

THE PERCEIVED RELATIONSHIP BETWEEN SUSTAINABILITY IN PROJECT MANAGEMENT AND PROJECT SUCCESS

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Abstract: Sustainable project management is one of the most important global project management trends today. And despite several studies addressing the relationship between sustainable project management and success, this relationship is still inadequately addressed. Following the suggestion that project success is just as much influenced by subjective perceptions as it is by objective performance data, this study focuses on the subjective perception of the relationship between the dimensions of sustainable project management and the criteria of project success. Based on a quantitative survey-based research design, the study found a positive perceived relationship between sustainable project management and all criteria of project success. However, the participants of the study differentiated this positive relationship for the different criteria of project success. The study also found that practitioners perceive sustainable project management as a single integrated construct and do not differentiate between the different dimensions of sustainable project management.

Keywords: Sustainability; Project management; Project success

1. INTRODUCTION

The awareness that sustainable development of society requires a more conscious use of natural resources, and a balance between economic, environmental and social impacts, is now firmly established in businesses and organizations. The 2019 'State of 'Sustainability' business survey indicates that CEOs are increasingly pursuing the integration of sustainability into the strategies and practices of their businesses (BSR/GlobeScan, 2019). This integration impacts a wide range of functional areas in the organization, such as strategy, research and development, human resources management, supply chain management and finance (Tulder et al., 2014). The transition towards more sustainable business practices requires organizational change, in which projects play an instrumental role (Marcelino-Sádaba et al., 2015).

The pivotal role of projects in the transition towards sustainability of businesses, organizations and society require a reconsideration of the way projects are planned, organized, executed, managed, and governed (Silvius and Schipper, 2014). This sustainability perspective on project management (Silvius, 2017) is addressed in a growing number of studies (Aarseth et al., 2017; Sabini et al., 2019; Silvius and Schipper, 2014). An open question, however, is how sustainability impacts project success (Silvius and Schipper, 2016). Considering sustainability in project management may increase the quality of the deliverable of the project and/or the satisfaction of stakeholders, but considering sustainability also comes at a price (Silvius et al., 2012). Khalifeh et al. (2019), therefore, conclude that the relationship between sustainability and project success is still inadequately addressed in the literature and that more research is needed. It is this gap in the literature that the study reported in this paper addresses.

One of the issues in studies on the relationship between sustainable project management and project success is the operationalization of success. Studies on project success point out that success is multidimensional (Ika, 2009), evolving over time (Pinto and Slevin, 1988; Shenhar et al., 2001) and perceived differently by different stakeholders (Prabhakar, 2008). PS is therefore not easy to measure. Pirozzi (2021) points out that, perhaps even more important

than the objective measurement of success, the subjective perception of project success may be essential. In line with this, Silvius and de Graaf (2019) found that the more favorable the project manager believes the outcome of considering sustainability in the project will be, the more likely he or she is willing to consider sustainability. For the consideration of sustainability in project management, therefore, the perceived impact on project success plays an important role. The study reported in this paper, therefore, focuses on exploring the perceived relationship between sustainable project management and success. This focus presents a novel approach compared to the earlier studies on this topic, and the therefore makes a contribution to the understanding of the aspects and effects of integrating sustainability into project management.

The research question of the study was formulated as *How does considering sustainability in project management influence the perceived success of projects?*

The remainder of the paper is organized as follows. In the following paragraph, the main variables of the study, sustainable project management (SPM) and project success (PS) will be described based on the literature on these topics. The largest part of the review of the literature will be devoted to the discussion of earlier studies on the relationship between sustainable project management and project success. The design and methodology of the study are revealed in the third paragraph of this paper, after which the following paragraph will discuss the findings and the data analysis. The paper will be concluded with a reflection on the findings and the answering of the research question.

2. BACKGROUND LITERATURE

In this paragraph, the main variables of our research question, SPM and PS will be explored. We used Google Scholar as the search engine in our search for relevant literature. As PS is a frequently studied topic in academic literature, we relied on earlier published literature reviews on the topic, specifically Ika (2009), to guide the operationalization of this variable. On SPM, a number of recently published structured literature reviews, specifically Silvius and Schipper (2014), Chofreh et al. (2019), Sabini et al. (2019) and Kiani Mavi et al. (2021), provided a solid

foundation for the understanding of the concept of SPM. For the analysis of literature that specifically focuses on the relationship between SPM and PS, we formulated a series of search strings that were all variations of the main search string ""PROJECT+SUCCESS+SUSTAINABILITY"". We expanded our search based on the sources used in the publications that were found. In total 66 publications were identified that based on their abstracts, were reduced to 18 relevant studies. After reading the full papers, our analysis focused on 15 articles that specifically addressed the relationship between SPM and PS variables. This paragraph will first discuss the characteristics of SPM shown in the literature. Following this, the concept of success in projects and project management will be discussed. The literature review will be completed with a discussion of earlier studies on the relationship between SPM and PS.

2.1 Sustainability Project Management

SPM is defined as "*the planning, monitoring and controlling of project delivery and support processes, with consideration of the environmental, economic and social aspects of the lifecycle of the 'project's resources, processes, deliverables and effects, aimed at realizing benefits for stakeholders, and performed in a transparent, fair and ethical way that includes proactive stakeholder participation*" (Silvius and Schipper, 2014). This definition integrates the consideration of familiar sustainability concepts, such as the 'Triple Bottom 'Line' (TBL) of economic, social and environmental perspectives (Elkington, 1994), lifecycle orientation (Labuschagne and Brent, 2005) and stakeholder orientation (Freeman, 1984) into project management, which is defined as the planning, monitoring and controlling of project delivery and support processes. SPM is considered one of the most important global project management trends today (Alvarez-Dionisi et al., 2016; Gemünden, 2016) and several authors (Silvius and Schipper, 2014; Aarseth et al., 2017; Sabini et al., 2019) report a growing number of studies that address the topic. From this emerging literature base, it appears that the relationship between sustainability and project management can be interpreted in two ways (Sabini et al., 2019; Silvius

- and Schipper, 2015). These two interpretations are characterized by Huemann and Silvius (2017) as:
- "Sustainability by the project": the sustainability of the deliverable or result that the project realizes;
 - "Sustainability of the project": the sustainability of the delivery and management processes of the project.

