success or failure. However, the dimensions are now expanding to include other aspects of sustainability, risk, ethics and many more [12]. For MIPs, it is reported that 9 out of 10 projects suffer from the negative effects of cost and time commitment [13], which is a sign of failure. Denicol et al.'s [14] also claimed that the ratio of the failure of MIPs is very high due to certain constraints faced by projects of this nature. Whilst many projects often face complexity and challenges in terms of execution and success, MIP development is considered a more



complex cycle due to long-term planning techniques and complex interfaces involved [15]. Therefore, the construction of MIP requires a high level of technical and creative competence, professional staff, and high investments. Meanwhile, many developing countries find it difficult to achieve monetary, social, and environmental goals on their project, due to lack of necessary capabilities, skills, resources, power to manage and execute projects [16]. These challenges in managing MIP will affect the overall value and success of projects in those countries.

Despite much research done so far, it is still not clear what the causes of MIP success are [17]. There is still a large research gap on the influence of various factors on MIP to examine whether megaprojects success can be well quantified through a variety of different success factors [18]. Therefore, this study aims to analyse the most critical success factors required to be accomplished in a megaproject in order for such project to be deemed successful. The study starts by carrying out a comprehensive review on project success factors and how these relates with mega projects. The various success factors (SF) are gathered from existing students and finally analysed by means on a survey questionnaire. Finally, recommendations for future developments are provided and implication for decision support examined.

## 2. Literature Review

### 2.1. Success Factors (SF).

There is generally no consensus in determining what project success are and how they should be measured. When examining projects, there are two main dimensions by which the term 'success' can be viewed, these are project success and project management success [19]. The main difference is that the former is concerned with measuring success based on the business goals set from inception (including the social and environmental goals of various stakeholders) while the later relates to the overall progress goals defined by the traditional iron triangle involving time, cost and quality [20]. More recently, the dimensions of project success have evolved into researchers and practitioners studying critical success factors for various types of projects to improve effectiveness of project delivery. This is even more important for MIP given the scale and complexity of such projects, and the need for making key decisions at early stage to impact project success. Successful implementation of MIP has long been the desire of professionals involved in their design and construction [21]. The scale and complexity of MIP poses a challenge with simultaneously managing the interrelated activities and makes it extremely difficult to see which actors and components that influence their success and dissemination [22].

In recent years, the project management literature has diligently explored the "success factors" that influence project success, as measured by presumed "signs of success" (or patterns) [8, 9]. "Success factors" are characteristics or variables that can significantly influence the outcome of a project both positively and negatively. These are considered the vital factors to focus attention and this can be identified through a process of "separating the trivial many" [23]. Despite the best practices all around the globe, numerous challenges can move a megaproject from a programmed success to a failure scenario such as uncertain environment, currency fluctuation and political uncertainties/policies can affect the performance of MIP development and cause excessive costs [2]. This creates an interval of uncertainty over the result of a MIP and its positive impact as well as over the justification of the enormous number of resources spent. MIP pose several challenges for successful completion, there seems to be no general agreement among researchers on what are the success factors (SFs) in MIP. SFs vary across various projects, countries, cultures, clients, and public expectations [24]. In addition, different stakeholders have different perceptions of success [7]. As found by researchers, two of the most important stakeholders in any construction project are Clients and Project Managers, each having different views to most important success factors/criteria [15]. For instance, MIP can be seen as successful innovations on one end, however, still classified as financially a failure due to exceeding their budget requirements and extended time of completion on the other end [2, 25]. Likewise, although not all project goals may be achieved, the client may be satisfied with the project results and view the project as a success. Achieving the business objectives of the MIP should therefore be seen as the basis for success [8].

Past studies have often voiced concern that important MIP have repeatedly failed due to extensive overruns (whether in time or cost) [25], misunderstanding of expectations, or both [26]. However, there

seems to be no clear understanding as to what the major success factors/criteria on which a project is judged by from the perception of the clients and the project manager [27]. Therefore, researchers have attempted to classified critical success factors (CFS) of Megaprojects based on their monetary, political, and social importance in the community/society, it is quite traditional for all projects and configurations, and obvious to a competent project manager [28]. Therefore, this study will focus on success of Mega project using SF measured by project goals, business goals, social and environmental goals as in previous studies (e.g. [15]).

