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LOOKING FOR PROJECT SUCCESS IN INFRASTRUCTURE PROJECTS - HOW CAN WE ACHIEVE IT?

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Even though the main aim of project management (PM) is to assure successful projects, the PM literature still lacks a clear definition of project success (PS), since it highly depends on the stakeholders' expectations and the point in time in which the project was evaluated. In this context and due to their specialties e.g. long duration or a large number of stakeholders, the infrastructure projects are subjected to time delays and cost overruns and therefore, criticized in the society and described as failed or unsuccessful projects. This paper hypothesizes the need to adapt our PM approach to follow more systemic methods and presents the main principles of systematic project management (SPM) as a success factor (SF) for infrastructure projects. In addition, a case study about the Gotthard Base Tunnel is presented to verify the literature findings.

Keywords: Systematic project management, Gotthard base tunnel, Success factors, Success criteria.

1 INTRODUCTION

Despite the major technical development in the last decades, the well-known written research results about PM, the growth and acceptance of PM in the last forty years or the rapid growth in membership of PM bodies, projects still fail to satisfy their stakeholders (Spang 2016), especially those still associated with massive cost overruns and time delays (Flyvbjerg 2005).

In order to phrase a holistic definition of PS for infrastructure projects that include multiple stakeholders with multiple perceptions of PS, we need to consider the following points:

- The difference between PS and successful projects: according to Pinto and Slevin (1987) a successful project is defined as one that resulted in organizational change. While PS has several pragmatic definitions, including meeting schedule, budget, and performance.
- The difference between PS and PM success: according to de Wit (1988) PM success can be measured in terms of time, cost and quality; PS can be measured by comparing the project outcomes and the planned project targets.
- The specialties of infrastructure projects: beside the specialties of construction projects, infrastructure projects, especially transportation projects, acquire others (e.g. strong interaction with the environment, big budgets that to be provided from taxes, technical challenges, special regulation for the procurement process, long-lasting projects, limited ability to predict the construction condition (e.g. subsoil, weather, problematic for public acceptance (Spang 2016))).

PM has always been presented as a big support for PS (Spang 2016, de Wit 1988), moreover, many authors e. g. (Spang 2016, Wirkus 2016) claimed, that by adapting of the PM approach, better outputs in terms of cost, time and quality can be achieved in infrastructure projects and this consequently means higher PS.

2 DEFINITION OF PROJECT SUCCESS IN INFRASTRUCTURE PROJECTS

In order to define the PS, the researchers have been facing many challenges such as coping with the different expectation of the stakeholders as well as choosing the right point in time to evaluate the project. Therefore, a great focus has been given to identifying PS criteria or dimensions as a means to assess PS, however, these criteria can vary from project to project, from stakeholder to stakeholder or from a point in time to another.

2.1 Multidimensional Concept

In order to overcome these problems, many authors have been using multidimensional PS assessment models and adopting its core concept to fit with different industry sectors. Shenhar *et al.* (1997) presented a four-dimensions project assessment model. The first dimension “project efficiency” defines success according to three criteria on-time, within budget, and within specification. Second dimension “impact on customer” addresses client-oriented criteria e. g. meeting performance measures and functional requirements. Third dimension “business success” deals with the direct impact on the organization in terms of market shares and total improvement of the organization. Fourth dimension “preparing for the future” addresses the preparation of the organization for the future e.g. new opportunities for further markets or innovation capabilities.

Bannerman (2008) presented a multi-level assessment model for IT-Projects and this model consists of five levels to evaluate PS. The first two levels are processed success and PM success and in these levels, the project will be evaluated against its performance such as time, cost and quality. The third level reflects the perceptions of users and emphasis their acceptance and satisfaction. The last two levels are future-oriented levels to address the impact of the project on its own organization (business success) and on the market (strategic success).

2.2 Multidimensional Framework for Infrastructure Projects

In order to integrate the specialties of infrastructure projects and the big number of stakeholders, Elbaz and Spang (2018) presented a multidimensional PS assessment model consisting of six dimensions distributed over the project life cycle and adaptable to acquire different stakeholders’ success criteria. These dimensions are:

Function Success: this dimension outlines the fact that a project must deliver its supposed functions. Unfortunately not all infrastructure projects achieve this goal e. g. Berlin Airport BER or Big Dig Boston. Even with a project delay or overruns, once the project delivers its supposed function this dimension can be considered as achieved.

Management Success: this dimension testes if the project is completed in time, within budget and according to specifications. A very few numbers of projects achieve this dimension by 100% and the literature has shown that an overrun of 30% in infrastructure projects is considered “normal” (Kostka and Fiedler 2016).

