Sustainability Impact Assessment on the project level; A review of available instruments

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Abstract: Concerns about sustainability drive organizations to assume responsibility for societal impacts. Reducing negative impacts requires organizational change, in which projects play an instrumental role. Considering sustainability in project management is an important project management trend today, and requires instruments to assess the sustainability of a project. Several instruments have been published for this, with most of them having limited impact. This study reports a review of three selected sustainability impact assessment instruments. It was found that all three instruments assessed the sustainability impact of a project on multiple levels and based on a holistic set of criteria. The instruments, however, differed in the specificity of their assessment and their adaptability to the project's context. The instruments were found to be light on their description of the assessment process. The contribution the study makes is that it provides insight into practically applicable instruments for the consideration of sustainability in project management.

Keywords: Project Management; Sustainability; Sustainability Impact Assessment

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1. INTRODUCTION

'Green' or 'Sustainable' project management is considered one of the most important global project management trends today (Alvarez-Dionisi et al., 2016; Gemünden, 2016). As companies and organizations are increasingly integrating sustainability considerations into their strategies (BSR/GlobeScan 2019), a wide range of functional areas in the organization, such as research and development, procurement, supply chain management, human resources management and finance are influenced (Tulder et al., 2014). The transition towards more sustainable business practices requires the changing of products, services, business model, processes, policies and resources of companies (Tulder et al., 2014), Projects play an instrumental role in implementing these organizational changes and thereby the sustainable development of organizations and society (Marcelino-Sádaba et al. 2015).

The relationship between sustainability and project management is being addressed in a growing number of studies and publications (Silvius and Schipper, 2014; Aarseth et al., 2017; Sabini et al., 2019). However, despite this growing attention for sustainability in project management, Økland (2015) still observes a gap between the literature on sustainability in project management and what is carried out in practice. Also, Marcelino-Sádaba et al. (2015) observe a "*lack of integration of sustainability and project management*." As the concept of sustainability is understood by instinct but difficult to express in concrete, operational terms (Briassoulis, 2001), one reason for this may be the lack of practical knowledge, tools and instruments (Silvius et al., 2017a). And although the latest versions of international project management standards, such as the ICB 4 (International Project Management Association, 2015) refer to sustainability, they still lack more practical guidance on how to integrate the concepts of sustainability into project management processes and methods.

In order to operationalize the consideration of sustainability in project management, Carboni et al. (2018), suggest that a Sustainability Impact Analysis (SIA) is performed in the initiation or planning phase of the project. SIA is defined by the OECD as "*an approach for exploring the combined economic, environmental, and social impacts of a range of proposed policies, programmes, strategies and action plans.*" (OECD, 2010). A SIA can assist in decision making and strategic planning of policies, programs and actions. In the last years, a number of specific project focused SIA instruments have been published. For example the Sustainable Footprint Methodology (Oehlmann, 2011), the Sustainability Project Management Maturity Model (SPM3) (Silvius and Schipper, 2015), the P5 standard for sustainability in project management

(GPM Global, 2014), the Project Sustainability Excellence Model (PSEM) (Szabo, 2016) and the Project Sustainability Impact Assessment (PSIA) (Tam, 2017). Despite several studies reporting the application of some of these instruments (For example: Simionescu and Silvius, 2016; Clinning and Marnewick, 2017; Silvius et al., 2017b), not much is known about the quality of these instruments. It is this gap in the literature that this paper addresses by providing a review of published project SIA instruments.

The contribution the study aims to make is to support project managers and stakeholders with the identification of, discussion about and decision on sustainability-related improvement opportunities of projects. It thereby answers to the appeal made by Silvius (2019) to 'package' the sustainability perspective in practically applicable tools.

The remainder of this article is organized as follows. In the next paragraph, the literature on SIA will be studied in order to identify the best practices from this field. The second half of this paragraph will report the specific project SIA instruments found in academic literature. Following this, and a section on the research design of the study, three selected project SIA instruments will be reviewed based on the SIA best practices derived from literature. The paper will be concluded with a reflection on the findings and the conclusions that can be derived from the study.

2. LITERATURE

The purpose of this study is to review the published instruments that are specifically developed for SIA on the level of a project. We searched for these instruments in academic publications (journal articles, conference papers, book chapters and books) by using Google Scholar. Search strings used were combinations of 'project' or 'project management' and 'sustainability' or 'sustainable development' and 'impact analysis' or 'impact.' Further literature was searched by following the references and referencing of the publications that were found. Based on the abstract, or if necessary, the full texts, we selected those publications that proposed a method or instrument for project SIA. This means that studies that reported the sustainability impact of a specific project, without developing or applying a specific method for this impact assessment were omitted. The second part of this paragraph provides an overview and a classification of the specific project SIA instruments that were found.

In order to develop a framework for the review of the project SIA instruments, the first part of this paragraph will derive a number of 'best practices' on SIA from the extensive literature base on this.

2.1 Sustainability Impact Assessment

In the past two decades, publications on sustainability assessment have grown exponentially (Bond et al., 2012). Sustainability assessment has been called the third generation of impact assessment, following environmental impact assessment (EIA) and strategic environmental assessment (SEA) (Sadler 1999). However, it should be noticed that the field of sustainability assessment is not unambiguous in its terminology and that several terms emerged simultaneously (Bond et al., 2012). For example environmental and social impact assessment (ESIA), social impact assessment (SIA), urban impact assessment (UIA), biodiversity impact assessment (BIA), cumulative effects assessment (CEA), triple bottom line assessment (TBL), integrated impact assessment (IIA), and sustainability appraisal and sustainability assessment (SA). A discussion on where these terms overlap and where they complement each other is beyond the scope of this study. We will therefore refer to all of the aspects addressed above with the term Sustainability Impact Assessment (SIA).

Sustainability assessment thinking and techniques can be applied to different social systems, such as society, policies, industries, organizations, projects and actions. As the focus of the study reported in this paper is on the project level, our interest is on the applications of SIA on this level. Bond and Morrison-Saunders (2011) define SIA as "*any process that directs decision-making towards sustainability*."

Within the context of projects, one of the decisions that need to be made refers the selection of projects at the approval stage, which is related to project business case development (Kester et al., 2009) and project portfolio management Müller (2009). A SIA of a project must, therefore, assess whether the project is in line with policies at the strategic level (Laedre et al., 2015). The use of SIA for this purpose, however, comes with a number of challenges. The first being the lack of a common denominator for the evaluation of all impacts. As the economic consequences of a project are quantifiable in monetary values, they may overshadow the social and environmental impacts, which are often more difficult to quantify (Heinzerling and Ackerman, 2002).

