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Chapter 3
Factors Affecting the Integration of Sustainability in the Early Project Phases in an Integrated Project Management Model

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Abstract This study investigates the factors affecting the integration of sustainability into the project management of infrastructure projects, specifically highway projects during early phases. The research was drawn upon previous studies in order to develop a sustainability framework for measuring the project success in three aspects of sustainability: People, Planet, and Prosperity (triple bottom line). Next, Critical Success Factor (CSF) framework in the construction sector was extracted through a comprehensive literature review. A qualitative cross-case analysis was conducted on three sustainability-oriented highways projects in the Netherlands. Data were collected through document review and twelve in-depth interviews with different roles of Integrated Project Management (IPM) model. The findings suggest that each IPM role is inclined towards specific sustainability dimension which affects the application of sustainability CSFs. The results reveal that among the sixteen identified CSFs promoting the integration of sustainability, following factors were acknowledged by all the IPM roles: awareness of project external factors, clearly defined scope, clearly defined goals/ambitions. Further, the paper conceptualizes a model for integrating key roles involved in the project management of infrastructure projects. The model is based on the triple bottom line of sustainability bringing all the roles involved in the project management of infrastructure projects together.

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Keywords Project management · Sustainability · Infrastructure projects · Highway projects · IPM model · CSFs

3.1 Introduction

Recently, the concept of sustainability has evolved as one of the challenges and focal points for society [1]. Sustainability can be regarded as an important project goal which entails a broad range of value and benefits [2]. The focus on sustainability has resulted into the emergence of studies on the integration of this concept into project management practices suggesting that sustainability can be considered as new school of thought in project management [3, 4]. This school of thought mainly includes the following features: considering projects in a societal perspective, having a 'Management for stakeholders' approach, applying Triple bottom line criteria, and taking a value based approach to projects and project management [4].

Specifically in the construction sector, companies are criticized for their conventional approach focusing only on their short-term benefit [5]. In addition, construction industry is considered as one of the main polluters of the natural resources such as carbon emissions, air and water quality [6]. Thus, there is more pressure on these companies to extend their accountability and focus more on social and environmental aspects of their business [7]. The transport sector is assumed to be the second largest emitter of carbon dioxide (CO_2) emissions, the main anthropogenic greenhouse gas [8]. The emissions from the transport sector might double by 2050 due to the fast development of the emerging economies [9]. Highway projects, thus, play a significant role in bringing a change and create value into society by integrating sustainability. This is also very important since by 2030, the public project organization of Dutch highway projects aims to become energy neutral and working according to the circular principle [10].

The current study contributes to both science and practice. Regarding the scientific contribution, the study suggests a framework of the sustainability success factors. Sabini et al. [11] performed an extensive and systematic literature review of 770 publications focused on sustainability and project management from the period 1993 to 2017. They identified three themes showing different views on sustainability: (1) The value of implementation of sustainability into project management (why); (2) The extent to which sustainability affects traditional project management practices (what); and (3) The determinants for the optimal implementation of sustainable project management (SPM) and providing practical suggestions (How). Following this explanation, the current study positions itself in the third identified theme of sustainability literature by providing recommendations on how sustainability can be implemented in highway projects. Regarding the practical implications, the developed model in this research can be used by managers in infrastructure projects oriented towards sustainability. This paper is based on Tamak [12]'s Master thesis on integrating sustainability into project management.

The main objective of this research is to inspect sustainability in the current project management practice and propose a conceptual model which helps improving project success of a sustainability-oriented highway project. More specifically, this research is aimed to prepare current IPM managers of a public project delivery organization for future highway projects to become more sustainable-oriented. Based on the aforementioned problem statement and the objective of this research, the research question is formulated as:

> How can Critical Success Factors be applied in an integrated project management model to improve the chances of project success during the exploration and planning phase of a sustainability-oriented highway project?

The paper is structured as follows. The next section acknowledges sustainability in project management literature as a project success criterion and relevant Critical Success Factors in the construction industry. Then, the methodology for empirical data gathering is explained followed by the research findings. After the discussion, the conclusions and potential directions for further research are given.

