

Evaluation of Critical Success Factors for Road Construction Projects in Sri Lanka

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Abstract

A construction project is commonly acknowledged as successful when it is completed on time, within budget, and in accordance with specifications and to the stakeholders' satisfaction. However, outside the control of the management, there are many factors which could determine the success or failure of a project. Search for the factors influencing project success is not new in management studies particularly, in the domain of construction and project management. The last two and half decades have witnessed a drastic increase in "critical success factors" (CSFs) research. However, there is no such study on the implementation of CSFs in road construction projects in Sri Lanka.

Massive infrastructure development drives have contributed to the economic growth of Sri Lanka since 2010. The Sri Lankan transportation sector has been identified as a priority by the government of Sri Lanka with major road development projects. However, road projects in Sri Lanka have time and cost overruns and are exposed to risk frequently. Therefore it is essential to improve the success of road projects in Sri Lanka.

This research paper was focused on identifying critical success factors and establishing the most important CSFs for different project phases in the road construction project life cycle. The research problem was approached through an expert survey and a questionnaire survey conducted among the professionals in the road construction sector in Sri Lanka.

The findings revealed all the factors found through the literature survey are relevant to Sri Lankan road construction projects. Further the study established the most important CSFs in each phase of the construction project life cycle of road construction projects in Sri Lanka. This will be useful and aid the Sri Lankan road construction projects towards successful completion.

Key words: Critical Success Factors, Road Construction Projects, Project Life Cycle Phases

Introduction

A project is an achievement of specific objectives, which involves a series of activities and tasks which consume resources within a set of specifications, having definite start and end dates (Munns and Bjeirmi, 1996). Generally, there is no consistent interpretation of the term project

success (Baccarini, 1999 cited Ahadzic *et al.*, 2008). In fact, the definition of success is so broad that its meaning differs from one specific branch of science to another. Thus, success is not easily defined or determined (Shokri-Ghasabeh and Kavousi-Chabok, 2009). The focus of most studies of project success is on dimensions of project success (how to measure it) and factors

influencing project success (Wang and Huang, 2006). Outside the control of the management, there are many factors which could determine the success or failure of a project (Belassi and Tukel, 1996).

Search for the factors influencing project success is not new in management studies. Since 1960, various studies have been conducted to explore the really important factors that need to be considered to achieve project success (Cooke-Davies, 2002; Fortune and White, 2006). Belassi and Tukel (1996) pointed out that the success and failure factors were first introduced by Rubin and Seeling in 1967. Rockart (1982 cited Fortune and White, 2006; Koutsikouri *et al.*, 2008; Sanvido *et al.*, 1992; Toor and Ogunlana, 2009) were the first to use the term “critical success factors”. The construction industry is considered to be one of the most important industries in the economy. In any modern economy, infrastructure plays a pivotal role often decisive enough in determining the overall productivity and development of a country’s economy (Mody, 1997 cited Sharma and Vohra, 2009). In the infrastructure sector, roads play a major role and as such it is the forerunner to all other developments. It is also the backbone of the transport sector of the country (Ministry of highways Sri Lanka, 2010).

However, according to Perera (2006), 80% of road projects in Sri Lanka have time and cost overruns and are exposed to risk frequently. These factors can highly affect the success of road projects and the country’s economic growth. Therefore it is essential to improve the success of road projects in Sri Lanka in order to achieve the economic targets of the country. The aim of this paper is to evaluate the implementation of **Critical Success Factors (CSFs) for projects**

in the Sri Lankan **Road Construction Sector**.