A second concern is the use of SIA for project selection, are the trade-offs between the different sustainability perspectives, social, environmental and economic (Sadler, 1996). Trade-offs illustrate concessions that can be given between the economic, social and environmental spheres (Laedre et al., 2015) and a logical concern in SIA practice is that the environmental interests get traded off for socio-economic benefits (Morrison-Saunders and Fischer, 2006).
Sustainability assessments, however, can also be used to evaluate and manage trade-offs (Morrison-Saunders and Pope, 2013). The management of trade-offs in sustainability assessment requires good processes that are focused on optimizing sustainability outcomes (Bond et al., 2012). Gibson et al. (2005) have put forward trade-off decision rules designed to ensure that sustainability assessment processes better deal with and account for sustainability trade-offs (Bond et al., 2012).
However, SIA is not intended to provide any final answer for project investment decisions (Laedre et al., 2015). Whatever the choice of method and methodology, SIA is an aid to decision-making, not a substitute for it (OECD 2010: 14).
Another application of SIA in a project is its use as a tool for exposing the most significant impacts of projects, positive as well as negative. In this application of SIA, it is a tool for making improvements to the design, organization, execution, management and governance of a project, which is also the application of SIA on the project level that Silvius et al. (2017b) report in their study of 32 cases. This use of SIA on the project level, aimed at project *improvement* and not necessarily project *selection*, is less prone to the challenges with trade-offs between different impacts. Our study focuses on this application of SIA, as it is also the application that is proposed by the literature on sustainability and project management (For example Carboni et al., 2018).

From the 'state-of-the-art' practices of SIA (Bond et al, 2012), a number of 'best practices' can be derived.

- ***SIA requires a holistic set of assessment criteria***

  In its theoretical foundation, SIA is relatively simple. Its most recognizable conceptual background is the Triple Bottom Line (TBL) concept (Elkington, 1994) of economic, environmental and social sustainability. These three 'pillars of sustainability' guarantee a holistic perspective on the impacts of a project, but also introduce the risk of trade-offs. Merely considering the three pillars of sustainable development is insufficient

(Bond et al., 2012). Therefore, best practice sustainability assessment, reflecting state-of-the-art thinking, would take systems, rather than a three pillars approach, seeking to deliver net sustainability gains (Gibson et al., 2005), through greater system health and resilience over the long term (Grace, 2010).

- ***SIA requires consideration of different levels of impact***

  Inspired by the literature on project management, Laedre et al. (2015), identify several levels of impact analysis: operational – tactical – strategic. In this distinction, the operational level refers to the impact that occurs during the project life-cycle, from inception to closure of the project, whereas the tactical and strategic levels refer to the overall objectives, effects and benefits of the project.

  This identification of different levels of impact of a project can also be found in the emerging body of literature on sustainability and project management (Sabini et al., 2019). For example Huemann and Silvius (2017), distinguish between "*Sustainability by the project*", the sustainability of the deliverable or result that the project realizes, and "*Sustainability of the project*", the sustainability of the delivery and management processes of the project.

  In one of the first publications on sustainability and project management, Labuschagne and Brent (2005) link these two levels of impact, by considering projects from a life-cycle perspective. They argue that in the context of projects, a life-cycle perspective implies that not just the life-cycle of the project (for example, initiation–development–execution–testing–launch) should be taken into account, but also of the 'result' the project produces, being a change in products, assets, systems, processes or behaviour. This result, in their words the 'asset', should also be considered over its full life-cycle, being something like design–develop–manufacture–operate–decommission–disposal. In its life-cycle, the asset has a productive phase ('operate'), in which it generates value by producing products or services. Elaborating on the life-cycle view even further, Labuschagne and Brent claim that the life-cycles of the products or services that the asset produces should also be considered.

  Because Labuschagne and Brent include the result of the project, the asset, in their framework, it is sensitive to the context of the project. Their studies regarded the manufacturing sector in which projects generally realize assets that produce products. In other contexts, the result of a project may not be an asset, but an organizational change

or a new policy. The general insight gained from their work, however, is in assessing the impact of a project, both the *process* of performing the project as the *product* the project realizes should be considered.

Laedre et al. (2015) point out that it is essential to distinguish these different analytical perspectives, *process* and *product*, when performing a SIA of a project, as "*an impact can be characterized as sustainable from one perspective, but not sustainable from another perspective*".

- ***SIA requires a context-specific approach***

  Organizations are faced with the challenge of developing, understanding and implementing sustainability strategies that meet the vision and needs of stakeholders (Poveda and Young, 2015). What constitutes sustainability in the context of an individual organization or project, therefore, needs to be determined on a case-by-case basis (Bond et al., 2012). As the specific context of any sustainability assessment matters (Gibson et al., 2005), the relevance of different potential indicators needs to be established for the specific project and organization that is assessed. A SIA approach needs to accommodate pluralism (Bond et al., 2012) and each sustainability assessment process should be tailored to its context. Pluralism is therefore considered a condition for an effective SIA (Bond and Morrison-Saunders, 2012) and should be accommodated throughout the SIA process.

- ***SIA needs to support development***

  SIA is still a 'young' concept and in its initial phase of development (Bond et al., 2012). A lot of experience with sustainability assessment to date can be framed as 'learning by doing' (e.g. Gibson, 2006, Bond et al., 2011). Approaches and methodologies have not yet reached a level of maturity in which they are 'proven practices', making further development important (Cherp 2001). In order to properly compare the effectiveness of SIA practices, a consistent framework needs to be applied (Bond et al., 2012). Gibson et al. (2005) suggest that a robust sustainability assessment process will facilitate 'learning from mistakes' in recognition that decisions and actions cannot be expected to be perfect in the first instance.

- ***SIA requires an open process***

  Traditionally SIA is a process that takes place behind 'closed doors' (Sadler, 1996). However, as sustainability is a value-based concept (Bond et al., 2011), what sustainability is and by which indicators it ought to be measured vary among stakeholders and the public. Gibson (2006) therefore, concludes that Stakeholders must be involved in the SIA through an open and participatory process. This necessitates the engagement of stakeholders at the outset of the SIA process and ideally involves a visioning process of some kind (e.g., what a sustainable outcome for the decision at hand might look like) and the establishment of principles and objectives that will deliver that vision (Pope et al., 2004). Bond et al. (2011) adds that this assessment process is carried out throughout the project, so that stakeholders are not marginalized in the implementation phases.

- ***SIA requires a comprehensive output***

  A practical condition for implementing sustainability-driven improvements in projects, is a comprehensive presentation of the SIA results (Silvius et al., 2017b). A visual presentation of sustainability risks and opportunities, and confrontation of these risks/opportunities with the strategies and interests of stakeholders, supports the understanding and acceptance of improvements (Silvius and Schipper, 2015). A SIA instrument should, therefore, be designed to develop a comprehensive output that supports the follow-up actions of the assessment.