3.2 Literature Review

3.2.1 Sustainability as a Project Success Criterion

Project success is a multi-dimensional concept [13, 14]. This includes the project efficiency, impact on the project team, impact on the customer/client, business and direct success, and preparation for the future. However, more recent literature also incorporates environmental, economic, and social sustainability dimensions [15]. Currently, it is widely accepted that achieving sustainability ambitions becomes crucial for measuring the overall success of infrastructure projects [16]. Carvalho et al. [15] conducted a survey in a wide range of industrial sectors, countries, project complexity, and project size. Their findings show a significant relation between project success and project social & environmental impacts with project sustainability management. Thus, findings from literature suggest use of sustainability as an upcoming project success criterion.

3.2.2 Definition of a Sustainable Highway

In order to explain how sustainability can be defined in a highway project, Elkington's People Planet Profit (3P) principle was selected as a sound sustainability theory [17]. People and Planet dimensions of sustainability have remained unchanged in the recent literature. With regard to third pillar, however, recent literature suggests "prosperity" as a concept that goes beyond economic development, i.e. Zimmerman

[18]. The Council of Transport Ministers of the European Union adopted a definition for a sustainable transport as a system Windhoff-Héritier et al. [19]. Hence, based on these explanations, in this study, the following definition for sustainable highway is considered:

- For People: allows the basic access and development needs of individuals, stakeholders and societies involved in the surroundings to be met equitably and in a manner consistent with the ecosystem
- For Planet: ensures environmental protection or limits the impact on the ecosystem while consideration of economic feasibility and the society (stakeholders) involved
- For Prosperity: is affordable, operates fairly and offers added value to support a competitive and balanced economy in the long term

In order to establish sustainability as a project success criterion, a distinct set of success sub-criteria is required. For developing a distinct sustainability success sub-criteria list, recent literature is reviewed. Gijzel et al. [20] developed a framework for sustainable aspects of a tunnel. We adopted this framework to identify sustainability success sub-criteria of a highway. Based on three expert judgments and discussions [12], a total of 30 sustainability success sub-criteria for a highway project, were validated and defined for this study (see Appendix 1).

3.2.3 Success Factors for Implementing Sustainability

Some earlier studies investigated Critical Success Factors (CSFs) for integrating sustainability into project management practices (i.e. Mavi et al. [21]; Martens et al. [22]. Another attempt was made by Banihashemi et al. [23] to review the recent literature and identify CSFs for properly integrating sustainability into project management practices of construction projects in developing countries. Specifically, following Slaughter [24], they identified success factors at five different stages of identification, evaluation, commitments, preparation (on projects and in organization) and implementation. Despite these earlier studies, there is still call for practical implications into how sustainability has been emended into project management.

The current study builds upon earlier work of Molaei et al. [25] on identifying factors leading to the project success through an extensive literature review. The modified list of factors clustering into seven categories, following Westerveld [26]. Recognition of the success causes or failure cause is crucial for maintaining the sustainability of infrastructure projects, which are usually publicly funded. A project delivery organization is a separate entity within a public domain, responsible for delivering the project and in essence functioning as client towards contractors [27]. The role of the client for integrating sustainability is crucial, since one of the influential enablers for considering sustainability is whether “the client asks for it” [28]. The current research is performed in a public project delivery organization in the Netherlands which is an agency of the Ministry for Infrastructure and Environment.

This organization is responsible for project success on behalf of the public client. Currently, this organization follows an Integral Project Management (IPM) model for performing projects, consisting of five managers or roles, who can dominantly affect project success of any undertaken project which is further elaborated in Sect. 3.3.2. It is evident that IPM roles carry out CSFs through their professional role, which shows the demand for this research.

3.3 Research Method

3.3.1 Research Design and Case Selection

As this study aims to explore the recent nature of sustainability as a project success criterion and to identify CSFs by in-depth investigation of sustainability-oriented highway projects, a case study approach was followed. Multiple case studies help in providing deeper understanding to the researcher. Knowledge obtained from different cases can be used to generalize across similar cases [29]. The aim of this study is to see processes and outcomes across the cases, to understand how these processes are qualified by local conditions, and thus to develop more sophisticated descriptions and powerful explanations. Case studies provide means to verify findings from literature [30].