Project Success

Traditionally, measures of project success reflect three aspects of the “triple constraint” or “iron triangle”: cost, time, and quality/ performance and those dimensions are still considered central to measuring project success (Atkinson, 1999 cited Papke-Shields *et al.*, 2010). (Figure 1)

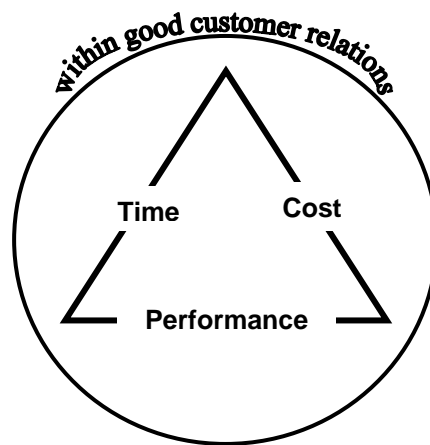


Figure 1: Project success triple constraints
(Source: Kerzner, 2001, p.5)

Kerzner (2000) illustrated how the definition of project success was changed according to traditional and modern project management as illustrated below;

Table 1: Definitions of project success (*Source: Kerzner, 2000, p.162*)

Traditional Project Management	Renaissance period	Modern Project Management
Technical terms only	Time, cost, performance (quality, technical)	Time, cost, performance and accepted by the customer

Ashley (1987) cited Sanvido *et al.* (1992) referred that project success results were much better than expected or normally observed in terms of cost, schedule, quality, safety, and participant satisfaction. However, Shenhar *et al.* (1997) explained that project success is meaningful only if considered from two vantage points: the degree to which the project's technical performance objective was attained on time and within budget; the contribution that the project made to the strategic mission of the enterprise. According to Kerzner (2001), the definition of project success as "the completion of an activity within the constraints of the time, cost and performance", has pertained for the past twenty years, thus the definition of project success should be modified to include completion:

- Within the allocated time period
- Within the budgeted cost
- At the proper performance or specification level
- With acceptance by the customer or user
- When the customer's name can be used as reference
- With minimum or mutually agreed upon scope changes
- Without disturbing the main work flow of the organization
- Without changing corporate culture.

Construction Project Success

According Chua *et al.* (1999), it is generally accepted that the major goals in a construction project are budget,

schedule and quality, although there are other more specific objectives, such as safety consideration and market entry, depending on the nature of the project and company. Therefore achieving those objectives leads to project success. Toor and Ogunlana (2009) explained that success of a construction project can be considered as achievement of specific objectives through project management system that involves a series of activities and tasks which consume resources.

Success in Road Construction Projects

Kaliba *et al.*, (2009) mentioned that in developing economies much of the national budget on infrastructure development is channelled to road construction projects as a major component of the construction industry. Ministry of Highways Sri Lanka (2010) mentioned that it is imperative that the road sector organizations should be properly coordinated, developed and maintained at an optimal cost and conform to planned schedule, in order to achieve an effective transport system, which meets the development aspirations of the people of this country. Hence, road construction project success can be basically viewed as completing the activity in a properly coordinated, developed and maintained way at an optimal cost and conforming to planned schedule and specifications.

However, Ahadzie *et al.* (2008) mentioned that within the last decade that there was an increasing number of research undertaken towards identifying success criteria within the construction industry in developing countries and the

key significance of those studies lie in their systematic contribution towards developing an understanding of the overall success model. Furthermore Koutsikouri *et al.* (2008) stated that in recent years, researchers in construction and construction project management have become increasingly interested in critical success/failure factors. Hence, in order to further illustrate on the concept of project success criteria and factors it is necessary to proceed with the research.

Project Success Criteria and Critical Success Factors

As mentioned by Wang and Huang (2006), the focus of most studies of project success is on dimensions of project success (or how to measure it) and factors influencing project success. Thus the literature related to 'project success' provides evidence that, most of the researches have touched the concepts of both 'project success criteria and success factors' (Andersen *et al.*, 2006;Cooke-Davies, 2002; Frodell *et al.*, 2008; Lim and Mohamed, 1999; Nguyen *et al.*, 2004; Sanvido *et al.*, 1992; Shokri-Ghasabeh and Kavousi-Chabok, 2009; Westerveld, 2003).

According to the Concise English Dictionary, Lim and Mohamed (1999, p.243) explained a criterion as 'a principle or standard by which anything is or can be judged'; whereas a factor is described as 'any circumstance, fact, or influence which contribute to a result'. Furthermore Cooke-Davies, (2002) stated that it is important to distinguish project success criteria and success factors.