The SIA best practices listed above provide a review framework that will be used in our discussion of the project SIA instruments found in the literature. The following section will provide an overview and a classification of these instruments.

2.2 Instruments of Project Sustainability Impact Assessment

Acknowledging the role projects play in sustainable development, Silvius and Schipper (2014) conclude that the concepts of sustainability should be integrated in the way projects are planned, organized, executed, managed and governed. This sustainability perspective on project management (Silvius, 2017) evolved into the concept of Sustainable Project Management

(SPM), which 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 life-cycle 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).

Sustainability considerations are increasingly being integrated into the industry standards of project management. For example, the recently published ISO 21505 standard on governance of project, programme and portfolio management (International Organisation for Standardisation, 2017) refers explicitly to sustainability and states that "*The governance of projects, programmes and portfolios should reflect the organisation's commitment to ethical values and sustainability*". Also the latest IPMA Individual Competence Baseline (International Project Management Association, 2015), explicitly refers to sustainability in its 'Perspective' competence element "*Compliance, regulations and standards*", which includes the indicator "*Identify, and ensure that the project complies with relevant sustainability principles and objectives*". The description of this key competence indicator states that the project manager should be able to "*assess the impact of the project on the environment and society*". How this assessment of the project's impact should be performed is not further, but the project management standards pose a clear need for an SIA instruments on the level of a project.

A specific sustainability-oriented standard is Projects Integrating Sustainability Methods PRiSM (Carboni et al., 2013). PRiSM describes a generic set of project management processes that is based on a generic project life-cycle, which is in itself not innovative. However, it integrates the consideration of sustainability into the project management processes, by integrating a project SIA in the project initiating phase. The results of the SIA are documented in a "*Sustainability Management Plan*" (SMP) for the project. Throughout the project life cycle the SMP is managed and at the closure of the project the sustainability aspects of the project are reviewed in a meeting that also includes the sustainability or CSR officer of the organization. A similar approach can be found with Asad and Khalfan (2007), who discuss the need for incorporating sustainability within the process of construction projects and propose the introduction of a "*Sustainability Management Activity Zone*". Johansson and Magnusson (2006) suggest that this sustainability management activity zone is best organized as a specific ''*Green*'' sub-project. Organizing the attention for sustainability as a sub-project can serve as

a means to put environmental considerations on the agenda and act as an arena for engaging environmental specialists in the project and discuss sustainability performance requirements of the project. However, a sustainability-oriented sub-project also introduces the risk that confusion arises about who bears the responsibility for fulfilling these performance requirements.

The suggestions that arise from the studies above provide a number of methods or practices that can inspire organizations to integrate sustainability considerations into their project management processes.

A condition for the successful integration of sustainability considerations in projects is an instrument to assess the sustainability impact of a specific project. For the project SIA that PRiSM prescribes, it also proposes an instrument: P5 (GPM Global, 2014). P5 is one of the project SIA instruments that has been published in the last decade.

Our literature search delivered over 100 studies and publications in which the sustainability impact of a project is reported. However, as our study is aimed at reviewing SIA instruments, we selected those studies that reported a SIA method or instrument and that showed a wider orientation than a single case. Also the instruments that focused merely on the sustainability of the deliverable of the project, without applying the concepts of sustainability also to the process of performing and managing the project, were removed from our selection. The resulting literature sample included 16 instruments. Table 1 provides an overview of these instruments.

Instru-ment	**Project Assessment Matrix (PAM)** (Keeble et al, 2003)	**A Checklist for Assessing Sustainability Performance of Construction Projects** (Shen et al., 2007)	**Sustainability criteria for projects** (Silvius, 2010; Silvius et al., 2012)	**Sustainable Footprint Methodology** (Oehlmann, 2011)	**Wa-Pa-Su Project Sustainability rating system** (Poveda and Lipsett, 2011a)	**Sustainable Project Management Maturity Model (SPM3)** (Silvius and Schipper, 2010; 2015)	**Composite Sustainability Index of a Project (CSIP)** (Dobrovolskiiene and Tamosiuniene, 2016)	**Project Sustainability Maturity Level (PSML)** (Siew et al., 2016)	**Sustainability Assessment Methodology for Built Innovations** (Maier et al., 2016)	**Project Sustainability Excellence Model (PSEM)** (Szabo, 2016)	**Composite Sustainability Index of Real Estate Projects** (Dobrovolskiiene et al., 2019)	**Project Sustainability Impact Assessment (PSIA)** (Tam, 2017)	**Life Cycle Sustainability Analysis (LCSA)** (Wang et al., 2018)	**P5 Standard for Sustainability in Project Management** (GPM Global, 2014; 2019)	**Project Sustainability Index** (Chen et al., 2019)	**Composite Highway Sustainability Index (CHSI)** (El-Kholy and Akal, 2019)
Sustain-ability criteria	4 perspectives, operationalized in 15 criteria with 69 indicators	3 perspectives, operationalized in 15 variables with 83 indicators	3 perspectives, operationalized in 11 variables with 36 indicators	3 perspectives, operationalized in 48 variables	To be selected during the assessment	3 perspectives, operationalized in 22 variables with 77 potentially relevant indicators	3 perspectives, operationalized in 15 indicators	6 knowledge areas, operationalized in 15 potentially relevant variables	4 perspectives, operationalized in 9 impact category groups with 36 indicators	3 perspectives, operationalized in 57 variables with 143 potentially relevant indicators	3 perspectives, operationalized in 15 indicators	3 perspectives, operationalized in multiple potentially relevant variables/indicators	3 perspectives, operationalized in 10 impact categories with 23 indicators	3 perspectives, operationalized in 11 variables with 46 indicators	4 perspectives, operationalized in 42 indicators	3 perspectives, operationalized in variables with unknown indicators
Derived from	- Case company strategy	unclear	- GRI G3	- GRI G3 - Life Cycle Assessment (LCA) - UN Commission on Sustainable Development - WWF Principles for Sustainability - Sweden's Environmental Objectives	- Integrating several standards.	- Several sustainability indicators frameworks and studies - Several stages of sustainability frameworks	- ISO-21932-2013	- PMBoK	- UN SDGs	- IPMA Project Excellence Model - GPM P5 standard	- ISO-21932-2013	unclear	- UN SDGs	- Several UN standards - List of sustainability criteria as published by Silvius, 2010	unclear	unclear
Concep-tual foun-dation	- Triple Bottom Line	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line	- CMM	- Triple Bottom Line - Life-Cycle Analysis	- EFQM quality management model	- Triple Bottom Line	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line - Life-Cycle Analysis	- Triple Bottom Line - Life-Cycle Analysis
Nature	Assessment model	Checklist	Checklist	Assessment model	Assessment model	Maturity model	Assessment model	Maturity model	Assessment model	Assessment model	Assessment model	Assessment model	Assessment model	Assessment model	Assessment model	Assessment model
Scale	5 point ordinal scale	n/a	n/a	5 point ordinal scale	0-100 point score	4 level ordinal scale	5 point ordinal scale	9 point ordinal scale	3 point ordinal scale	5 point ordinal scale	5 point ordinal scale	5 point ordinal scale	3 point ordinal scale	7 point / 5 point ordinal scale	5 point ordinal scale	5 point ordinal scale
Unit of analysis	- Project	- Project process - Project product	- Project	- Project	- Project process - Project product	- Project process - Project product	- Project process - Project product	- Project process - Project product	- Project process - Project product	- Project process - Project product	- Project process - Project product	- Project	- Project process - Project product	- Project process - Project product	- Project process - Project product	- Project process - Project product
Applic-ability	Case specific	Construction projects	Generic	Generic	Customizable to context	Customizable to context	Construction projects	Generic	Development Projects for Built Innovations	Generic	Real estate projects	Customizable to context	Waste Management	Generic	Transnational Public–Private Partnership projects	Highway construction projects