Two criteria were set for selecting the cases: (1) The highway project should be sustainable-oriented in the public project delivery organization, (2) The exploration and planning phase of the project should be completed or near completion. This enables access to the IPM roles or other practitioners working on the project.

3.3.2 Interview Data and Analysis

The primary sources of data for a case study "*comes mostly from document reviews, interviews, observation, and secondary analysis*" [31]. Extensive document review was conducted to identify sustainability themes (or) goals (or) ambitions of the three selected highway projects and subsequently look for used CSFs. The document review of the highway projects was done prior to conducting interviews. This was done to verify or clarify the findings from the case studies.

Next, the semi-structured interviews were conducted. The purpose of the research and the anonymity were explained to the interviewees before conducting the interviews. Based on the availability of IPM roles in each case, four respondents per case have been selected for the interviews. The roles of the respondents per case are presented in Appendix 2. As discussed, the IPM model consists of five and sometimes more roles, depending on the project size and complexity. The five fundamental roles

include Project Manager (PM), Project Control Manager (PCM), Project Environment Manager (PEM), Technical Manager (TM), and Contract Manager (CM). For each case, next to the project manager, at least two different respondents, who represent one fundamental IPM role, are involved. The two extra IPM roles are assumed to provide enough experience and expertise for comparison with other fundamental IPM roles.

Each interview consists of three parts. (Part 1): First the respondents were asked to judge to what extent the validated 30 sustainability success sub-criteria were perceived as important in their specific highway project. They explicitly asked to rank these sub-criteria on a scale from 1 to 5. (Part 2): The second part of the interviews focused on the semi-structured interviews where open-ended questions were asked for the identification of CSFs for the implementation of sustainability. (Part 3): Finally, the respondents were requested to verify the list of 28 CSFs by ranking them from 1 to 5 and to express if any CSF was missed during the interview.

All interviews were recorded and transcribed while maintaining the anonymity of the interviewees and the cases. The identified CSFs were coded by a combination of inductive and deductive approaches. In deductive coding, existing theoretical framework of CSFs was used for identification of CSFs in the case studies. Inductive coding entails the identification of new CSFs to be acknowledged by the respondents.

3.4 Results

The results of the three parts of the interviews were analyzed in three stages. In stage 1, CSFs which is presented in all the cases were identified by following this approach: the frequency of occurrence of each of the identified CSFs were determined. If a specific CSF was stated by the majority of the respondents (75% or more), it was considered for further data analysis. Then, the codes are combined to develop the final Sustainability Success Factors (SSFs) framework as presented in Table 3.1.

In stage 2, the inclination of the IPM roles to sustainability dimensions (People, Planet, Prosperity) was determined by analyzing the results of the ranking of sustainability sub-criteria during part 1 of the interviews. The findings suggest that not all IPM roles have equal inclination towards sustainability dimensions.

The PM is responsible for various aspects in the project having a balanced view of sustainability dimensions. The PCM role is not affected by sustainability making this role to work outside the dimensions of sustainability. The PEM, TM and CM are directly connected and constantly involved with various stakeholders, design/technical teams and contractors respectively. Based on their ranking of the sustainability sub-criteria, the PEM is positioned mainly in the People dimension, the CM is positioned in the Prosperity dimension, and the TM can be placed in the Planet dimension.

The last stage includes determination of the inter-relationships between the inclination of the IPM roles towards sustainability dimensions, and use of common SSFs across the cases. These patterns are based on specific type of interaction between the

Table 3.1 Sustainability Success Factors (SSFs)