As per Lim and Mohamed (1999) the criteria of project success is the set of principles or standards by which project success is or can be judged and those are the conditions on which judgement can be made. Sanvido (1992) declared that the success criteria related to a building often changes from project to project

depending on participants, scope of services, project size, sophistication of the owner related to the design of facilities, technological implications, and a variety of other factors. However, as mentioned by Andersen (2006), expanding the success criteria as the concept overall project success indicates will necessarily postpone the final judgement on the project. The performance on some of these success criteria will be finally decided months or years after the termination of the project.

Westerveld, (2003) stated that project success factors are the levers that project managers can pull to increase the likelihood of achieving a successful outcome for their project. According to Leidecker and Bruno (1984 cited Milosevic and Patanakul, 2005) 'Critical success factors' can be described as characteristics, conditions, or variables that can have a significant impact on the success of the project when properly sustained, maintained, or managed. Rockart (1979 cited Nguyen *et al.*, 2004) defined CSFs as those few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his or her goals. Within a project context, CSFs can be described as the factors that a manager needs to take into account in order to achieve a successful delivery (Koutsikouri *et al.*, 2008).

Many researchers have conducted their studies based on CSFs in general construction projects (Chua *et al.*, 1999; Savindo *et al.*, 1992), design and build projects (Chan *et al.*, 2001), public-private-partnerships or Build Operate Transfer (BOT) projects (Tiong *et al.*, 1992), urban regeneration projects (Yu and Kwon, 2011), large scale construction projects (Nguyen *et al.*, 2004; Toor and Ogunlana, 2009), collaborative multi-disciplinary design projects (Koutsikouri *et al.*, 2008) and various other project management topics (Chua

et al., 1997; Cooke-Davies, 2002; Fortune and White, 2006).

Exhaustive lists of success factors have been introduced, which vary from less than 10 to over 60 factors. Although different researches emphasized different sets of success factors, Toor and Ogunlana (2008 and 2009) observed that most studies on CSFs for construction projects are context specific. According

to Fortune and White (2006), many authors have published lists of factors, sometimes relating them to specific problem domains and types of activity. Therefore, the specific implications of studies on success factors are limited to the countries and cultures where these studies have been conducted.

As a result of the substantial review of the literature, the researcher identified following CSFs tabulated in Table 2.

Table 2: CSFs identified through the literature survey

CSFs	Reference
1. Top management support	Belassi and Tukul (1999); Fortune and White (2006); Locke (1984 cited Belassi and Tukul 1999); Martin (1976 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2008)
2. Clear objectives and scope	Baker <i>et al.</i> (1983 cited Belassi and Tukul 1999); Chua <i>et al.</i> , 1999; Fortune and White (2006); Koutsikouriet <i>al.</i> (2008); Martin (1976 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2008);
3. Competency of project manager	Belassi and Tukul (1999); Fortune and White (2006); Koutsikouriet <i>al.</i> (2008); Locke (1984 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
4. Adequate funding throughout the project	Baker <i>et al.</i> (1983 cited Belassi and Tukul 1999); Fortune and White (2006); Nguyen <i>et al.</i> (2004)
5. Sufficient well allocated resources	Belassi and Tukul (1999); Fortune and White (2006); Koutsikouriet <i>al.</i> (2008); Martin (1976 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009)
6. Multidisciplinary/competent project team	Fortune and White (2006); Nguyen <i>et al.</i> (2004); Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2009);
7. Commitment to project	Baker <i>et al.</i> (1983 cited Belassi and Tukul 1999); Belassi and Tukul (1999); Chan <i>et al.</i> (2001); Locke (1984 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004);
8. Timely, valuable information from different parties	Nguyen <i>et al.</i> (2004)
9. Awarding bids to the right designer/ contractor	Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
10. Accurate initial cost estimates	Baker <i>et al.</i> (1983 cited Belassi and Tukul 1999); Belassi and Tukul (1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana(2009);