Table 1 Overview of instruments for project sustainability impact analysis.

It might be noted that, given the selection criteria we applied in the selection of academically published project SIA instruments, typical industry standards on sustainability, such as ISO standards (specifically the ISO 14000 family of standards on environmental management systems and ISO 26000 on social responsibility) and the 'green building' certification standards BREEAM and LEED are excluded from our study. That is a deliberate choice of the study.

The impact of the 16 identified project SIA instruments was studied by analyzing the studies that referenced the published instruments. In this step, it was determined whether these further studies merely referenced the instrument or whether they reported the application of the instrument. The documentation of applications of and experiences with an instrument and its subsequent evolution in further versions was taken as an indication of its impact.

From the overview provided in Table 1, it can be observed that almost all project SIA instruments found to use a TBL based set of sustainability variables or indicators in their assessment. This is in line with the general literature and methodologies of SIA about which Laedre et al. (2015) commented that "*it makes sense to categorize the indicators into the economic, social and environmental dimensions*.". A second observation is that most project SIA instruments recognize the different levels of impact of a project: impacts related to the project's *process* ("Sustainability *of* the project") and impacts related to the project's *product* ("Sustainability *by* the project").

In their nature, most instruments are assessment models, with two earlier ones being simple checklists, and two others being developed as maturity models, that also include an assessment instrument. In their applicability, the instruments are mixed. Some are developed with a focus on a specific industry, where others have a more generic orientation.

Based on their nature and their assessed impact, the project SIA instruments listed in Table 1 were categorized in three groups.

- ***Rudimentary SIA checklists***

  Early attempts to provide practical guidance for the consideration of sustainability in project management included the checklists developed by Shen et al. (2007) and Silvius (2010). Both these checklists were developed in expert-studies. Both checklists develop indicators for the assessment of the sustainability impact of projects, based on the TBL perspectives of social impacts, environmental impact and economic impact. The

checklist of Shen et al. (2007) applies this SIA to the phases of the project and its deliverable, from inception to demolition,

The checklist documented by Silvius (2010) was developed during an IPMA expert seminar on Survival and Sustainability as Challenges for Projects. The checklist was based on the GRI Sustainability Reporting Guidelines version 3 (Global Reporting Initiative, 2006), that provides a very detailed operationalization of the Triple Bottom Line perspectives. And although this checklist provided a very rudimentary SIA instrument, it served as the main inspiration for the first versions of more developed project SIA instruments, such as the maturity model for the integration of sustainability in projects and project management of Silvius and Schipper (2010) and the P5 standard for sustainability in project management of GPM Global (2014).

- ***Incidental study based project SIA instruments***

  The largest group of instruments in Table 1 consists of academically published project SIA instruments or methodologies. In this group we classify:

  – Project Assessment Matrix (PAM) (Keeble et al., 2003)
  – Sustainable Footprint Methodology (Oehlmann, 2011)
  – Composite Sustainability Index of a Project (CSIP) (Dobrovolskiiene and Tamosiuniene, 2015)
  – Project Sustainability Maturity Level (PSML) (Siew et al., 2016)
  – Methodology for the Sustainability Assessment of Development Cooperation Projects for Built Innovations (Maier et al., 2016)
  – Project Sustainability Excellence Model (PSEM) (Szabo, 2016)
  – Composite Sustainability Index of Real Estate Projects (Dobrovolskiiene et al., 2017)
  – Project Sustainability Impact Assessment (PSIA) (Tam, 2017)
  – Life Cycle Sustainability Analysis (LCSA) (Wang et al., 2018)
  – Project Sustainability Index (Chen et al., 2019)
  – Composite Highway Sustainability Index (CHSI) (El-Kholy and Akal, 2019)

  These project SIA instruments are mostly developed in empirical case studies (single or multiple), although some, for example, PSIA (Tam, 2017) and PSEM (Szabo, 2016),

are more conceptually developed. Notwithstanding the potential quality of these instruments, no further applications of or experiences with these instruments have been documented, beyond their initial or incidental study. They therefore appear to be 'one-off' project SIA instruments that did not impacted the further community of practitioners and researchers. This impact of the instruments in research or practice is what makes the following group of instruments stand out from this group.

- ***Further developed project SIA instruments***

  Our analysis of the literature showed that of three project SIA instruments, multiple applications and studies were published. They were therefore classified as more impactful. These three instruments are:

  – Wa-Pa-Su Project Sustainability rating system (Poveda and Lipsett, 2011a)
  – Sustainable Project Management Maturity Model (SPM3) (Silvius and Schipper, 2010; 2015)
  – P5 Standard for Sustainability in Project Management (GPM Global, 2014; 2019)

  Two of the three, the Sustainable Project Management Maturity Model (SPM3) of Silvius and Schipper and the P5 instruments of Green Project, were also published in multiple versions, indicating that these instruments are not one-off developments, but that they are applied, studied and updated.

  Table 2 provides an overview of the published applications and experiences of the three project SIA instruments in this group.

Project SIA instrument	**Applications reported by**
Wa-Pa-Su Project Sustainability rating system (Poveda and Lipsett, 2011a)	Poveda (2013; 2017); Poveda and Lipsett (2011b; 2012; 2013a; 2013b; 2013c; 2014a; 2014b; 2014c); Poveda and Elbarkouky (2015); Poveda and Young (2015)
Sustainable Project Management Maturity Model (SPM3) (Silvius and Schipper, 2010; 2015)	Silvius and Nedeski (2011); Silvius et al. (2013); Esezobor (2016); Simionescu and Silvius (2016); Clinning and Marnewick (2017); Marnewick (2017); Silvius et al. (2017)
P5 Standard for Sustainability in Project Management (GPM Global, 2014; 2019)	Turan and Johan (2016); Turan et al. (2016; 2017a; 2017b); Silvius et al. (2017); Sahimi et al. (2018), Rooijen (2019)

Table 2 Overview of studies reporting the application of Wa-Pa-Su, SPM3 of P5.