In Sustainability by the project, sustainability is mainly considered with regards to the deliverable or result of the project. Frameworks of sustainability are used to define or assess the content related aspects of the project (Silvius and Schipper, 2014), such as the specifications and design of the 'project's deliverable (Aarseth et al., 2017; Brones et al., 2014) materials used (Akadiri, 2015) benefits to be achieved (Silvius et al., 2012; Weninger and Huemann, 2013), quality and success criteria (Martens and Carvalho, 2017). Studies on the integration of sustainability into project management that take this content related perspective, often focus on operationalizing the TBL concept (Elkington, 1994), by developing sets of indicators on the different perspectives (For example, Bell and Morse, 2003; Edum-Fotwe and Price, 2009; Fernández-Sánchez and Rodríguez-López, 2010; Keeble et al., 2003; Labuschagne and Brent, 2008; Martens and Carvalho, 2017). In Sustainability of the project studies, the sustainability perspective is applied to the processes of project delivery, management and governance, such as the identification and engagement of stakeholders (Eskerod and Huemann, 2013), the process of procurement in the project (Molenaar and Sobin, 2010), the development of the business case (Weninger and Huemann, 2013), the monitoring of the project (Sánchez, 2015), the identification and management of project risks (Silvius, 2016) the communication in and by the project (Pade et al.,2008; Barendsen et al., 2021) and the selection and organization of the project team (Silvius and Schipper, 2014). In one of the first publications on sustainability and project management, Labuschagne and Brent (2005) link the two interpretations, Sustainability by the project and Sustainability of the project, by elaborating on the lifecycle orientation of sustainability. Project management logically considers the life cycle of a project, from its initiation to its closure. However, Labuschagne and Brent argue that from a

sustainability perspective, project management should not only consider the life cycle of the project, but also of the deliverable or result the project realizes, for example a change in products, assets, systems, processes or behavior. This deliverable, in their words: the "asset", should also be considered over its full life cycle, for example: design–develop–manufacture–operate–decommission–disposal. In the context Labuschagne and Brent studied, this asset would in its "operate" phase, produce products or services that would have a life cycle on their own. Considering sustainability in a project would therefore suggest that all three lifecycles, "project life cycle", "asset life cycle" and "product life cycle", are considered, as these lifecycles interact and influence each other. The definition of sustainable project management referenced above, refers to these interacting lifecycles by stating that in sustainable project management the sustainability perspective is applied to the life cycles of "the project's resources, processes, deliverables and effects" (Silvius and Schipper, 2014).

2.2 Project Success

The concept of success in projects or project management is one of the most studied concepts in project management research (Ika, 2009). In the literature, a distinction is made between project success criteria and project success factors. Project success criteria are the measures used to measure and judge the success or failure of a project (Müller and Jugdev, 2012). They may also be referred to as the performance indicators of the project. Project success factors are the elements of a project which, when influenced, increase the likelihood of success (Müller and Jugdev, 2012). These are the input factors or circumstances that make success more likely. The study reported in this paper focuses on the perceived impact of considering sustainability, as an input factor, on project success, as a resulting performance of the project. Therefore, we will elaborate in this section on the criteria and variables of measuring project success: the project success criteria. Few people would disagree with the statement that project success is interpretable in many ways. It is, simply put, a rather "elusive concept" (Prabhakar, 2008). Most early

research on project success seems to emphasize the three traditional criteria of success: realizing the deliverable of the project according to specifications within the agreed schedule and budget (Albert et al., 2017). This threesome of success criteria, quality, schedule/time and cost/budget, sometimes also referred to as the 'iron triangle', remains often used, "despite the fact that this method is currently subject to widespread criticism" (Bakker et al., 2010). Starting around the early 80s of last century, however, also other criteria of success emerged from literature, such as the benefits that the use of the project's deliverable generates for the user organization, or the "effectiveness of the project from the perspective of the stakeholder" (Jugdev and Müller, 2005). Ika (2009) analyzed the development of criteria used to assess project success, as visualized in **Figure 1**.

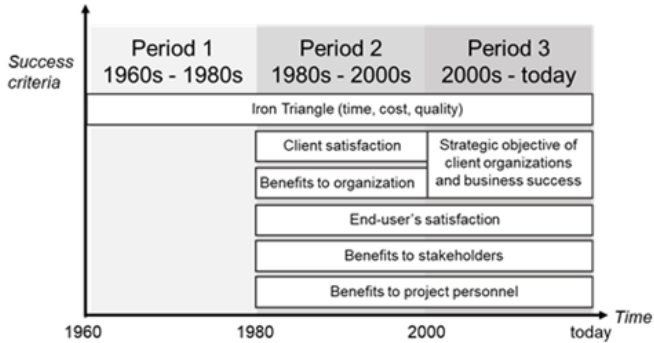


FIGURE 1 EVOLUTION OF PROJECT SUCCESS CRITERIA (BASED ON IKA, 2009).

From the overview in **Figure 1**, it appears that the criteria of PS evolved from the iron triangle of time, cost and quality to a more holistic set of criteria that also included the benefits that the project generates and the satisfaction of stakeholders. In addition to the success criteria identified by Ika, Almahmoud et al. (2012) conclude that criteria for health, safety, and environmental performance should be included in the assessment of PS. Sustainability, therefore, may be starting to be included in the criteria for PS.

2.3 The Relationship between SPM and PS

Following the distinction made above between project success factors and success criteria, the publications that relate SPM to PS also can be distinguished in these two perspectives. For example, Michaelides et al. (2014) and Daneshpour (2015) conclude that sustainability should be

considered a critical success factor for projects, whereas Kometa et al. (1995); Lim and Mohamed (1999); Chan and Chan (2004) and Almahmoud et al. (2012) assert that sustainability-related aspects should be included in the criteria for PS.

Despite this suggestion that considering sustainability should be considered as a factor or criterion for success, the actual relationship between SPM and PS has only received limited coverage in the emerging academic literature on sustainability in project and project management. Dubois and Silvius (2020) provide an overview of studies that specifically address the relationship between SPM and PS. Table 1 elaborates on their overview by presenting the 15 articles that our literature search delivered.

Table 1 shows that most of the initial studies were conceptual in nature. For example, Mishra et al. (2011) link PS to ethics in business. They conclude that "The project manager should make sure that he is completing the project while keeping the ethical standards and social impact in mind". Craddock (2013) also links PS to business and therefore aligns the criteria of PS with business excellence models, such as the European Foundation for Quality Management (EFQM) model. And as one of the EFQM model's fundamental concepts of excellence is "Taking responsibility for a sustainable future", he concludes that sustainability should be integrated in the criteria for PS and that SPM would therefore positively impact PS.