No.	SSFs	Definition
1	Awareness of project external factors	The awareness of project regarding sustainability goals/ambitions with respect to policy, society, technology and economic context
2	Clearly defined scope	A clear, well defined scope for sustainability goals/ambitions through establishment of boundaries and constraints (standards) & acknowledgement of ambitions by the client
3	Information sharing within the project team	Use of timely (active) distribution of necessary and valuable information regarding sustainability goals/ambitions through efficient communication channels from different project parties within the project team
4	Monitoring & Control	Use of standard control and monitor mechanisms for sustainability goals/ambitions through detailed plan, change management process, inspection/supervision and feedback mechanism to ensure acceptable progress on time, cost and scope
5	Risk Management	Use of risk oriented warning system and risk sessions to identify, define, analyse and assess risks pertaining to sustainability goals/ambitions
6	Proper selection of contracting strategy/tender process	Use of an adequate contracting strategy and competitive tender process that incorporates and promotes sustainability goals/ambitions (explicitly states sharing of risks and clarity about responsibility)
7	Collaboration between project parties	Required level of collaboration/cooperation among project participants for definition and implementation of sustainability goals/ambitions through an open (positive) attitude and effective communication
8	Competent/multidisciplinary team	Use of a suitably qualified project team to define and achieve sustainability goals/ambitions
9	Top management support	Commitment of senior management of the organization for the sustainability goals/ambitions
10	Client involvement	Timely consultation of client for decisions and support regarding sustainability goals/ambitions

(continued)

Table 3.1 (continued)

No.	SSFs	Definition
11	Active involvement of stakeholders	Timely involvement of stakeholders, in various stages of project to improve commitment, provide continuous support, lay grounds for negotiations, minimize opposition, develop mutual trust and improve overall communication for the sustainability goals/ambitions
12	Clear goals & Ambitions	Clear goals (obligatory) & ambitions (that have added value) regarding sustainability, linking to the requirements of the client
13	Sustainability policy	Use of sustainability policy
14	Systematic planning	Use of a realistic and detailed project plan to achieve the sustainability goals/ambitions
15	Adequacy & Efficiency of resources	Presence of available and competent resources for achieving sustainability goals/ambitions
16	Affinity for sustainability	Presence of ambitious nature, personal drivers and like-mindedness within the project team for sustainability goals/ambitions

two variables, namely inclination of the IPM roles and the SSFs [30]. The results of this analysis are plotted in a matrix as presented in Table 3.2. In this table, each "X" represents evidence from the interviews in at least two cases, to justify the relationship between two variables.

The results suggest that not all the IPM roles support application of all SSFs in order to improve chances of project success of a sustainability-oriented highway project. Thus, it can be observed that there might be specific focus area for each single IPM role. For instance, application of proper risk management for achieving sustainability ambitions is merely the responsibility of PCM. Active involvement of stakeholder is also acknowledged to be the responsibility of the PEM. In addition, the findings indicate the interdependency between the IPM roles to achieve a successful sustainable project. PM is considered to select the competent project team for implementing sustainability. As another example, defining a clear project scope for sustainability ambitions and determining the boundaries for is jointly attributed to all the IPM roles. Finally, CM is responsible for selecting a contracting strategy where sustainability is considered as selection criteria.

3.5 Discussion

The results from the cross-case analysis suggest that there is different inclination of the IPM roles towards sustainability dimensions. The results of the literature review and the empirical investigation are synthetized to propose a conceptual model for

Table 3.2 Matrix of the interrelationships between the inclination of IPM roles towards sustainability dimensions, and use of SSFs

	SSFs	PEM (people dimension)	TM (planet dimension)	CM (prosperity dimension)	PM (3P)	PCM (no dimension)
1	Awareness of project external factors	×	×	×	×	×
2	Clearly defined scope	×	×	×	×	×
3	Information sharing within the project team					×
4	Monitoring & Control					×
5	Risk management					×
6	Proper selection of contracting strategy/tender process			×		
7	Collaboration between project parties	×	×	×		
8	Competent/multidisciplinary team				×	
9	Top management support				×	
10	Client involvement				×	
11	Active involvement of stakeholders	×			×	
12	Clear goals & Ambitions	×	×	×	×	×
13	Sustainability policy	×	×	×	×	
14	Systematic planning					×
15	Adequacy and efficiency of resources				×	×
16	Affinity for sustainability	×	×	×	×	

integrating sustainability into project management practices. The model is called Integrated People, Planet, and Prosperity Management or I3PM model consisting of five fundamental roles, namely, Project Manager, Project Control Manager, Project Environment Manager, Technical Manager, and Contract Manager (see Fig. 3.1). This conceptual model depicts the focal points of the IPM roles and integrates the five roles to deliver a sustainable infrastructure project. Three of these roles, namely PEM, TM and CM, work in sustainability dimensions of People, Planet and Prosperity, respectively. PM is positioned in the intersection of the three dimensions, reflecting this crucial role in implementing sustainable ambitions of a highway project. The fifth role, PCM, is positioned outside the sustainability dimensions acting as the coordinator who has inter-dependency on other IPM roles to carry out his professional role and vice-versa.