It may be noticed that the original authors of the project SIA instrument are quite often also involved in publications that report the applications of the instrument. That is quite understandable, although an instrument gains impact when also other researchers choose to work with it.

Given the observation that these three instruments have developed an impact beyond a single case or single study, our study will focus on reviewing these three project SIA instruments, using the best practices on SIA that were derived from the literature in the first part of this paragraph.

3. METHODOLOGY

The contribution this study aims to make is to review the published instruments for SIA on the project level, in order to provide input for their further adoption and development. Based on this practical orientation of the aim of the study, the author decided to apply a pragmatic interpretive approach. In the pragmatic research paradigm, acceptable knowledge can be derived from either or both observable phenomena and subjective meanings (Saunders et al. 2015). The study applied this by reviewing the three selected project SIA instruments based on the SIA best practices derived from literature. Following the pragmatic paradigm, the output of the study should be judged on its "fit" with its purpose, provide insights for the application and further development of the project SIA instruments, and not on the "truth" or "true explanation" of the studied phenomenon, as is common in studies using a positivist paradigm (Avenier 2010). As the development of SIA instruments on the project level is still in its early stages, this pragmatic interpretive approach makes sense (Silvius et al., 2013).

4. REVIEW OF PROJECT SIA INSTRUMENTS

This paragraph reviews the three selected project SIA instruments, the Wa-Pa-Su Project Sustainability rating system (Poveda and Lipsett, 2013), the SPM3 Sustainable Project Management Maturity Model (Silvius and Schipper, 2015) and the P5 Standard for Sustainability in Project Management (GPM Global, 2014), based on the SIA best practices that were derived from the literature.

4.1 The Wa-Pa-Su Project Sustainability rating system

The developers of Wa-Pa-Su recognize that existing sustainability rating systems and standards are more outcome-based than process-based. These rating systems do not allocate many points for project management in the rating scale, and seem to ignore that project management, in particular in the planning phase (Eid, 2009), strongly influences the sustainability of a project. Wa-Pa-Su, therefore, goes beyond standards and regulations. The main objective is to accomplish excellence in environmental performance, not to meet government and environmental agency requirements; however, these have been included in the design of the weighted rating scale, since a company must meet legal requirements as a minimum condition for maintaining its operating license.

The Wa-Pa-Su project sustainability rating system introduces an integrated approach for SIA, based on three areas of knowledge: sustainability; continuous performance improvement (CPI), and multi-criteria decision analysis (MCDA). The origins of the system date back to 2008, as a PhD project in the Engineering Management program at the University of Alberta that was conducted as an independent research study (Poveda, 2013). Wa-Pa-Su is developed as a flexible environmental and sustainability rating system, with the aim of motivating scientist and practitioners to explore the implementation of a project sustainability assessment tool for industry sectors other than the building industry.

The flexibility and adaptability of the system are embedded in the assessment process. In this process, the assessment criteria are not predefined, but selected based in a multi-disciplinary stakeholder participatory process. The subsequent assessment of the selected criteria is done in the following steps: (1) calculation of each criterion's initial scores and weights; (2) calculation of the performance improvement factor (PIF); and (3) calculation of each criterion's final score. The PIF is defined as "*a factor to determine the degree of negative or positive improvement of each specific criterion (i.e., indicators) during a specific period of time*" (Poveda and Lipsett, 2013a). For the calculation of PIF, the impact of the project on a specific criterion is compared to a threshold or baseline value, using the formula: PIF = indicator performance actual value (PA) / indicator threshold or baseline value (PB). A PIF value of more than 1 indicates a performance improvement, whereas a PIF value of less than 1 indicates a negative impact. The individual PIF scores are multiplied with a weighting score for each criterion and summarized into an overall sustainability score of the project, on a scale of 1 – 10,000 points.

Figure 1 shows an example of the Wa-Pa-Su reporting format.

	Criteria Code	Performance Evaluation		Performance Improvement Factor (PIF)	CIS	Weights and CWF				CFS
		PActual	PBaseline			SDW	AEW	CFW	CWF	
IBE	IBEO06061	N/A	N/A	2.0	10,000	0.16	0.05	0.15	0.0012	24
	IBEO06063	0.25	0.30	0.83	10,000	0.16	0.05	0.20	0.0016	13.28
	IBEO06071	20	100	0.20	10,000	0.16	0.05	0.65	0.0052	10.4
				3.03						47.68

	Criteria Code	Performance Evaluation		Performance Improvement Factor (PIF)	CIS	Weights and CWF				CFS
		PActual	PBaseline			SDW	AEW	CFW	CWF	
ERCE	ERCEO06082	0.20	0.10	2	10,000	0.16	0.31	0.10	0.00496	99.2
	ERCEO06087	84	100	0.84	10,000	0.16	0.31	0.18	0.008928	74.9952
	ERCEO06095	45 hr/yr	50 hr/yr	0.90	10,000	0.16	0.31	0.25	0.01240	111.6
	ERCEO06107	0.92	1	0.92	10,000	0.16	0.31	0.47	0.023312	214.4704
				4.66						500.2656

Sustainability Assessment Score: 1631.9248 ≈ 1632 points

Figure 1. Example of the Wa-Pa-Su reporting format (Poveda and Lipsett, 2013c).

Wa-Pa-Su recognizes that SIA is context-specific. The first context in which the instrument was applied, was the context of oil sands and heavy oil projects (Poveda and Lipsett, 2011). The flexibility and adaptability of the rating system allow its implementation for any type of projects and can even be adapted to evaluate sustainability performance at the organizational level of corporations.

The section below discusses Wa-Pa-Su based on the six best practices for SIA that were derived from literature.

- ***A holistic set of assessment criteria***

  Wa-Pa-Su does not prescribe a predefined set of assessment criteria but includes the selection and weighting of relevant criteria in the assessment process. In this process, a set of potential criteria is developed, based upon the analysis of different sources. These sources can be grouped into three categories: (1) indicators agreed upon by public or governmental representatives through consensus, which include governmental regulations and committees, as well as organizations for standardization; (2) indicators identified by academics and practitioners, which include best practices in management and processes as well as academically and scientifically authored resources; and (3)

indicators established by organizations, including local, regional, national, and international organizations and industry sector standards and programs.