Investment Success: addresses the financial effects of projects and can be measured by Pay-Back-Period.

Organization Success: this dimension addresses the improvement of the internal process of the organization e.g. organizational structure, culture, and the ability of the organization to manage parallel projects.

Business Success: addresses the project's effect on the business of its stakeholders especially the owner. This dimension covers financial criteria such as market shares as well as non-financial criteria e.g. sense of achievement and sense pride.

Strategic Success: infrastructure projects are parts of a strategic plan and this dimension assesses the strategic effects of the project on the long run and introduces many criteria to measure it e.g. economic growth, socioeconomic trends and ecological trends.

3 ACHIEVING PROJECT SUCCESS IN INFRASTRUCTURE PROJECTS

Despite the significant number of SFs in the literature, stakeholders still cannot achieve a harmonic cooperation atmosphere in their projects and are not satisfied with the output of their projects. In order to facilitate the management of these complex projects, this paper presents SPM as a key SF and therefore claims that projects can be seen and considered as systems.

3.1 Project as a System

A system is a set of things working together as parts of a mechanism or an interconnecting network; a complex whole. This definition fits our understanding of projects very well but lacks the temporary nature, that's why projects can be seen as temporary systems (Heinrich 2014) yet meant to achieve predefined goals.

3.2 Systematic Project Management

Systematic means ”done or acting according to a fixed plan or system; methodical” or as “according to an agreed set of methods or organized plan”, accordingly PM has a systematic aspect by its definition.

This paper defines SPM as a collaboration of various yet linked and standardized management practices and techniques which have to be implemented as a whole set to ease and facilitate the implementation of SFs and to elevate the chances of PS.

3.3 Systematic Project Management as a Success Factor

PM has been approved as a key SF for project-oriented industries such as construction (Chan *et al.* 2004). Yet, the implementation of an efficient PM faces many difficulties, (e.g., the maturity of PM culture in companies, interlacing the project to its program or portfolio and further company's strategic vision, linking different PM knowledge areas to each other (e.g., risk management and stakeholder management or even connecting different project phases)).

The traditional PM approach assumes that the sponsor/customer can define project objectives, time and cost required to achieve these objectives as well as the way to get the work done (Wirkus 2016). But due to the complexity of infrastructure projects, this assumption can be very hardly and rarely achieved. In order to be more successful in today's projects, the PM needs to adopt more systematic approach in which: a) project objectives and targets are agreed among project stakeholders and comply with the strategic goals and objectives of their organizations. b) PS definition covers all project phases from initiating to closing. c) The purport of PS is unified between the different management levels. d) The PM processes are integrated in a nonlinear approach, that facilitates the flow of feedbacks between PM processes, project phases, and project stakeholders.

4 SYSTEMATIC PROJECT MANAGEMENT AS A SUCCESS FACTOR IN INFRASTRUCTURE PROJECTS

The SPM is a great support for the PS as discussed in section 2.2.

Function success: Infrastructure projects are predicted to have several changes, that affect their functionality or lead to a functional failure e.g Berlin Airport. Due to the complexity of these projects, changes can not be avoided by 100%. The project must have change management, that systematically proves and integrates these changes in the project plan, re-estimates the scope, cost, time, quality, resources, risks and sometimes even the procurement and contract management.

Management success: The SPM helps to achieve management success in many ways by:

- Linking the different PM elements and implement them as a whole set to manage the resources more properly during the project life cycle.
- Aligning project objectives with the company's strategic goals and linking the PS to the company success to insure continuous support of the top management.
- Complying the stakeholders to the PS by integrating their motivations and objectives into the project goals.

Investment success: since the project sponsors might have a different understanding of PS, the SPM aims to integrate the investment criteria into the project plan and provides the sponsors with regular reports about their investment to ensure more compliance and transparency.

Organization success: SPM helps organizations to better manage parallel projects by setting the organizational objectives in the first place and highlighting the outcomes of the project to the organization's assets. It also enables the organization to maintain a better relationship to customers, partners, and suppliers by addressing their goals and benefits in its proper understanding of the PS.

Business success: SPM links the project to its business case and hypothesizes the effect of the project on maximizing the value for the project's owner, sponsors, and stakeholders.

Strategic success: SPM provides a long term tracing to assess and evaluate the strategic effects of the projects and compare them to the strategic plan.

The next chapter presents the Gotthard Base Tunnel as a successful case study to verify the usability of the SPM.

5 CASE STUDY GOTTHARD BASE TUNNEL, SWITZERLAND (1992 – 2016)

The Gotthard Base Tunnel in Switzerland is the longest railway tunnel in the world with a total length of 57.1 km, total underground system of 151.8 km, approved by Swiss voters in a plebiscite in 1992 and in operation since 2016. It can be considered as a successful major project.