## 2.2. Mega Infrastructure Project (MIP) Success Factors

Project success is generally measured by comparison between project results and the set objectives and entails understanding the public importance of the project, human resources management, pre-defining and confirming success criteria, and management support [19]. Many researchers from their study has reported some SF used in measuring project success and these can generally be group under five categories relating to (i) execution of the project (ii) the capabilities of the project manager (iii) meeting project management KPIs of cost, time, quality etc. (iv) Project Culture and (v) stakeholder management (Table 1).

**Table 1:** Success Factors for Mega Infrastructure Projects

Category	Success Factors	Sources
<b>Project Execution</b>	Communication, coordination, contract design and control, planning, inspection, feedback.	Ghanbaripour, et al., (2020)
	Labour, materials and equipment organisation,	Mashali, et al., (2020)
	Engineering and construction productivity with the delivery system and best practices	Al Saeedi and Karim, (2020)
	Good delivery schedule and planning	Kakar, et al., (2020)
<b>Project Manager Abilities</b>	Planning, cost management, communication, project management success, project ownership success and project speculation success.	Mashali, et al., (2020),
	Improving communication and collaborative environment with suppliers.	Ghanbaripour, et al., (2020)
	Project manager's ability to complete the project or achieving compelling results.	He, et al., (2021).
	Selection of a full-time project manager, timely full project update without any impact on customer loyalty; values the resources and effectiveness of project.	
	Good performance, ability to share.	Chamberlain, et al., (2019)
<b>Project Management KPIs</b>	Cost and duration of the project.	Imam, (2021)
	Consistent quality, meeting deadlines and remaining budget.	Anantamula and Rad, (2018).
	Costs and time, high-quality	
<b>Culture</b>	Pzlnbcaying attention to unknown cultures and the images those cultures use to create rationality	Imam, (2021)
	An open culture, culture of diversity, Initiating a flawless culture at an organisational level.	Chamberlain, et al., (2019).
<b>Stakeholders Management</b>	Matching the stakeholder needs.	Abifarin, (2018),
	Internal meetings and external group behaviour trends	Marzouk and Gaid, (2018).
	Meet the needs of interested parties	Anantamula and Rad, (2018).
	Potential to meet the needs of interested parties	

Most researchers identified the project management iron triangle dimensions (cost, time and quality) as

key performance indicators (KPIs) for measuring project success [10, 16, 29]. Anantatmula and Rad [16] stated that project performance is measured by consistent quality, meeting deadlines and remaining within budget. This is because MIPs are affected by many performance issues, such as cost slumps, delays, and poor-quality construction. Other studies have also shown that MIPs often deal with important issues burdened with costs and time that complicate the success of Megaprojects [15]. Good performance is therefore, an important metric to drive the progress of MIP.

In addition to this, the importance of the role of the project manager was emphasised. For instance [17], have shown that ineffective construction management/supervision issues will not only affect the construction budgets, but also other aspects of planning, cost management, communication, labour, materials and equipment organisation. Also, Al Saeedi and Karim, [31] revealed that success can be achieved by assigning the person in charge of the construction line as a superior overseer of the project to improve the ability to understand the benefits of the project. Project Managers ability to serve is considered a measure of the performance and behaviour of subordinates and refers to the model's assumptions about the standards of respect, trustworthiness, and authority given to the individuals [10]. Therefore, before participating in any work, the Project Manager should consider their energy and teamwork skills in terms of testing goals and achieving goals which include the ability to communicate business strategy, goals, responsibilities, performance and give feedback [31]. Perhaps this is why [20] considered the selection of a full-time project manager as one of the success factors of MIP. Ghanbaripour, et al., [10] in their study identified some reasons why some project managers often fail to deliver the desired outcome. This stems from their inability to effectively develop formal collaborative work plans, coalitions, and alliances in the project. Therefore, the performance of the PM is one of the criteria for the success of MIPs [16].

The abilities and experience of the project managers also influences the project execution which is a key factor in achieving successful delivery of MIP. The execution of the project in terms of communication, coordination, contract design and control, planning, inspection, and feedback have been identified as vital success factors. Some factors that influence project success during the execution phase include changes in scope of work, cost measurement, project schedule assumptions, and changes in project details, poor material handling, work stoppages [10]. This shows there is a link between project performance, key productivity metrics, such as: cost, schedule, changes, safety, rework performance, engineering and construction productivity with the delivery system and best practices. As a result, labour productivity is not the primary cause of performance issues when executing projects. According to Kakar, et al., [28], much of the project work arrives on time and requires on-site assembly which may not be possible due to unresolved design issues or clashes detected during installation. However, where best practices are applied to different projects installation, results are often achieved faster.