Studies	Nature of the study	Research method	Industries covered	Geographical focus
Mishra et al. (2011)	Conceptual	Literature based	n.a.	n.a.
Craddock (2013)	Conceptual	Literature based	n.a.	n.a.
Tiron-Tudor and Ioana-Maria (2013)	Empirical	Archival analysis (n=35)	Across industries	Across countries
M.L Martens and Carvalho (2014)	Conceptual	Literature review	n.a.	n.a.
Kaysi (2015)	Empirical	Case study (n=1)	Construction	United Kingdom
Silvius and Schipper (2016)	Conceptual	Literature review	n.a.	n.a.
Martens and Carvalho (2016a)	Empirical	Expert panel	n.a.	6 countries
Martens and Carvalho (2016b)	Empirical	Case study (n=4)	Diverse	Brazil & USA
Khalilzadeh et al. (2016)	Empirical	Survey (n=108)	Oil & Gas	Iran
Carvalho and Rabechini Jr (2017)	Empirical	Survey (n=222)	Across industries	Brazil & Peru
Khalifeh et al. (2019)	Conceptual	Literature based	n.a.	n.a.
Malik, et al. (2020)	Empirical	Survey (n=189)	Construction	Pakistan
Dubois and Silvius (2020)	Empirical	Survey (n=112)	Diverse	Europe
Zaman et al. (2020)	Empirical	Survey (n=368)	Construction	Pakistan
Khan et al. (2020)	Empirical	Survey (n=207)	Construction	Pakistan

TABLE 1. PUBLISHED STUDIES ON THE RELATIONSHIP BETWEEN SPM AND PS.

The other conceptual studies, Martens and Carvalho (2014) and Silvius and Schipper (2016), both build up a conceptual model of the relationship between SPM and PS that later was used in empirical studies (in Martens and Carvalho, 2016b, resp. Khalilzadeh et al., 2016). Based on their conceptual model, Silvius and Schipper (2016) also provided a conceptual mapping of the different relationships between the dimensions of SPM and the criteria of PS. This mapping showed that most of the relationships are expected to be positive, however, the expected relationship between SPM and the PS criteria time and budget are labelled "uncertain".

The rationale behind the uncertain effect of SPM on two of the three iron triangle criteria of project success comes from the expectation that a more sustainable project may require additional investments, for example in better materials (Packard Foundation, 2002), that are projected to deliver a benefit in the medium to long term from lower operation costs. However, these future benefits are by nature uncertain, where the higher investment is not uncertain. In some cases, the higher investment may therefore result in the project not being taken beyond the initial concept and design phases (Pearce, 2008).

Besides this assumed higher investment risk, incorporating environmental and social considerations into projects suggests extra requirements and specifications (Maltzman and Shirley, 2010; Taylor, 2010), which may increase the complexity of the project. For example, Hwang and Ng

(2013) conclude that incorporating sustainability in construction projects makes planning harder, causes more variations in design, causes difficulty in selecting subcontractors, causes uncertainty in the required materials and equipment, requires more coordination with different parties, and leads to more unexpected circumstances at project closure. This increases the pressure on project managers and decision makers (Knight and Jenkins, 2009). Moreover, it has been argued that incorporating sustainability raises the level of expectations of stakeholders of the project (Marcelino-Sádaba et al., 2015) and may increase tensions between them (Brandoni and Polonara, 2012; De Brucker et al., 2013; Singh et al., 2007; Tam et al., 2007). Therefore, the expected impact of SPM on the iron triangle criteria of PS is considered uncertain.

Next to the conceptual studies, **Table 1** also shows 10 empirical studies on the relationship between SPM and PS. **Table 2** presents how these studies define or operationalize the variables SPM and PS, and what the studies concluded.

From the studies presented in **Table 2**, a couple of observations can be made.

- *PS is more than the iron triangle.*

The studies listed in Table 2, mostly operationalize PS in a holistic set of criteria that cover both the traditional 'iron triangle' criteria of project success, time – quality - budget, as well as criteria related to the project's deliverable and the benefits this deliverable enables. This is in line with the evolution of PS criteria that Ika (2009) observed.

- *The operationalization of SPM is diverse*

In most of the empirical studies, the TBL perspectives of economic dimension, environmental dimension and social dimension, are recognizable in the operationalization of SPM. This is in line with the observations of Silvius and Schipper (2014) that concluded that the TBL was the most used concept of sustainability in studies on SPM. However, the same authors concluded that SPM is more than considering the TBL perspectives. SPM also includes dimensions that are derived from the literature on (corporate)

Table 2. Overview of empirical studies on the relationship between SPM and PS. (continue)

Study	Operationalization of Project Success (PS)	Operationalization of Sustainable Project Management (SPM)	Main findings
Tiron-Tudor and Ioana-Maria (2013)	Criteria of PS: 1. Time & Cost 2. Quality of PM processes 3. Stakeholder engagement 4. Realization of strategic objectives 5. User satisfaction 6. Organizational impact	SPM operationalized in: 1. Setting the sustainability expectations. 2. Opportunities of reducing costs. 3. Sustainability risks management. 4. Value maximization. 5. Sustainability requirements that are to be to accomplished. 6. Engagement to suppliers and sub-contractors. 7. Motivate the project team.	Authors conclude low correlation between SPM and PS.
Kaysi (2015)	Criteria of PS: 1. Time 2. Risk 3. Scope 4. Cost 5. Quality 6. Benefit	Triple Bottom line perspectives of: 1. Economic dimension 2. Environmental dimension 3. Social dimension	Author concludes that sustainability should be added as the seventh criterion of project performance and success.
Martens. and Carvalho (2016a)	<i>Based on Martens and Monteiro de Carvalho (2014)</i> Criteria of PS: 1. Project Efficiency 2. Impact on Customer 3. Impact on Team 4. Business Success 5. Preparation for the future 6. Sustainability	<i>Based on Martens and Monteiro de Carvalho (2014)</i> Triple Bottom line perspectives operationalized in criteria representing 1. Economic dimension 2. Environmental dimension 3. Social dimension	Authors concluded that the experts showed consensus on the positive impact of SPM on most of the PS criteria. However, on the effect of SPM on project efficiency, completing the project within the constraints of budget and schedule, the experts showed less consensus.