The New Rail Link through the Alps (NRLA) at the Gotthard posed an unusual challenge to all involved considering the sheer size, the political significance and the exceptional length of the base tunnel. Moreover, the project owners and sponsors had to be able to rely on the project being constructed as it had been decided by the Swiss Parliament and the Swiss people in the agreed target (cost, time and quality)

Whereas cost and time could be defined quite accurately by target values with a range of variation (-10%/+40% for costs) already in an early stage, the definition of the quality requirements is more challenging. In the case of the Gotthard Base Tunnel the quality requirements were defined project specifically (based on the quality management standard SN EN ISO 8402 (1994)).

The project's owner developed a Sponsor-Contractor delivery model -Figure 1-, in which the sponsor (Swiss Federal Government) charged AlpTransit Gotthard Ltd (ATG) with a design-build mandate as a constructor (sponsor constructor model). The ministry (DETEC) and the federal railway authority (Federal Office of Transport, FOT) represented the federal government in the project organization. The system of the project requirements was divided into fixed requirements -without freedom of action- and open requirements -with freedom of action -Table 1. At the Gotthard Base Tunnel, stakeholders had a different view on the project requirements (e.g., the sponsor had his focus mainly on fixed requirements and the requirements related to final object).

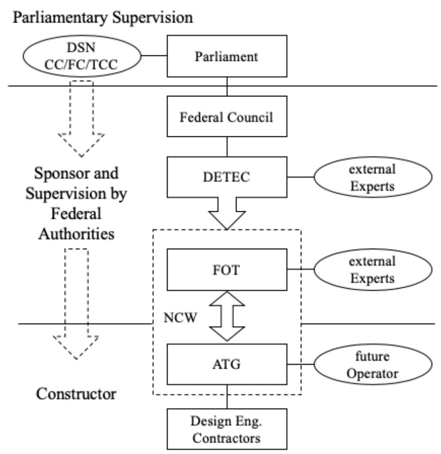

Figure 1. The sponsor constructor delivery model (Ehrbar *et al.* 2016).

Table 1. Project Requirements at the Gotthard Base Tunnel (Ehrbar *et al.* 2016).

Fixed Project Requirements without Freedom of Action	Open Project Requirements with Room of Action	
	Object-related Project Requirements	Process-related Project Requirements
<u>Agreed Project Requirements:</u> (Agreement Swiss Confederation / ATG) Completion • Of scope of work and agreed standers • Within budget • Within time schedule	<u>Quality / Function</u> Fulfillment required levels of • Reliability • Availability • Maintainability • Safety <u>Costs</u> Minimum of • Investment costs • Operation costs • Maintenance costs	<u>Occupational Health and Safety</u> • Highest OHS-Standers • Reasonable health protection <u>Project Organization</u> • High reliability: minimize errors and contradictions • Organization: clear structures, explicit interfaces, unambiguous tasks. • Processes: leadership, effcient performance and controlling • Information (internally / externally): at the right time, at the appropriate level
<u>Presupposed Project Requirements</u> Compliance with • Laws, regulations, codes • Project approval with obligations • Duty of care	<u>Schedule / Milestones</u> Minimum • Planning period • Period of approval • Construction period <u>Environment</u> • Optimum environmental safety and resources management	

The Project Management System at the Gotthard Base Tunnel was created with a best practice approach and was an important key SF. The key SFs for this project were systematic and very professional project management -Table 1- from the earliest beginning, based on a strategic plan (shifting the heavy traffic from the road to rail), taking into account all the requirements of the various stakeholders (public opinion, affected people, environmental organizations) as well as the market. The successful realization of the project was only possible thanks to the project-specific organization -Figure 1-, which was supported by a project-specific legislation.

6. SUMMARY

This Paper highlights the specialties of the infrastructure projects links the effects of these specialties with the project performance in terms of time, cost and quality as main project success criteria. These three criteria have been widely criticized to be the only ones used with infrastructure projects, thereupon this paper presents the six-dimensional Project success from Elbaz and Spang (2018) and illustrates the importance of systematic project management to each dimension.

The more complicated our projects are going to be, the more we need to adapt our way to manage things around them, and therefore this paper criticizes the traditional approach of project management and presents the SPM as an approach to achieve better results from infrastructure projects by a) Link project's objectives to organization's objectives to ensure more support from the top project management; b) Discuss and unify the purport of project success between all projects phases and project stakeholders; c) Reconstruct our project management process to ensure more agility and feedbacks among project stakeholders. In the end, it verifies the usability of SPM by presenting Gotthard-Base-Tunnel as a successful case study.

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