- ***Consideration of different levels of impact***

  Wa-Pa-Su takes into consideration the different resources utilized in the project, stakeholder expectations, and potential environmental, economic, social, and health impacts of the project. However, in the assessment process, Wa-Pa-Su does not distinguish between the impact of the *process* of the project and the impact of the *product*. If different levels of impact are considered, this, therefore, needs to show from the sustainability indicators. It can be imagined that certain indicators, such as "*noise*", are more applicable to the process, where others, such as "*biodiversity*", may logically apply more to the product of the project. However, indicators such as "*energy use*" might apply to both.

- ***A context-specific approach***

  By including the selection of relevant assessment criteria, Wa-Pa-Su is particularly suited to be tailored to specific contexts. While the original intent was to target the oil sands and heavy oil projects (Poveda and Lipsett, 2011a), the methodology for determining the rating structure and the assessment methodology to calculate the criteria weights and final sustainability scores can be used for designing rating systems with applicability across different industry contexts.

- ***A development approach***

  The central position of a "*performance improvement factor*" score in Wa-Pa-Su indicates a strong orientation on improvement and, therefore, development. Wa-Pa-Su is aimed at developing strategies in order to mitigate the environmental, social, health, and economic impacts of a specific project (Poveda and Lipsett, 2014a). However, the improvements Wa-Pa-Su aims to appear to be limited to the level of the single project. The flexibility and context orientation of Wa-Pa-Su goes at the expense of its ability to provide a foundation for the further development of SIA practices.

  As Bond et al. (2012) conclude, a consistent framework for SIA is a condition for the evaluation of the effectiveness of SIA practices and their further development. It can be

questioned whether Wa-Pa-Su provides enough content to evaluate the SIAs developed with it. Wa-Pa-Su provides mainly a process and a scoring model for SIA. However, Wa-Pa-Su does not provide a structure for the content of SIA, which limits the comparison of results.

- ***An open process***

  Wa-Pa-Su suggests a multi-disciplinary stakeholder participatory process to weight and select the final set of sustainability indicators used in the SIA. The published applications of Wa-Pa-Su also showed that effective stakeholder engagement and consensus-building increased the success of the SIA process and the acceptance of the results. The creation of a multi-disciplinary stakeholder committee assisted in the development and implementation of the rating system on several fronts.

- ***A comprehensive output***

  The primary reporting format of Wa-Pa-Su provides a quite detailed overview of PIF scores of all relevant impact criteria. As the selected set of criteria can be quite extensive, Poveda and Lipsett (2014a) report a case study with over 250 indicators, the completeness of the impact scores can hide the overview. In Wa-Pa-Su the overview can be enhanced by summarizing PIF scores in division and sub-divisions; however, a format for a more comprehensive overview is not provided. Poveda and Lipsett (2013a) propose the use of graphs in which the stakeholder valuation is linked to objective metrics, but also for this a comprehensive format is not provided.

Applications of and experiences with the Wa-Pa-Su model have been reported by Poveda (2013; 2017); Poveda and Lipsett (2011b; 2013a; 2013b; 2013c; 2014a; 2014b; 2014c); Poveda and Young (2015), with further development by Poveda and Elbarkouky (2015). The applications of Wa-Pa-Su were always aimed at finding improvements in projects. Wa-Pa-Su was originally developed to assess sustainability of Canadian oil sands projects, but the flexibility and adaptability of the framework also enabled applications in industry sectors such as for oil & gas, energy, mining, and heavy industrial (Poveda and Young, 2015).

4.2 The SPM3 Sustainable Project Management Maturity Model

The SPM3 model was published by Silvius and Schipper in 2015, as a further development of their maturity model for integrating sustainability in projects and project management published in 2010 (Silvius and Schipper, 2010). SPM3 is designed as a descriptive model, with which organizations can assess their level of integration of sustainability in a specific project. However, with the description of the different maturity levels and a list of sustainability variables, the SPM3 model also provides extensive guidelines on how to improve the integration of sustainability in projects. This improvement perspective is further supported by assessing the consideration of each individual variable of sustainability in the project twice: once as assessment of the 'actual' situation in the project and the second time as assessment of the 'desired' situation in the project. The difference between the 'actual' and 'desired' levels logically indicates a potential improvement.

Next to assessing 'actual' and 'desired' levels of sustainability consideration, SPM3 also prescribes separate assessments of the *process* of delivering and managing the project and the *product/deliverable* that the project realizes, including the effects of this deliverable.

SPM3 structures the assessment of different sustainability impacts in 22 indicators that were developed from the literature on and standards of sustainable development indicators, including the checklist of sustainability criteria for projects (Silvius, 2010). The indicators are organized in the TBL perspectives of economic, social and environmental indicators. During the SPM3 assessment, the consideration of all individual indicators by the project, is assessed on a four level maturity scale: compliant; reactive; proactive; purpose. These four maturity levels are described in Table 3.

Maturity level	Description
Level 1: Compliant	(This aspect of) Sustainability is considered minimalistic and implicit, and (only) with the intention to comply with laws and regulations.
Level 2: Reactive	(This aspect of) Sustainability is considered explicitly, with the intention to reduce negative impacts of the project.
Level 3: Proactive	(This aspect of) Sustainability is explicitly considered as one of the areas that the project contributes to.
Level 4: Purpose	Making a contribution to (this aspect of) sustainability is one of the drivers behind the project and sustainability considerations are included in the justification of the project.

Table 3. The maturity levels of the SPM3 model.

Reporting of the results of the SIA is done in a graphical way. An example of this can be found in Simionescu and Silvius (2016) (Figure 2).

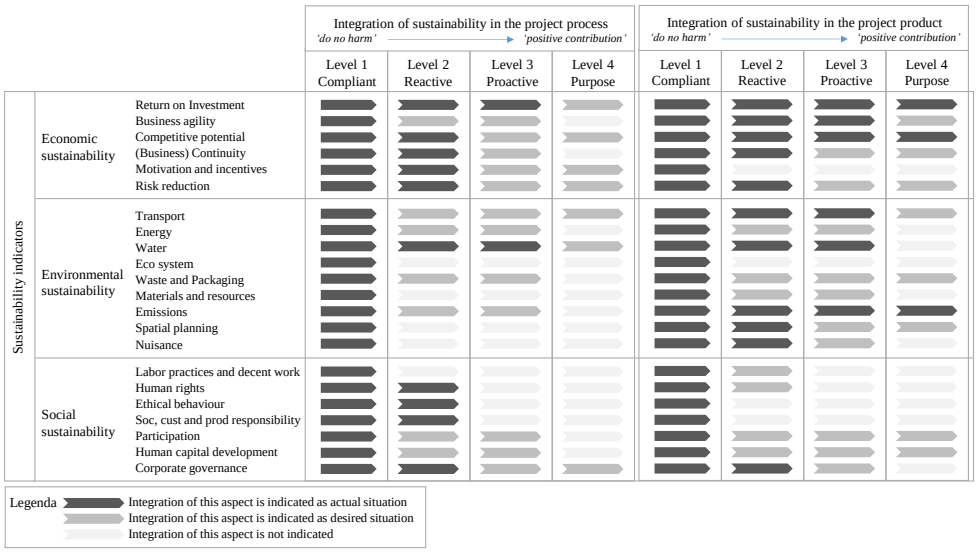

Figure 2. Example of the SPM3 reporting format (Simionescu and Silvius, 2016).