Martens and Carvalho (2016b)	<i>Based on Martens and Monteiro de Carvalho (2014)</i> Criteria of PS: 1. Project Efficiency 2. Impact on Customer 3. Impact on Team 4. Business Success 5. Preparation for the future 6. Sustainability	<i>Based on Martens and Monteiro de Carvalho (2014)</i> Triple Bottom line perspectives operationalized in criteria representing 1. Economic dimension 2. Environmental dimension 3. Social dimension	Authors found a significant positive and high contribution of SPM to all criteria of PS.
Khalilzadeh et al. (2016)	<i>Based on Silvius and Schipper (2016)</i> Criteria of PS: 1. The project is executed in a controlled manner 2. The agreed project deliverable is completed on schedule and within budget 3. The project's deliverable is 'fit for purpose' 4. The business objectives or goals of the project are realized 5. The stakeholders of the project are satisfied 6. The project prepares the organization for the future	<i>Based on Silvius and Schipper (2016)</i> SPM operationalized in: 1. Sustainability is about balancing or harmonizing social, environmental and economic interests 2. Sustainability is about both short-term and long-term orientation 3. Sustainability is about local and global orientation 4. Sustainability is about values and ethics 5. Sustainability is about transparency and accountability 6. Sustainability is about stakeholder participation 7. Sustainability is about risk reduction 8. Sustainability is about eliminating waste 9. Sustainability is about consuming income, not capital	Authors conclude that SPM relates positively to all criteria of PS.
Carvalho and Rabechini Jr (2017)	Criteria of PS: 1. Project Efficiency 2. Impact on Customer 3. Impact on Team 4. Business Success 5. Preparation for the future + Social & Environmental Performance of the project operationalized in 1. Environment damages reduction 2. Social benefits 3. Compliance to standards and legislation 4. Health and safety	Sustainable <i>management</i> of the project, operationalized in: 1. PM Focusing on sustainability 2. Green Procurement & Partnership 5. Social Responsibility Sustainable <i>deliverable</i> of the project, operationalized in: 3. Environmental Technologies 4. Designed for Environment	Authors conclude that SPM has a positive effect on Social & Environmental Performance. Authors conclude that SPM also has a positive effect on Project Success, although weak.
Malik et al. (2020)	PS operationalized in five items, not revealed	SPM operationalized in eight items, not revealed	Authors conclude a moderate positive correlation between SPM and PS.
Dubois and Silvius (2020)	Criteria of PS: 1. The project is executed within time	SPM operationalized in: 1. Sustainability by the project: - Environmental impacts considered - Social impacts considered	Authors conclude a strong positive correlation between SPM and PS.

Table 2. Overview of empirical studies on the relationship between SPM and PS. (continue)

	2. The project is executed within budget 3. The project delivers the right quality deliverable 4. Stakeholder satisfaction 5. The project delivers benefits for customers	- Economic impacts considered 2. Sustainability of the project: - Environmental impacts considered - Social impacts considered - Economic impacts considered	
Zaman et al. (2020)	Project management success, project ownership success, and project investment success, operationalized in 11 items.	<i>Based on Carvalho and Rabechini Jr (2017)</i> Sustainable <i>management</i> of the project, operationalized in: 1. PM Focusing on sustainability 2. Green Procurement & Partnership 5. Social Responsibility Sustainable <i>deliverable</i> of the project, operationalized in: 3. Environmental Technologies 4. Designed for Environment	Authors conclude a positive correlation between SPM and PS.
Khan et al. (2020)	PS operationalized in 14 items, not revealed	SPM operationalized in 14 items, not revealed	Authors conclude that SPM has a significant positive effect on PS.

TABLE 2. OVERVIEW OF EMPIRICAL STUDIES ON THE RELATIONSHIP BETWEEN SPM AND PS.

social responsibility (Silvius, 2017). Based on this broader understanding of SPM, Silvius and Schipper (2014) developed nine dimensions of SPM that are also used in a number of studies on the relationship between SPM and PS.

- The relationship between SPM and PS is mostly considered positively.

In line with the analysis of Khalifeh et al. (2019) the overview provided in Table 2 shows support for the conclusion that SPM supports PS, and that no negative impacts of SPM were observed. However, the limitations of the available studies, lead Khalifeh et al. (2019) to comment that the relationship between SPM and PS is still inadequately addressed in the literature and that more research is needed. Since this comment, four more empirical studies have been published that all concluded a positive correlation between SPM and PS. However, whether this empirical evidence is sufficient to convince project managers and project owners about the positive effects of SPM is still unknown. And in addition, it should be noted that the perception of the relationship between SPM and PS is not studied yet.

- Studies mostly focus on traditional project industries.
- With regards to the industries covered in the empirical studies, the traditional project industries, such as construction and oil & gas, show up more prominently than, for example, information technology or financial services

3. RESEARCH STRATEGY

3.1 Research approach and model

The authors choose a quantitative survey-based research design for the investigation of the perceived relationships between SPM and PS. The conceptual model of the study was taken from the studies of Silvius and Schipper (2016) and Khalilzadeh et al. (2016). In this model, SPM is operationalized in nine dimensions of sustainability in project management, that was developed by Silvius and Schipper (2014) in the first structured literature review on the topic:

- Sustainability is about balancing or harmonizing social, environmental and economic interests
- Sustainability is about both short-term and long-term orientation

- Sustainability is about local and global orientation
- Sustainability is about values and ethics
- Sustainability is about transparency and accountability
- Sustainability is about stakeholder participation
- Sustainability is about risk reduction
- Sustainability is about eliminating waste
- Sustainability is about consuming income, not capital

In this model, SPM is operationalized in the above mentioned nine dimensions, and PS in six criteria, resulting in $9 \times 6 = 54$ relationships between the different dimensions of SPM and the different criteria of PS. And as our study was aimed at exploring the perceived relationship between SPM and PS, these 54 relationships provided the foundation for the development of the questionnaire.

3.2 Hypothesis development

Based on the research model, the hypotheses on the relationship between SPM and PS can be developed in four possible scenarios:

- A. 54 hypotheses for all perceived relationships between individual SPM dimensions and individual PS criteria.
- B. Nine hypotheses for the relationships of the individual dimensions of SPM with the overall concept of PS.
- C. Six hypotheses for the relationships of the overall concept of SPM with the individual criteria of PS.
- D. One hypothesis for the perceived relationship between overall concept of SPM and overall concept of PS.