There are also external project factors that are vital to the success of MIP. Stakeholder management is one key aspect. As project capacity and the number of stakeholders increase, the more complex the association becomes and the more likely there are incompatible situations between stakeholders and dynamic institutions in the context of vulnerability. This situation can lead to cost overruns, delays, and construction disruptions [22]. Also, stakeholder's performance is influenced by many factors and an important component of the success of the project. The success is dependent on three metrics: project management success, project ownership success and project speculation success, each in the interest of the project manager, owner, and financier [17]. Therefore, matching the stakeholders needs has become a critical test for monitoring MIPs.

This leads into the next success factor which is cultural aspects. Many MIPs have global connection/association and monetary capital. Hence, cultural differences between regions may reduce the efficiency of communication and the alignment of interests. The diversity of stakeholder's needs often leads to many weaknesses throughout the life cycle of Megaprojects [17]. However, Project Managers who understand the cultural sensitivity of the organisation can respond, focus on obvious threats, point in a different direction, and urge stakeholders to adopt the desired approach despite the societal challenges of internal meetings and external group behaviour trends [12]. It is important to note that the diversity of the different stakeholders, which depends on their assumptions and their degree of

implementation could also be a criterion for success in MIPs. The implication is for the Project Manager to be aware of the need to avoid overlapping foreign cultures with local cultures in order to harness this strength. If the project manager does not understand the situation or ignores the unforeseen success factors used to guard the opponent's culture, the project performance success will not be optimal, which include paying attention to unknown cultures and the images those cultures use to create rationality [29].

Other aspects such as improving the communication and collaboration environment with suppliers is essential for the success of MIPs [10]. The key success factors of collaborative behaviour are an open culture, ability to share, culture of diversity. Initiating a flawless culture at an organisational level is the basis for an energetic development of thinking [8] (Chamberlain, et al., 2019). The project team, which participates in continuous shared risk management, group arrangements and regular leisure group building activities, as further developed collaborative practices that eliminate the culture of confrontation [16] and results into effective delivery of the project.

### 3. Research Methodology

The quantitative method of research was adopted in this study through use of survey questionnaire to collect data from targeted participants. The questionnaire design in this study focused on each of the themes/categories identified during the literature review regarding vital factors that influences success of MIPs. To gather the information of the critical success factors, the targeted respondents includes various construction stakeholders such as project managers, clients and project and site supervisors in other to capture the perspectives of these categories of decision makers on project success. The questionnaire includes a series of questions about the most important factors in evaluating and determining a project success/performance. A target of between 100 – 200 participants sample size is deemed sufficient for this study and the questions asked were mostly based on a 5-point Likert scale rating giving the respondents opportunity to rank the various success factors. The data collected consists of 100 responses in total, 50 participants are the construction managers involved in various construction project, 30 of the participants are supervisors working under the authority of project managers whilst 20 of the participants are clients or major stakeholders who have invested in the project.

The Relative Importance Index (RII) technique was used to analyse the questionnaires data. The analysis consisted of ranking of various variables factors based on the relative importance index. Through the analysis, different success factors were put in the ranking based on the relative importance index. This was calculated using Likert's scale.

$$RII = \text{Sum of weights } (W1 + W2 + W3 + \dots + Wn) / A \times N$$

where W = weights given to each factor by the respondents and will range from 1 to 5 where '1' is strongly disagree and '5' is strongly agree. A = highest weight (i.e., 5 in this case), and N = total number of respondents [31]. The analysis conducted was used to determine the variable factors with the highest contribution to success of MIPs.

### 4. Result, Findings and Discussion

#### 4.1. Analysis of Result

Multiple factors may affect the success and prosperity of Mega Construction/Infrastructural Projects. The study participants assert that most people believe that labour/expert (0.89) on MIPs is key in achieving successful completion during the procurement process from the conception stage through to design and construction process. The project influence on society (0.81) in term of benefit and defining the success criteria (0.804) are contributing factors. Other influencing factors include 'Project Stakeholder Management', 'Diversified Workforce' and 'Outsourcing' as shown in Table 2. However, some of the respondents assert that complexity and payment related factors are significant to the success or failure of mega project. Delay in MIPs increases the cost of the project. The participants assert that delays make the project more expensive, it is obtained that the least contributor to any mega project's success or failure is the project manager (0.43) and organisation social responsibility (0.27). Whilst majority of participants assert that labours, stakeholder and society or client have a significant contribution to the success of the project.