The reporting format provides a comprehensive overview of the four-level assessment of the 22 sustainability criteria for both the process as the product of the project. The different colors indicate whether the consideration of a specific aspect is adequately integrated in the project (actual situation), is not but should be integrated (desired situation), or is not and should not be integrated.

For the assessment process, SPM3 suggests that stakeholders participate in the actual assessment, although no further support is offered for this. Also, the results of the assessment should be shared with stakeholders, and potential improvements to the project, typically indicated by the differences between actual and desired integration of sustainability considerations, should be discussed. With these improvements the ambition should not be to 'color the whole model black', indicating that all indicators are considered on the highest level (Purpose), as this is not realistic and often also not relevant. SPM3 proposes that consideration of sustainability in the project is aligned with the context of the project, for example the strategies and interests of the main stakeholders of the project. In the project the sustainability aspects that are highly relevant for these stakeholders should be considered at the higher SPM3 levels (levels 3 and 4), whereas for the less material aspects, a level 1 or 2 score may suffice.

The section below discusses SPM3 based on the six best practices for SIA that were derived from literature.

- ***A holistic set of assessment criteria***

  SPM3 assesses the sustainability of a project on a TBL based set of perspectives, operationalized in 22 variables with 77 potentially relevant indicators (Silvius and Schipper, 2015). The variables and indicators are derived from the literature and standards on sustainability indicators, and cover a wide range of perspectives and insights.

- ***Consideration of different levels of impact***

  SPM3 requires separate assessment of the project *process*, including the resources used in the project processes and the way the processes are organized and executed and the project *product*, the deliverables of the project and their effects on various stakeholders and society (Silvius and Schipper, 2015). This is in line with the different levels of SIA that Laedre et al. (2015) identify.

  In the earlier version of the maturity model (Silvius and Schipper, 2010), the authors integrated the two levels of impact, *process* and *product*, into a single maturity scale, but this created inconsistencies in the application of the model. The SPM3 model published in 2015, therefore includes separate assessments of *process* and *product*.

- ***A context-specific approach***

  Although SPM3 is a generic model that can be applied as a SIA instrument for all types of projects and all industries, it requires the alignment of the consideration of sustainability in the project that is being assessed, with contextual strategies and interests. This alignment is one of the crucial steps in interpreting the SPM3 result and strengthens the contextual orientation of the assessment.

  The second level of contextualization of the SPM3 model is the selection of indicators within the 22 variables used to assess the sustainability impact. Silvius and Schipper (2015) propose in total 77 indicators, but also suggest that the specific typology and context of the project being assessed may require the formulation of other indicators.

The selection and/or formulation of these indicators is included in the assessment process.

- ***A development approach***

  With its focus on the improvement of the project from a sustainability perspective, SPM3 supports a development perspective on the project level. However, by providing a generically applicable method, SPM3 also supports organizational development and learning. Having a commonly used method for project SIA allows organizations to collect data on the assessment process and on the impacts of their projects. Studies that use SPM3 for the SIA of projects have also been found to collect data across organizations (For example Clinning and Marnewick, 2017; Marnewick, 2017; Silvius et al., 2017. However, the sharing of data across organizations was not prolonged after these studies. A generically applicable method such as SPM3 would allow for the build-up of a knowledge base across organizations, but an overarching initiative to collect, analyze and share experiences and data has not developed.

- ***An open process***

  An assessment of a project with the SPM3 model follows a typical step-by-step process as is indicated in Figure 3.

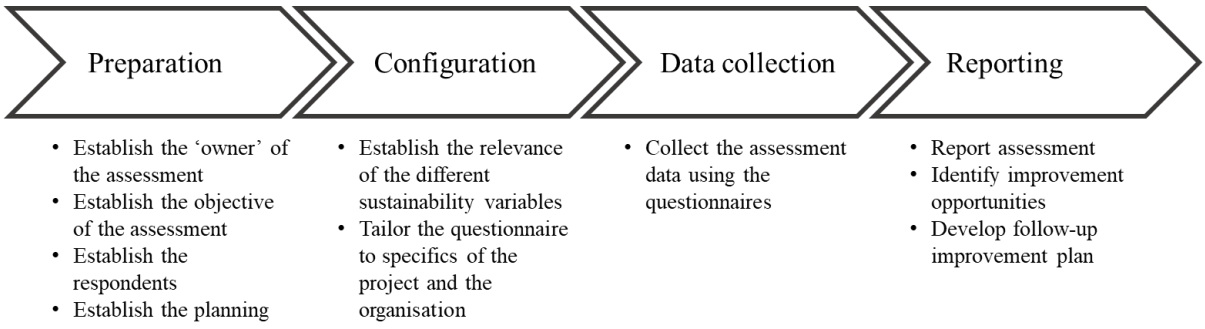

Figure 3. Process model of the SPM3 assessment (Silvius and Schipper, 2015).

The process model of the SPM3 assessment adds to the logical process steps of 'Preparation', 'Data collection' and 'Reporting', the step 'Configuration'. In this step, the weight of the different variables and the formulation of the specific assessment indicators can be tailored to type of the project being assessed and the strategies and

interests of the contextual organizations and stakeholders. SPM3 does not explicitly mention the inclusion of stakeholders in the assessment process, but it is implied.

- ***A comprehensive output***

  The primary presentation format of the SPM3 based SIA is the overview model shown in Figure 2. With this graphical output, the main sustainability-related issues and opportunities of the project can be quickly identified (Silvius et al., 2017). The presentation format also supports the alignment of the impacts of the project with the strategies and interests of stakeholders. The presentation format is not showing different views or perceptions of the project's impacts by different stakeholders.

Case studies on the applications of the SPM3 model and its predecessor have been published by Silvius and Nedeski (2011) and Simionescu and Silvius (2016). On the use of SPM3, this last case study reports that "*The participants of the study agreed that the assessment of the project with the SPM3 model provided a holistic analysis of the sustainability of the project, both regarding the process of the project and the product. Moreover, the assessment formed an essential step in the further development and improvement of the project. Participants agree that the reflection around the findings of the assessment provided rich information for further discussion for the project team and for the organization in respect of robust strategic thinking in the area of sustainability.*". The study by Silvius et al. (2013) reported a quantitative analysis of 56 cases across various industries. Silvius et al. (2017) report an analysis of the improvements to projects as a result of their SIA. This study was based on 32 cases that used either the SPM3 or the P5 instruments. They reflected that the graphical reporting format of SPM3, with both 'actual' and 'desired' levels of consideration of the different sustainability indicators, allowing for a visual presentation of improvement opportunities and comparison of the assessment with the strategic ambitions of the organization.