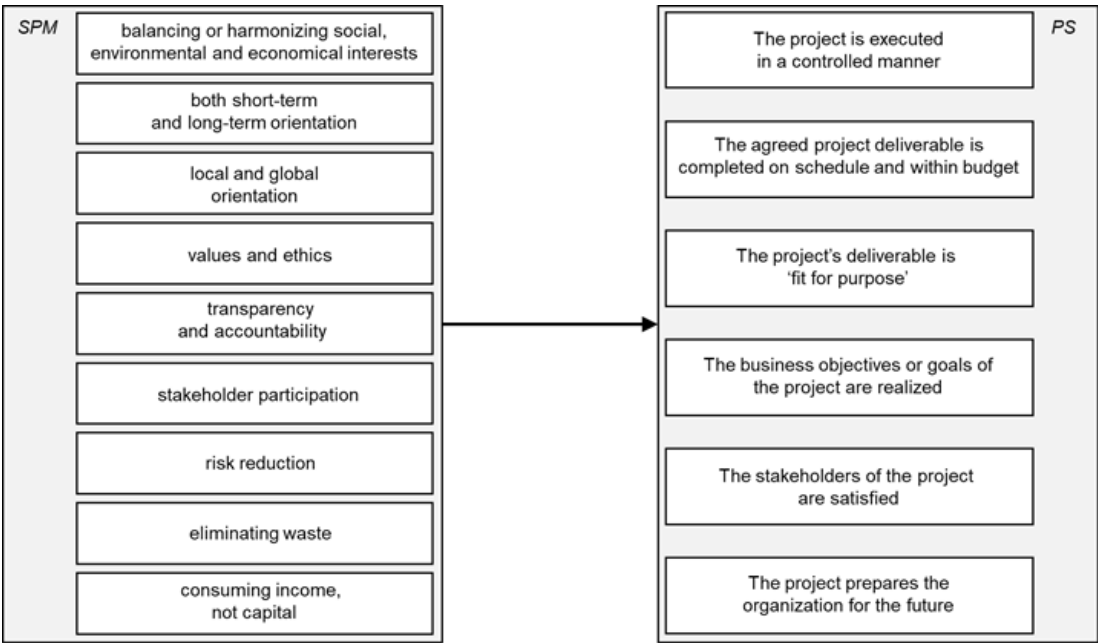


FIGURE 2. CONCEPTUAL MODEL OF THE RELATIONSHIP BETWEEN SPM AND PS (BASED ON SILVIUS AND SCHIPPER, 2016).

Based on earlier studies the impact of SPM on the product/benefits related criteria of PS is more positive than on the iron triangle related criteria. The previous studies therefore provide an indication that scenario C might be the best depiction of the relationship between SPM and PS. The study therefore adopts scenario C for the formulating the hypotheses of this study. However, in the data analysis, all four scenarios A - D will be considered, by analyzing the internal consistency of both the SPM and the PS composites.

The hypotheses for the study were formulated as:.

- H1. Project managers perceive the relationship between sustainable project management and more controlled execution of the project as positive.
- H2. Project managers perceive the relationship between sustainable project management and completing the project on time and within budget as positive.
- H3. Project managers perceive the relationship between sustainable project management and the project's deliverable is fit for purpose as positive.
- H4. Project managers perceive the relationship between sustainable project management and the realization of

project's benefits as planned in the business case as positive.

- H5. Project managers perceive the relationship between sustainable project management and the satisfaction of project's stakeholders as positive.
- H6. Project managers perceive the relationship between sustainable project management and how the project prepares the organization for its future as positive.

Figure 3. shows the hypotheses plotted on the conceptual model of the study.

3.3 Questionnaire

The content section of the questionnaire contained nine questions, Q8 – Q16, corresponding with the nine dimensions of SPM, in which the respondent was asked to express his or her perception between the particular dimension of SPM and the six criteria of PS. The relationships between SPM and PS were formulated as statements expressing a positive effect of considering SPM, on which the respondent was asked to indicate his consent on a five-point Likert-type scale, ranging from strongly disagree to strongly agree.

TABLE 3. CRITERIA OF PROJECT SUCCESS (SILVIUS AND SCHIPPER, 2016)..

Criteria	Measures included in this criterion
The project is executed in a controlled manner	The project management process is adequate Project risks are managed adequately The project is performed with a high standard of work quality.
The agreed project deliverable is completed on schedule and within budget	The project is completed within schedule The project is completed within budget The deliverable is meeting technical specifications
The project's deliverable is 'fit for purpose'	The deliverable is meeting functional performance requirements The customer of the project is using the deliverable (after completion) The deliverable is fulfilling the customer's needs The deliverable is solving a customer's problem
The business objectives or goals of the project are realized	The business objectives of the project are met The business objectives of the suppliers / contractors are met The deliverable creates a larger market share of the customer organization
The stakeholders of the project are satisfied	The project sponsor is satisfied with the project The (other) stakeholders are satisfied with the project The end-user is satisfied with the project The supplier is satisfied with the project The project team is satisfied with the project The cooperation of parties and individuals in the project is good.
The project prepares the organization for the future	The project prepares the organization for its future The project contributes to the development of the participating organizations The project contributes to the personal/professional development of the participating individuals The project creates a positive economic impact on society The project creates a positive social impact on society The project creates a positive environmental impact on society The project earns public recognition

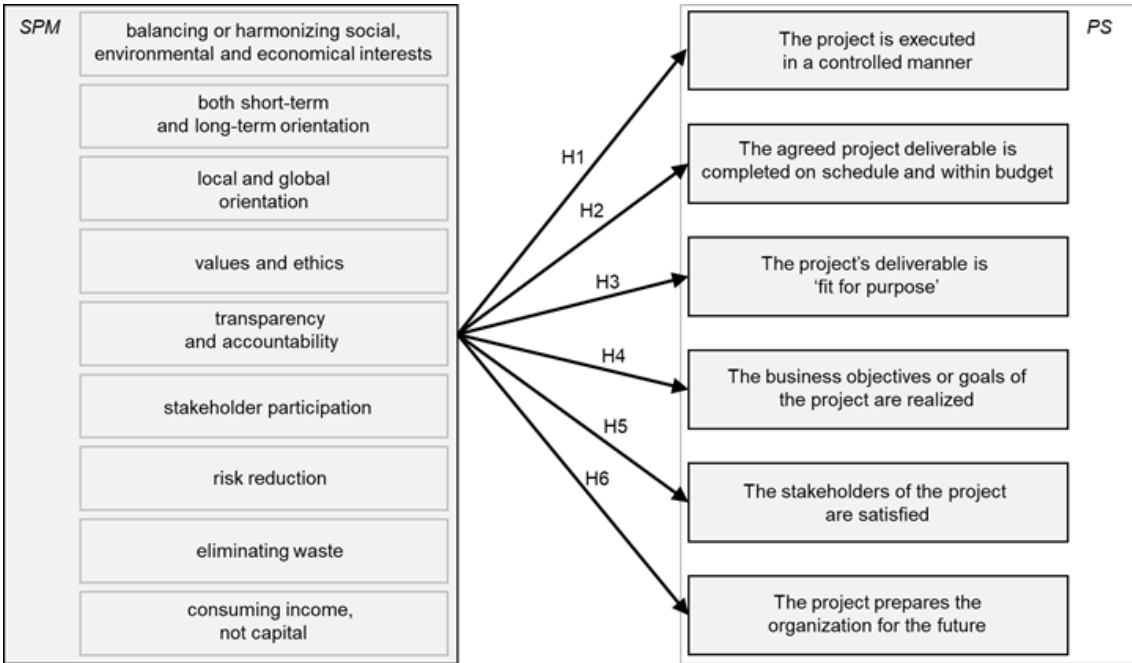


FIGURE 3. THE HYPOTHESES PLOTTED ON THE CONCEPTUAL MODEL OF THE STUDY.