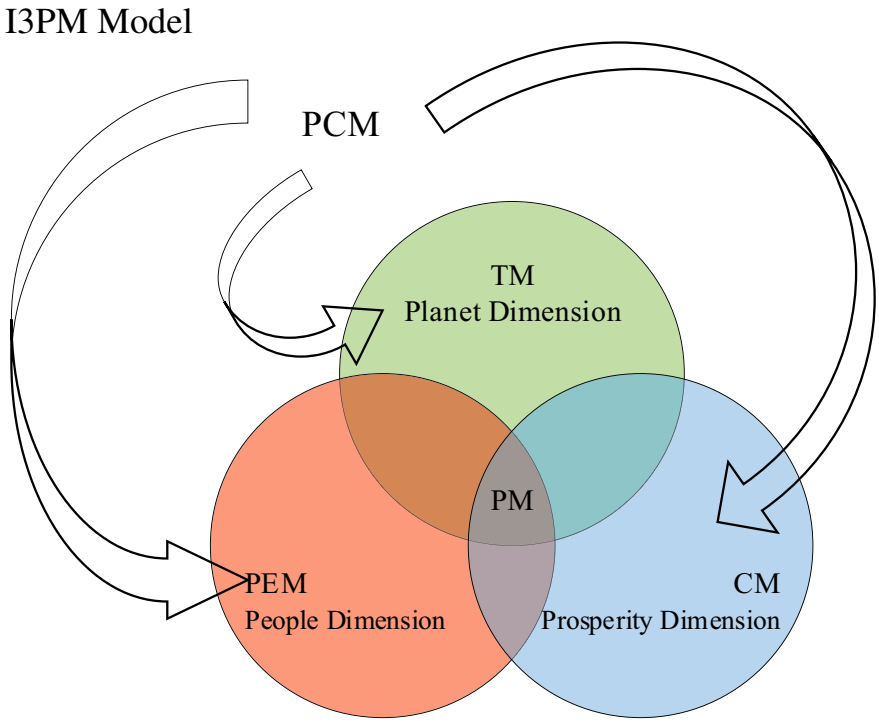

Fig. 3.1 Integrated people planet prosperity management model. *Note* PM stands for Project Manager; PCM for Project Control Manager; PEM for Project Environment Manager; TM for Technical Manager; and CM for Contract Manager

The model also consists of sixteen SSFs, which were identified from the relationship between the inclination of IPM roles towards sustainability dimensions and use of SSFs as explained in Sect. 3.4. The model and the list of SSFs were further validated through an expert judgement within the public project delivery organization. Experts confirmed that the application of SSFs could improve the chances of project success. However, based on the experts' views, two adjustments were made with respect to the boundaries of I3PM model. First, clearly defined scope is modified based on the expert comments to "Flexible scope" which is defined as "*a flexible scope for sustainability goals/ambitions through establishment of opportunity space by the client*". This finding also supports the study of Lechler et al. [32] suggesting that identifying opportunities for maximizing the project value requires a flexible approach which might result in changing the scope.

Second, affinity towards sustainability was acknowledged by the respondents as a new success factor for implementing sustainability in infrastructure projects. This is also confirmed by the study of Silvius et al. [33] where they claim that the extent to which sustainability is considered, depends on the project manager's personal

attitude and training. Based on the findings, they distinguished three groups of project managers [33]:

1. Pragmatic managers, who integrate sustainability upon good applicability and they are not self-motivated for sustainability;
2. Intrinsically motivated managers, who care about the nature and their environment and this behavior is self-stimulated;
3. Task-driven managers, who consider sustainability only if it is part of the project's requirements or objectives.