Table 2 (cont...): CSFs identified through the literature survey

CSFs	Reference
11. Absence of bureaucracy	Baker <i>et al.</i> (1983 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
12. Comprehensive contract documentation	Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
13. Effective project planning, control and monitoring	Baker <i>et al.</i> (1983 cited Belassi and Tukul 1999); Fortune and White (2006); Locke (1984 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
14. Continuing involvement of stakeholders in project	Nguyen <i>et al.</i> (2004); Yu and Kwon (2011)
15. Effective strategic planning	Nguyen <i>et al.</i> (2004)
16. Up to date technology utilization	Fortune and White (2006); Koutsikouriet <i>al.</i> (2008); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
17. Proper emphasis on past experience	Fortune and White (2006); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009);
18. Frequent progress meeting	Koutsikouriet <i>al.</i> (2008); Locke (1984 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Toor and Ogunlana (2009); Yu and Kwon (2011)
19. Clear information, communication and coordination channels	Belassi and Tukul (1999); Fortune and White (2006); Locke (1984 cited Belassi and Tukul 1999); Martin (1976 cited Belassi and Tukul 1999); Nguyen <i>et al.</i> (2004); Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2009); Yu and Kwon (2011)
20. Community involvement	Chan <i>et al.</i> (2001); Nguyen <i>et al.</i> (2004);
21. Client consultation and responsiveness	Belassi and Tukul (1999); Fortune and White (2006); Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2009);
22. Political stability	Belassi and Tukul (1999); Fortune and White (2006);
23. High quality workmanship	Chan <i>et al.</i> (2001); Koutsikouriet <i>al.</i> (2008); Toor and Ogunlana (2009);
24. Fast trouble-shooting capabilities in the system	Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2009);
25. Standard software infrastructure and adequate use of IT	Toor and Ogunlana (2009);
26. Proper dispute resolution clauses incorporated in the contract	Toor and Ogunlana (2009);
27. Developing positive friendly relationship with project stakeholders	Toor and Ogunlana (2009); Yu and Kwon (2011)
28. Client acceptance of plans	Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2009);

Table 2 (cont.): CSFs identified through the literature survey

CSFs	Reference
29. Strong/ detailed plan kept up to date	Fortune and White (2006); Martin (1976 cited Belassi and Tukul 1999); Pinto and Prescott (1988 cited Belout and Gauvreau 2004); Toor and Ogunlana (2009); Yu and Kwon (2011)
30. Effective change management	Fortune and White (2006); Koutsikouri <i>et al.</i> (2008); Toor and Ogunlana (2009)
31. Defined roles and responsibilities	Koutsikouri <i>et al.</i> (2008); Martin (1976 cited Belassi and Tukul 1999); Toor and Ogunlana (2009); Yu and Kwon (2011)
32. Risk and liability assessment	Chua <i>et al.</i> , 1999; Fortune and White (2006);

Research Methodology

In order to achieve the ultimate aim of this study, a quantitative research approach was determined to be the most appropriate method for gathering and analysing data. As the first step a literature review was carried out in order to define the project success and identify the CSFs recognized by the previous researchers. An expert survey was conducted as the subsequent step, to identify the CSFs relevant to Sri Lankan road construction industry to identify the importance of CSFs in each phase of the road construction project life cycle, based on a questionnaire which targeted experts with more than ten years experiences in the road construction sector. Questionnaires were distributed among 18 professionals in the Sri Lankan road construction sector who have more than ten years experience in the industry. Out of 18 distributed questionnaires only 15 were collected. The response rate for the expert survey was 83.33%. The Relative Important Index (RII) technique was used to analyse the data collected through the expert survey in order to identify the most relevant CSFs to Sri Lankan road construction projects.

Data Analysis and Research Findings:

Expert Survey Analysis I: Identification Of CSFs Relevant to Sri Lankan Road Construction Projects

To elicit the relevance of the CSFs identified through the literature review to Sri Lankan road projects, as the first part of the expert survey, the respondents were given a questionnaire to rate the identified CSFs against the five-point Likert scale, from “not relevant” (0) to “extremely high relevant” (4). Moreover the respondents were advised to mention any other factors which should be added to the list.