Table 4 presents an example of one of these question, the one on the SPM dimension Stakeholder participation.

The questionnaire included two further sections with descriptive questions. The first is about the demographics of the respondent and the second about the projects the respondent usually works in. **Table 5** shows these questions and the answer categories.

TABLE 4. EXAMPLE OF THE QUESTIONNAIRE DESIGN.

Q13. Stakeholders participation in project management increases...					
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
A. the probability that the project is executed in a more controlled way.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
B. the probability that the project is completed on time and within budget.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
C. the probability that the project's deliverable is fulfilling its purpose.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
D. the probability that the project realizes its benefits as planned in the business case.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
E. the probability that the project's stakeholders are satisfied with the project.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
F. the probability that the project prepares the organization for the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Question number	Variable	Topic	Question	Answer scale
1	Demographic	Gender	What is your gender?	Category
2	Demographic	Age	What is your age?	Category
3	Demographic	Experience	How many years of experience in projects do you have?	Category
4	Work environment	Type of project	What type of project do you usually work in?	Category
5	Work environment	Industry	In what industry do these projects mostly take place?	Category
6	Work environment	International	Are these projects international?	Category
7	Work environment	Business partners	How many business partners (suppliers, subcontractors, etc.) participate in the project?	Category

TABLE 5. DESCRIPTIVE QUESTIONS OF THE QUESTIONNAIRE.

3.4 Sampling

Data collection was done internationally based on convenience sampling. Assuming a total global population of project managers of over one million individuals, the targeted sample size was set at 384 for a 5% confidence interval at a 95% confidence level. Although a larger size of sample leads to the less amount of probable errors for generalizing the population, practical issues prevented the study to realize this sample size. In total, 133 PMs were reached through

LinkedIn and project management website, of which 132 provided useable answers. Based on the recommendations of Reio and Shuck (2015), this was considered satisfactory. The sample size of 132 delivered a confidence interval of 8.53%, at 95% confidence level, instead of the targeted 5%, which is acceptable. For the validity of the data, respondents with less than one year of experience in projects were excluded. **Table 6** presents the demographics of the sample.

TABLE 6. DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE.

Question	Answer categories	Percentage
Q1: Gender	Female	17.4
	Male	82.6
	Total	100
Q2: Age	<25 years	4.5
	25 – 34 years	19.7
	35 – 44 years	22.7
	45 – 54 years	28.8
	55 – 64 years	21.2
	65 years or over	3
	Total	100
Q3: Experience in projects	1-5 years	31.1
	6-10 years	18.9
	11-15 years	18.2
	>15 years	31.8
	Total	100
Q4: Type of projects	Building & Construction Public Infrastructure.	9.1
	Building & Construction Real Estate.	1.5

TABLE CONTINUE...

	Building & Construction Development.	3.8
	Organizational Change.	16.7
	IT	17.4
	R&D	33.3
	Other	18.2
Q5: Industry	Total	100
	Agriculture	1.5
	Industry	34.8
	Energy	18.2
	Building & Construction	4.5
	Healthcare	4.5
	Wholesale & Retail	2.3
	Logistic Services	7.6
	HR Services	1.5
	ICT & Communication Services	3.8
	Consulting	3.8
	Public Administration	2.3
	Education & Training	6.8
	Other	8.3
	Total	100
Q6: Internationalization	No	21.2
	Yes, the result of the project has international aspects.	33.3
	Yes, the resources working on the project are international.	31.1
	Yes, the suppliers in the project are international.	14.4
	Total	100
Q7: Business partners	0	2.3
	1-5	56.1
	6-15	25.8
	16 – 50	8.3
	> 50	7.6
	Total	100

TABLE 6. DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE.

Table 6 shows that the sample was male dominated, 82.6% male respondents versus 17.4% female respondents, which reflects the professional community of project managers, as also appears from other studies (Silvius and de Graaf, 2019). Regarding the age of respondents, the majority of the PMs are in the age category of 45 to 54 years, and only 4 project managers participated in this study are 65 years old or over. Also, this pattern can be observed in other studies on project management and may be an indication that project management requires a certain level of knowledge gained through work experience in other fields.

The experience in projects within the sample shows an even distribution between 1 to 10 years of experience and more than 10 years of experience, with the largest fractions of participants being the ones with 1 to 5 years of experience and the ones with more than 15 years of experience. This provides a well-distributed basis of data for our study. The industries that are represented in the sample skews towards the sectors industry and energy, with the service sectors being somewhat underrepresented. This might be caused by the personal networks of the research team, as convenience sampling was followed. However, as the type of

projects in the sample shows a quite even distribution amongst building and construction, organizational change, R&D, IT and other projects, the overrepresentation of certain industries in the sample is not considered a blocking limitation for the analysis of the data from the sample. More than half of the projects represented in the sample are international, and the majority of projects has between 1 and 15 business partners.

3.5 Data analysis

The data from the content questions of the questionnaire coded 1 to 5, thereby following the 'interval lists' view of Likert-type scales (Carifio and Perla, 2008). SPSS software was used for the analysis of the consistency of the SPM and PS composites and the influence of the demographic and work environment variables.

4. FINDINGS

This paragraph presents the data analysis and findings of the study. Section 4.1 presents the descriptive analysis of the 54 perceived relationships between SPM and PS. In section 4.2 the fit with our conceptual model will be analyzed by testing the consistency of the SPM and PS composites. Section 4.3 presents the inferential analysis of the demographic and work environment variables.

4.1 Descriptive analysis

Figure 4 presents the overview of the participant's perception of the relationships between SPM and PS. The relationships are shown in order of the perceived positive impact of SPM on the individual criteria of PS. This figure shows that the participants in the study in general perceive the relationship between the dimensions of SPM and the criteria of PS positively. All relationships showed a mean score of between 3 and 4.2, which indicates that they agreed with the statements that SPM increases the probability of success. The study confirms the six hypotheses formulated in section 3.2. SPM is perceived to relate positively with all criteria of PS.