This SSF is allocated to IPM roles which are professionally affected by sustainability, namely PM, PEM, TM and CM. However, the corresponding position of this SSF (with regard to IPM roles) is changed. Based on the perspectives of the experts, sustainability cannot be forced and it should be indistinctly embedded in an IPM role. The SSF "competent/multidisciplinary team" was mainly agreed as a SSF under PM role whereas "affinity for sustainability" is strongly suggested to be part of other IPM roles as well. The reason might stem from the fact that a PM can initiate the implementation of sustainability by appointing a competent/multidisciplinary team which is in line with the findings of Silvius et al. [33]. However, maintaining the affinity of sustainability requires collective approach of all IPM roles since it depends on personal nature of all the team members and NOT on leadership/team building skills of a PM.

The final list of SSFs and the corresponding IPM role responsible for implementing them to be used in the I3PM model is summarized in Table 3.3. This provides a practical approach for implementing and integrating sustainability into project management practices.

3.6 Conclusion

The paper adopted a qualitative approach in which the findings of the cross-case analysis of three projects revealed sixteen Sustainability Success Factors for achieving the sustainability ambitions of highway projects. Application of these SSFs are deemed to improve chances of identified sustainability success sub-criteria of a sustainability-oriented highway project. Next, SSFs are synthesized and integrated into an I3PM model identifying various SSFs to be implemented by each of the roles in this model. I3PM model could help project management practice for better achieving sustainability goals/ambitions of a highway project. The conceptual model is further validated through expert judgement. This model provides a direction to focus on crucial areas during exploration and planning phase of a sustainability-oriented highway project.

The use of qualitative cross-case analysis can be considered as one of the limitations of this study. However, by doing the expert judgement, the credibility of the results, and thus, the possibility of generalizability of the findings is increased. Another limitation was the use of the triple bottom-line sustainability dimensions as

underlying sustainability theory which forms the sustainability sub-criteria. Other aspects of sustainability such as lifecycle thinking was not explicitly considered in this project which can provide some future directions for the research.

All projects in this study were performed through DBFM (Design, Build, Finance, and Maintain) contract where the project lifecycle is considered by making the contractor responsible for a longer duration due to "Finance and Maintenance" aspects. Use of DBFM or DBFM plus, and the use of Innovative partnerships are suggested as ways to include sustainability success sub-criteria in a contract, supporting the study of Kivilä et al. [2] suggesting that alliance contract activates the partners to exploit innovation opportunities.

In addition, sustainability is highly context dependent [34] which suggests further research into inclusion of the contextual factors in the model. This research proposed the I3PM model within a public project delivery organization (predominantly based on a client's perspective). Contractor's perspectives need to be investigated as well.

Compliance with Ethical Standards

Table 3.3 SSFs and the corresponding IPM role responsible for implementing them

IPM role responsible for implementing SSFs	SSFs
All IPM roles	Awareness of project external factors
	Flexible scope
	Clear goals/ambitions
PM/PEM/TM/CM	Sustainability policy Affinity for sustainability
PEM/TM/CM	Collaboration between project parties
PM/PCM	Adequacy & Efficiency of resources
PM	Competent/multidisciplinary team
	Top management support
	Client involvement
PCM	Information sharing within the project team
	Monitoring and Control
	Risk Management
	Systematic planning
CM	Proper selection of contracting strategy/tender processes
PEM	Active involvement of stakeholders

Declaration of Competing Interest The authors declare that they have no conflict of interest.

Ethical Approval All the procedures concerning the ethical impact of human research performed in this research were reviewed and approved by the Human Research Ethics Committee (HREC) at the Delft University of Technology. All the participants were informed about the goal of the research. Regarding data privacy, the research participants were assured of their anonymity and the case studies before conducting the interviews.

Appendix 1: Sustainability Success Sub-criteria Framework

Appendix 2: Selected IPM Roles for the Interview

IPM role in project	Case 1	Case 2	Case 3
Project Manager		×	
Project Control Manager	×	×	×
Project Environment Manager		×	×
Technical Manager	×		×
Contract Manager		×	×
Plan-study Manager	×		

(continued)

(continued)

IPM role in project	Case 1	Case 2	Case 3
Innovation Manager	×		
Total interviewees per case	4	4	4
Total	12		

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