Based on the data collected through the expert survey all the CSFs identified through the literature review were ranked using the RII formula. The following Table 3 illustrates the results.

Table 3: Relevance of CSFs to Sri Lankan road construction projects

Critical Success Factors	RII (%)	Rank	Critical Success Factors	RII (%)	Rank
Clear objectives and scope	100.00	1	Absence of bureaucracy	76.67	17
Competency of project manager	98.33	2	Client acceptance of plans	76.67	17
Top management support	96.67	3	Continuing involvement of stakeholders in project	75.00	19
Adequate funding throughout the project	93.33	4	Frequent progress meeting	75.00	19
Commitment to project	91.67	5	Developing positive friendly relationship with project stakeholders	75.00	19
Sufficient well allocated resources	90.00	6	Up to date technology utilization	73.33	22
Effective project planning, control and monitoring	88.33	7	Political stability	73.33	22
Clear information, communication and coordination channels	86.67	8	Proper dispute resolution clauses incorporated in the contract	70.00	24
High quality workmanship	86.67	8	Client consultation and responsiveness	68.33	25
Defined roles and responsibilities	86.67	8	Fast trouble-shooting capabilities in the system	68.33	25
Multidisciplinary/competent project team	85.00	11	Strong/ detailed plan kept up to date	66.67	27
Awarding bids to the right designer/ contractor	85.00	11	Effective strategic planning	65.00	28
Comprehensive contract documentation	83.33	13	Standard software infrastructure and adequate use of IT	65.00	28
Proper emphasis on past experience	83.33	13	Risk and liability assessment	61.67	30
Accurate initial cost estimates	81.67	15	Community involvement	58.33	31
Timely, valuable information from different parties	78.33	16	Effective change management	51.67	32

As per the data analysis of the expert survey the factor “Clear objectives and scope” was top ranked among the 32 factors in the relevancy rating with a

relative importance of 100%, which indicates that all the respondents of the expert survey have identified that as an ‘extremely high relevant’ factor to Sri

Lankan road construction projects. Moreover the factors, competency of project manager, top management support, adequate funding throughout the project, commitment to project, sufficient well allocated resources, effective project planning, control and monitoring, clear information, communication and coordination channels, high quality workmanship and defined roles and responsibilities were ranked as the top most relevant factors. The factor “Effective change management” which gained relative importance of 51.67% was ranked lowest. However when considering the result of Table 3, none of the factors could be identified as not relevant to Sri Lankan road construction projects. Further, none of the respondents identified additional factors.

**Expert survey analysis II:
Identification of the importance of
CSFs in each phase of construction
life cycle of road construction projects**

As the second part of the expert survey, expert opinion on the importance of CSFs in each phase of the construction life cycle of road construction projects in Sri Lanka was observed. Basically six phases namely, ‘conceptual stage’, ‘planning stage’, ‘design stage’, ‘tender stage’, ‘construction stage’ and ‘operational stage’ were considered and the respondents were advised to rate the CSFs against these phases based on the five-point Likert scale, from “not important” (0) to “very highly important” (4). Based on the data collected through the expert survey, the CSFs were ranked using the RII formula under each of the identified stages of the construction life cycle. The following Table 4 illustrates the summary of most important factors (top ten ranked) in all six phases and it visualizes how the importance of factors changes at different phases.

According to the results the factor “Clear objectives and scope” was ranked as the

most important factor in “conceptual”, “planning” and “design” stages. Nevertheless in “tendering stage” the factor “Awarding bids to the right designer/ contractor” was the most important factor and when it comes to “construction stage”, the factor “Competency of project manager” was top ranked. According to the experts’ opinions in “operational stage” the factor “Adequate funding” was top ranked.