However, Figure 4 also shows that this positive relationship between SPM and PS is not perceived equally strong for the different criteria of PS. The perceived impact of SPM on the

different criteria of PS is summarized per criterion in Table 7. This table ranks the different PS criteria in order of strongest perceived relationship with SPM.

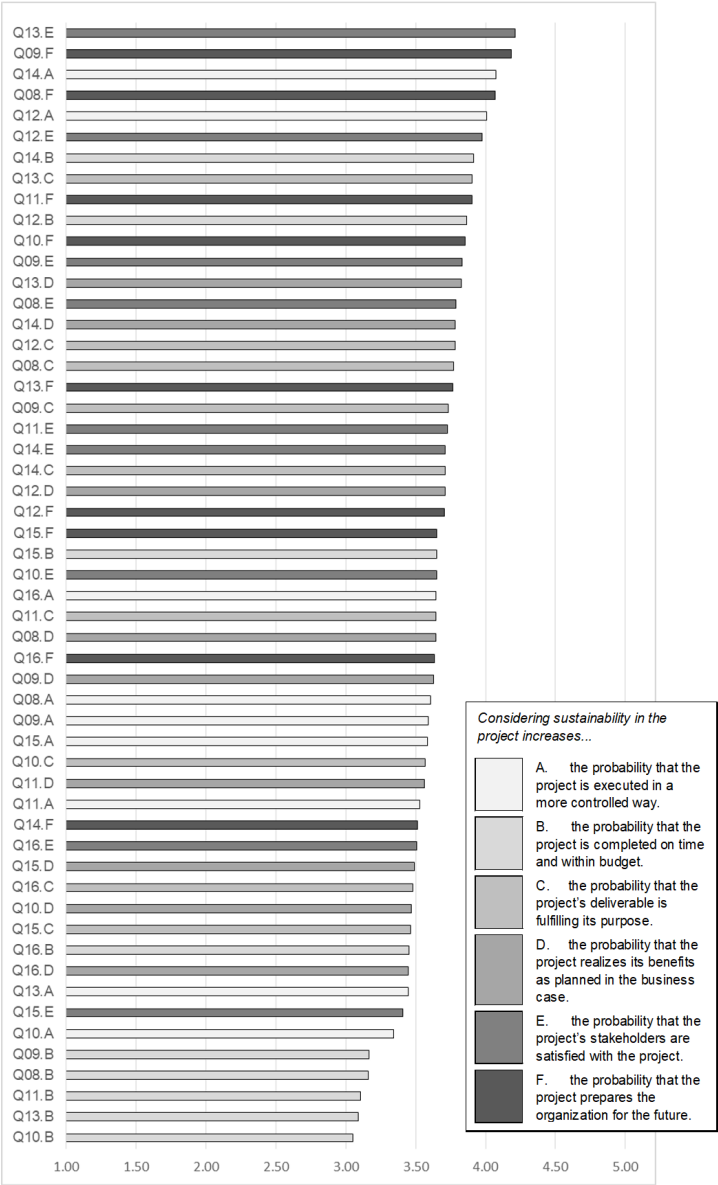


FIGURE 4. PERCEIVED RELATIONSHIPS BETWEEN DIMENSIONS OF SPM AND CRITERIA OF PS.

This table confirms the impression that arises from Figure 4. The strongest perceived positive impact of SPM relates to the PS criteria. The stakeholders of the project are satisfied and The project prepares the organization for the future. The weakest perceived relationships are related to the criterion. The agreed project deliverable is completed on schedule and within budget.

Criterion of PS	Mean
F. Project prepare organization for the future.	3.81
E. Project increase the stakeholder's satisfaction.	3.76
C. Project's deliverable is fulfilling its purpose.	3.67
A. Project is executed in a more controlled way.	3.65
D. Project's benefit is realized as planned in the business case.	3.62
B. Project is completed on time and within budget.	3.38

TABLE 7. PERCEIVED RELATIONSHIPS BETWEEN SPM AND PS. TOEALED PER PS CRITERION.

This finding is in line with the expected relationships between SPM and PS formulated by Silvius and Schipper (2016). In the model they developed, the expected relationship between SPM and the iron triangle criteria of PS were labelled 'uncertain'. However, Khalilzadeh et al. (2016) found, when testing the model of Silvius and Schipper, a positive relationship between SPM and all criteria of PS. Apparently, the perceptions and expectations of the project managers on this point are underestimating the positive effects of SPM.

4.2 Consistency analysis

In the development of hypotheses for the study, section 3.2. discusses four potential scenarios for depicting the relationship between SPM and PS. Based on the findings from earlier studies, the study adopted scenario C, consisting of six hypotheses for the relationships of the overall concept of SPM with the individual criteria of PS. for the formulation of hypotheses for this study. However, the collected data allows us to test this scenario, based on a consistency analysis of the SPM and PS constructs. For this consistency analysis, the Cronbach's alpha reliability coefficient was calculated.

TABLE 8. CONSISTENCY ANALYSIS OF THE PS CRITERIA.

PS criterion	Cronbach's alpha
A. Project is executed in a more controlled way	0.780
B. Project is completed on time and within budget	0.738
C. Project's deliverable is fulfilling its purpose	0.802
D. Project realizes its benefits as planned in the business case	0.847
E. Project's stakeholders are satisfied with the project	0.832
F. Project prepares the organization for the future	0.857

The consistency of the total set of 54 relationships showed a Cronbach's Alpha of 0.919, indicating the high internal consistency of the questionnaire. A high Cronbach's Alpha on the 54 perceived relationships implies that the participants see the relationship between SPM and PS as one consistent relationship and they do not differ so much between all 54 potential relationships between different dimensions of SPM and criteria of PS. The respondents do not consider this relationship in a very detailed or specified way which is the indication of scenario D.

PS Composite internal consistency

In order to test the internal consistency of PS criteria, all six criteria are tested for the consistency in the perceived relationships with the nine sustainability dimensions, resulting in a Cronbach's alpha value for each criterion of PS. From this **table 8**, it shows that the Cronbach's alpha coefficient of all PS criteria is above 0.7, indicating that there is a high consistency in the relationships of a specific PS criterion with all nine dimensions of SPM. This shows that the participants do not differentiate between the different dimensions of SPM, but perceive SPM as a single 'overall' concept.

SPM Composite internal consistency

The internal consistency analysis of the SPM dimensions can be found in **Table 9**. From this table, it can be concluded that the consistency of the perceived relationships related to the individual dimensions of SPM is on the majority of the SPM dimensions' moderate'. This indicates that the respondents differentiated the perceived impacts of the dimensions of SPM between the different criteria for PS.