**Table 2:** Response from Respondents.

<b>Variable Factors</b>	<b>Agree %</b>	<b>Strongly Agree %</b>	<b>Neutral %</b>	<b>Disagree %</b>	<b>Strongly Disagree %</b>	<b>Relative Important Index Value</b>	<b>Importance</b>
<b>Complexity</b>	50	25	5	10	10	0.74	8th
<b>Time</b>	62	13	19	6	-	0.664	9th
<b>Cost</b>	40	35	5	10	10	0.76	7th
<b>Communication</b>	15	15	30	30	10	0.59	11th
<b>Security</b>	2	8	20	50	20	0.456	12th
<b>Influence on Society</b>	30	50	-	15	5	0.81	2nd
<b>Critical Social Responsibility</b>	5	10	5	10	70	0.27	14th
<b>Outsourcing</b>	20	50	10	10	10	0.78	6th
<b>Define Success Criteria</b>	30	50	2	8	10	0.804	3rd
<b>Project Management Stakeholder</b>	30	50	-	10	10	0.80	4th
<b>Incompetent Project Manager</b>	5	15	10	20	50	0.43	13th
<b>Diversified Workforce</b>	20	50	10	15	5	0.79	5th
<b>Unavailable Labour</b>	30	60	5	5	-	0.89	1st
<b>Project Lifecycle Cost</b>	10	40	5	15	30	0.63	10th

#### 4.2. Findings and Discussion

Mega construction/infrastructure projects are speculative projects with unusually high investment. Including an enormous direct and indirect displacement of the environment, climate and organisations involved, creating a huge public or political interest [2]. Many mega construction/infrastructure projects failed because of repeated underlying goals. In terms of delays and cost overrun, many of the stakeholders have describe this as “failure” and stain in the heart of mega project management, including underlining lawsuits and allegations that can result from the process. Successful management cannot be achieved without adequate planning and controlling measure in place which must involve those directly responsible for organising and directing the management of mega project [30].

Mega project management must move from reaction-based cost management to forecasted cost management to control the delays and cost overrun of mega construction/infrastructure projects. The major planning and control tools available for managing project can be specifically designed to handle planning, management, and control plans, which are essentially continuous [8]. This control equipment must be operated by personnel who are well prepared and experienced enough to provide a good project management model and assessment ability.

The management/project organisation manages the interface between general procedures and projects; manages third-party vendors; and is responsible for meeting time, cost, and quality performance targets [29]. Most of the remaining assessments are concerned with understanding why mega construction/infrastructure projects fail and trying to identify the pieces of metrics that make mega construction/infrastructure projects so difficult to manage, including their “size, uncertainty, complexity, urgency and institutional structure” [32]. Various other variable deduced from the research are discussed under the following heading:

- **Project Execution Strategies - Planning and Procurement:**

Any decisions reach during the early planning stage of MIPs will affect successive stages and in achieving the benefits or successful projects result. The main causes of poor performance are poor planning of both functional and project structure and its evolution over time, and coordination between the formal governance structures [20], poor understanding of the roles and responsibilities of stakeholders, project teams, customers, and project managers involved in the project through there lifecycle. There is need for greater understanding of roles, responsibilities, relationship, project conditions and trust among the teams [10]. Without a clear vision and role, the elements that drive the project often try to transfer risk to the supply chain. Customer organisations are not willing to take risks.

MIPs have complex supply chains with many agreements with contractors, specialists and subcontractors, previous research indicate the need for skills framework integration to simplify collaboration between suppliers and manufacturers. More guidance on standards, strategies and technologies is needed to help clients understand how to break the supply chain of any project into manageable packages and modules including leveraging and negotiating skills to manage various agreements, competing interests, practices, and how the needs of different suppliers are considered concerning mega construction/infrastructural projects [1, 33].

- **Project Management KPIs – Cost, Time, Quality.**

MIPs are mostly procure through private investment or public body financing the project in the form of private finance initiative by raising the capital and manage the project until it attain its maturity stage and been transfer to the clients whilst the project will be leased back and the government makes annual payments to the private organisation, this is been criticised for non accountability and not given value for money since it will increase cost for delivery on this type of project whilst quality may be compromised.