The findings revealed that for a successful project, in the earlier stages it is most important to have a firm and defined direction or aim and acquaintance of the project scope. Better selection of the appropriate designer/ contractor is very important in the tender stage. In construction stage proper coordination, monitoring and leadership of the project manager is most essential and in the operational stage having adequate funding is considered as more essential.

Table 4 Most important CSFs for different project phases in road construction project life cycle

Rank	Conceptual Stage	Planning Stage	Design Stage	Tender Stage	Construction Stage	Operational Stage
1		1. Clear objectives and scope	2. Client acceptance of plans	1. Awarding bids to the right designer/ contractor	1. Competency of project manager	1. Adequate funding
2	2. Top management support	2. Client acceptance of plans		2. Comprehensive contract documentation	2. Commitment to project	2. Political stability
3	3. Client acceptance of plans	3. Top management support	3. Multidisciplinary/competent project team	2. Accurate initial cost estimates	3. Effective project planning, control and monitoring	3. Commitment to project
4	4. Multidisciplinary/competent project team	4. Multidisciplinary/competent project team	4. Defined roles and responsibilities	4. Proper emphasis on past experience	4. Adequate funding	4. High quality workmanship
5	5. Proper emphasis on past experience	5. Client consultation and responsiveness	5. Timely, valuable information from different parties	5. Top management support	4. High quality workmanship	5. Client consultation and responsiveness
6	5. Client consultation and responsiveness	6. Timely, valuable information from different parties	5. Commitment to project	6. Commitment to project	6. Defined roles and responsibilities	5. Defined roles and responsibilities
7	5. Risk and liability assessment	6. Clear information, communication and coordination channels	7. Clear information, communication and coordination channels	7. Proper dispute resolution clauses incorporated in the contract	6. Proper emphasis on past experience	7. Sufficient well allocated resources
8	8. Clear information, communication and coordination channels	8. Competency of project manager	8. Risk and liability assessment	7. Timely, valuable information from different parties	8. Multidisciplinary/competent project team	7. Proper emphasis on past experience
9	9. Political stability	9. Absence of bureaucracy	8. Proper emphasis on past experience	7. Clear information, communication and coordination channels	8. Frequent progress meeting	9. Competency of project manager
10	10. Timely, valuable information from different parties	9. Proper emphasis on past experience	10. Client consultation and responsiveness	10. Defined roles and responsibilities	8. Fast trouble-shooting capabilities in the system	10. Fast trouble-shooting capabilities in the system
				10. Clear objectives and scope	8. Sufficient well allocated resources	10. Risk and liability assessment

Conclusions

Completion of construction project on time, within budget, and in accordance with specifications and to the stakeholders' satisfaction is commonly acknowledged as a successful completion of a project. There are many factors which could determine the success or failure of a project and those factors vary based on different aspects such as project type, countries and cultures where these studies have been conducted. This research study is mainly based on CSFs for Sri Lankan road construction projects.

From the literature survey it was found that no research studies have been conducted based on CSFs for road construction projects in Sri Lanka. Therefore firstly the CSFs relevant to Sri Lankan Road construction projects needed to be identified. Hence an expert survey was conducted among the experts in the industry using the thirty two CSFs identified through the literature survey. The result of the expert survey explicated that all the factors identified through the literature survey are relevant to the Sri Lankan road construction projects and no additional factors were added to the list.

Simultaneously the importance of CSFs in each phase of construction life cycle of road construction projects in Sri Lanka was observed as the second part of the expert survey.

Through the data analysis the researcher could recognize the importance of each factor in the identified six phases of the road construction project life cycle and the most important factors were illustrated in Table 4.

The findings revealed that for a successful project, in the earlier stages it is most important to have a firm and defined direction or aim and acquaintance

of the project scope. Better selection of the appropriate designer/ contractor is very important in the tender stage. In the construction stage proper coordination, monitoring and leadership of the project manager is most essential and in the operational stage having adequate funding is considered as more essential.

According to the finding obtained through this research survey, the researcher recommends to practitioners in road construction projects (basically top management), to consider the most important factors in each of the phases of the construction life cycle in order to obtain a successful project completion.

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