A more detailed analysis shows that especially the relationship with the PS criterion D. *Project realizes its benefits as planned in the business case is perceived differently*. For all SPM dimensions, the consistency increases when the relationship with this PS criterion is removed from the analysis. However, the resulting Cronbach's alpha values are still lower than the values for the PS construct. An additional consideration is that removing this business case criterion of PS from the analysis, damages the completeness of the construct.

Discussion of the Scenarios

Based on the high internal consistency of the total set of 54 relationships (showing from the Cronbach's Alpha of 0.919), it might be concluded that scenario D (one hypothesis for the perceived relationship between the overall concept of SPM and overall concept of PS) depicts the perceived relationship between SPM and PS best. However, studying the relationship between SPM and PS as a single unspecified relationship does not make a contribution to the understanding of this relationship and how it is perceived by

project managers. Based on our analysis of the consistency of the SPM and PS constructs, we conclude that scenario C, in which SPM is considered as a single concept, but PS is considered in six separate PS criteria, provides the best depiction of the perceived relationship between SPM and PS as appears from our study. Therefore, the conceptual model of the study is confirmed, and the formulation of hypotheses remains as developed in section 3.2.

4.3 Inferential Statistics Analyses

In order to investigate the influences of demographic questions on findings, ANOVA tests were performed for all seven demographic and work environment-related variables. From this analysis it appeared that from all demographic variables (Gender, Age and Experience) no significant inferential effect was experienced. Also, the work environment variables Type of project, Industry and International did not show a significant interference. Only the number of business partners showed a significant influence, on the PS criterion: *realization of the business objectives or goals of the project*. An explanation for this interference could not be derived from the data. However, a potential explanation could be that a higher number of business partners adds complexity to the project, for example in decision making with regards to the integration of sustainability, which might hinder the realization of business benefits.

TABLE 9. CONSISTENCY ANALYSIS OF THE SPM DIMENSIONS.

Dimension of SPM	Cronbach's alpha
Sustainability is about balance or harmony between the interests of social, environmental and economic	0.590
Sustainability is both for short-term and long-term orientation	0.537
Sustainability is both the local and global orientation	0.701
Sustainability is about values and ethics	0.681
Sustainability is about transparency and accountability	0.709
Sustainability is about stakeholder participation	0.712
Sustainability is about risk reduction	0.690
Sustainability is about eliminating wastes	0.720
Sustainability is about income consumption, not capital	0.669

5. CONCLUSION AND DISCUSSION

The study reported in this paper set out to answer the question How does considering sustainability in project management influence the perceived success of projects? The study focused on the relationship between SPM and PS because earlier studies indicated that this relationship is not straightforward. Where some studies found that considering sustainability in project management positively influenced the success of those projects, other studies showed doubts about the positive effect of SPM on the famous 'iron triangle' criteria of project success.

Adding to the complexity of the relationship between SPM and PS is the realization that success in projects can be assessed through multiple criteria, that are also weighted differently by different stakeholders. It might be concluded that success is a criterion that is just as much influenced by subjective perceptions as it is by objective performance data. Following the recommendation of Pirozzi (2021), the study, therefore, focused on investigating the perception of the relationship between SPM and PS.

The conceptual model of the study operationalized SPM in nine dimensions of sustainability in project management and six criteria for PS. This resulted in 54 perceived relationships between dimensions of SPM and criteria of PS. Based on the indications found in earlier studies, six hypotheses were formulated, suggesting a positive perception of SPM, as a single construct, on all six criteria of PS. Based on a quantitative survey-based research design, with 132 participants, the study confirmed this model of the relationship between SPM and PS. The findings also showed a positive perceived relationship between SPM and all criteria of PS, thereby confirming the hypotheses. However, the participants of the study differentiated this positive relationship for the different PS criteria. The strongest perceived positive impact of SPM relates to the PS criteria. *The stakeholders of the project are satisfied and The project prepares the organization for the future.* The weakest perceived positive relationship is found on the iron triangle criterion. *The agreed project deliverable is completed on schedule and within budget.*

The perceived relationships between SPM and PS appeared to be independent of personal characteristics, such as gender, age, experience, and work-related aspects, such as

industry, type of projects and internationalization. Only the number of business partners showed a significant influence on a single criterion of PS. In general, it may therefore be concluded that the perception of the relationships of SPM and PS is independent of demographic and work environment-related variables.

The interfering effect of the number of business partners in the project, which showed from the study, provides a relevant direction for further exploration.

The study reported in this paper once again shows a positive relationship between SPM and PS, as also shown from the studies of Khalifeh et al. (2019), Malik, et al. (2020), Dubois and Silvius (2020), Zaman et al. (2020) and Khan et al. (2020). The contribution the study makes is that it explores the subjective perception of the relationship between SPM and PS. This complements the earlier studies, that aimed to establish a relationship between SPM and PS based on performance data of the projects. But as success is not just determined by the performance of the project, highlighting the subjective perceptions contributes to the further understanding of the effects of SPM.

The study also contributed to the further development of the model of the relationship between SPM and PS. By testing the consistency of the answers of the participants it could be established that the participants perceive SPM as a single overall construct, but with differentiated effects on the different criteria of PS.

The study showed that the perception of the positive relationship between SPM and PS is not equally strong for all criteria of PS. As was already expected by Silvius and Schipper (2016) and the experts of the study by Martens. and Carvalho (2016a), the relationship between PS and the traditional iron triangle criteria of PS is less straightforward. In fact, the perception this relationship appeared in the study was only slightly positive, despite empirical studies showing positive relations. Apparently, the perception that paying attention to sustainability costs money, is widespread. In projects, this perception implies that sustainability might endanger the iron triangle success criteria cost and time. Further studies need to be developed in order to investigate the financial and time impacts of sustainable project management further.

Limitations of the study are provided by the geographical

focus of the sample. Sampling was based in the Netherland which may present a bias. In the study the researchers aimed to eliminate the limitations of previous studies, by not focusing on specific industries or types of projects.

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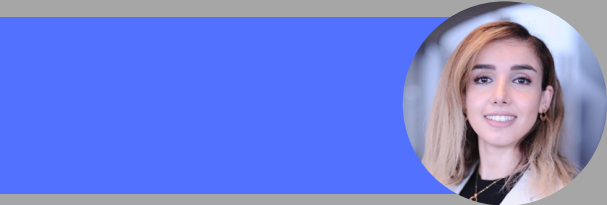
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