The issue of inaccurate estimation or quantification of MIPs is among the factor responsible for poor project delivery within the costs and time frame, this complexities and associated risks certainly contributes to project delays and cost overruns [25]. However, since labour is a large part of construction costs, labour productivity is a useful measure of hourly output. Estimating labour productivity does not prove the productivity of the individual workforce. However, it measures the combined effects of labour, hardware and various production enhancing factors [22]. Whilst the overall productivity of the construction industry makes up a large part of the public economy.

- **Project Managers Abilities - Education and Capacity Building.**

Developing project capability in an independent, cross-organisational project requires that skills, and experiences, recollections from previous projects for individual or organisation to access. Well-trained projects personnel can increase knowledge in project organisation, integrating mutually beneficial practices in project management preparation, enhancement, knowledge management, cost management, and capacity development leading to an improve communication of successful mega construction/infrastructure projects [3]. Emphasis should be placed on intelligent learning in educational programs to train future project managers with critical thinking to maintain the perfect attitude in managing project complexity, include creating soft skills, which are not quite the same as professional skills, and learning with true life projects to gain important experience [8]. In addition to planning the career style of project managers and certification, companies need to install valuable drivers for improving project management in line with the clear attitudes of the organisation.

- **Stakeholder Management**

Managing stakeholder relationships is important in any project manager's plan, mutually beneficial settlements will extend the history of the checks to meet the requirements for domestic socio-political and cultural measurements. Hence, the need to understand local norms



and culture where such project is taking place [10]. A relationship management methodology is necessary for organisations involved in global infrastructure projects to manage external stakeholders, administrative experts, local project boards, supply chain and manufacturers. Applying professional experts can lead to greater value creation and general stakeholder satisfaction. By promoting the alignment of shared group responsibilities, centralised group execution, shared skills and structures, and high-level initiatives, selective ownership and client-contractor relationships can be developed [18]. The project is about the individual and their attitude in a competitive and rational environment. Teamwork and a social mindset, including trust, shared visions and goals, transparent communication, impeccable culture, constructive struggle, social collaboration, and senior management responsibility are key issues for the collaboration between contractors and clients [16].

- **Cultures**

Dealing with opposing cultures involves considering unknown cultures and the images that these cultures use for cognition [15]. Project managers need not only to understand local cultures but to use inward-looking norms to find out that global structures affect different cultures. The project manager must achieve a cultural breadth by paying attention to unknown cultures and limiting differences in cultural diversity [33]. That choice is to ignore cultural differences and various emerging issues, which can lead to loss of project performance and total disappointment.

An appropriate usage of language or words by project manager can influence the attitude and profile of the project team when dealing with new staff. Hence, the correct language should be used to engage internal and external employees, collaborate creatively, and prepare and update collaboration from the organisation's various internal and external meetings [32]. Managers and leaders can also skip over contradictions without weakening them, highlight the benefits of conflicting viewpoints and present a group of opposites, use their mutual relationship to unite the group, and use organisational culture to identify the difference between performance goals, actual and planned organisational to understand performance goals.

Collaboration between managers is closely related to creating an environment that encourages collaboration [34]. Improving the communication and participation environment with suppliers is crucial for the success of MIPs. Cooperation is positive organisational behaviour that is conducive to the development and flowering of creativity in the organisation [10]. Key success factors in a collaborative society are a culture of transparency, desire to share, and a culture of no-blame. Establishing a guilt-free culture at the organisational level is the basis for successful thought development.

## **5. Conclusions**

The study concludes that a key factor that can influence the success of MIPs is the project manager years of experience and expertise. This would in turn influence the project team strategy in delivering the work. Project execution strategies such as using hosting strategy to work with systems thinking to manage issues, evolving communications, share resources, share best practices and mindset can help to ensure the success of MIPs. Also, the collaboration between stakeholders is a key factor for MIP. If stakeholders can understand the mutual need to achieve a joint project execution plan, this would allow the project managers to focus on the components of social change and performance of MIPs and how ideas are replicated/refined in the resulting mega projects. The client's project manager must involve the company's key project staff during the tendering process or ensure that risk is based on an offer from the contractor's business improvement staff. Coexistence of project managers and other staff from different parts of the project stakeholders is important for the project success. Therefore, care must be taken when hiring consultants for the tendering process so that risk can be allocated to the organisation who can manage it for the successful completion of the project.

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