Quantitative studies using the model were reported by Esezobor (2016); Clinning and Marnewick (2017) and Marnewick (2017). And whereas Esezobor (2016) focused on the consideration of sustainability in the construction industry, the studies of Clinning and Marnewick (2017) and Marnewick (2017) were focused at sustainability integration in information technology projects.

4.3 The P5 Standard for Sustainability in Project Management

The P5 SIA instrument was originally developed in August 2011 to define what and how to measure a project for sustainability-related impacts (GPM Global, 2014). The main purpose of P5 is to identify potential impacts to sustainability, both positive and negative, that can be analyzed and presented to management to support informed decisions and effective resource allocation.

P5 prescribes that the sustainability impact of a project is considered throughout the life-cycles of both project processes and (resulting) product. In the P5 ontology (Figure 4) this is shown by the lines "Product impacts" and "Process impacts".

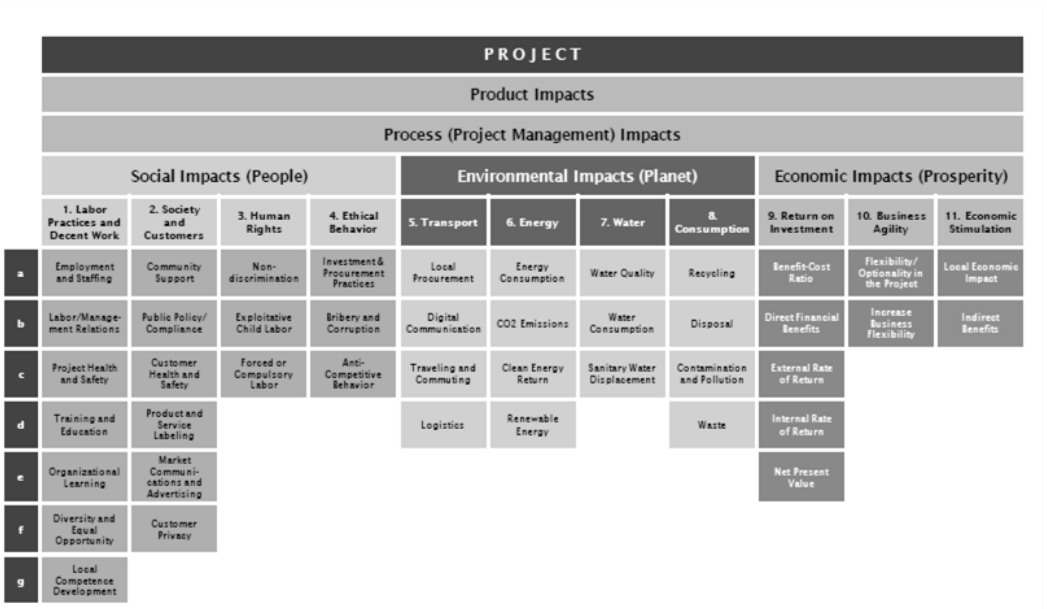

Figure 4. Overview of the P5 ontology (GPM Global, 2019).

Figure 4 also shows that in P5, the impacts of a project's process and product are assessed based on a TBL based set of 11 sustainability variables, specified in 46 indicators. This set of variables and indicators has evolved throughout the different versions of P5. In the first version (GPM Global, 2014), the variables and indicators were strongly inspired by the GPM G3 based expert checklist published by Silvius (2010). Later versions of P5 also integrated other standards.

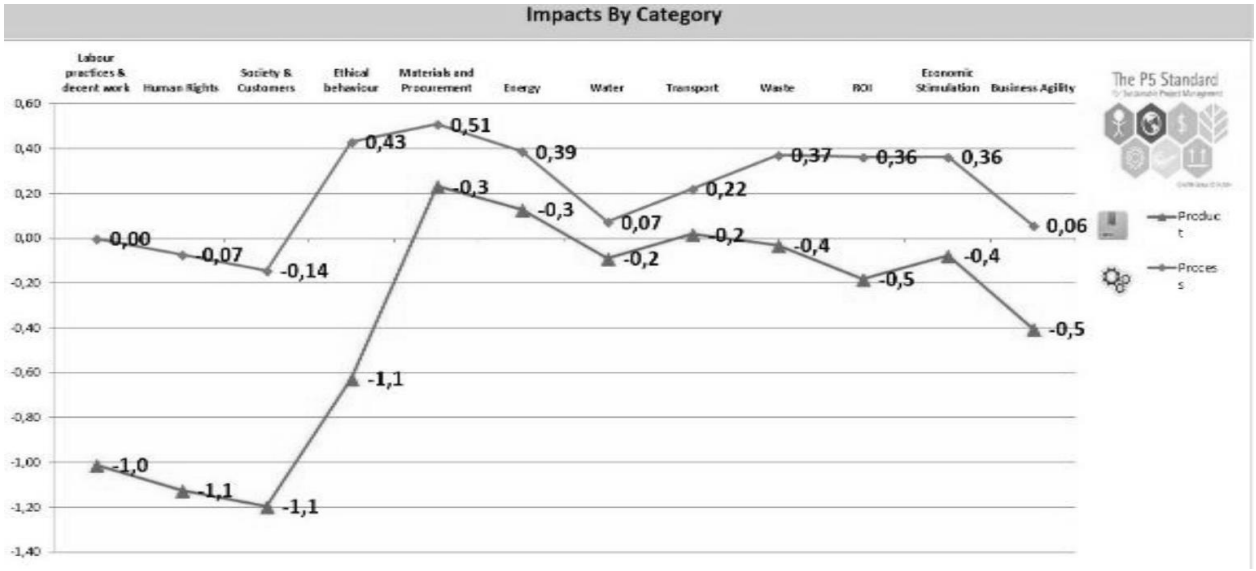

Figure 5. Example of the P5 reporting format.

During the P5 assessment process, the impacts of the project's process and product are scored on all individual indicators, using a 7-point scoring scale that runs from "3" for high negative impact to "-3" for high positive impact, with "0" as a neutral score. (In the latest version of the P5 model, sometimes a 5-point ordinal scoring scale is used.) The scores are summarized per variable and presented in a graphical format (Figure 5).

In the P5 SIA reporting format, separate lines indicate the assessed impact of the project's process and product.

The section below discusses P5 based on the six best practices for SIA that were derived from literature.

- ***A holistic set of assessment criteria***

  In its latest version (GPM Global, 2019), P5 states to be based on a large number of internationally recognized standards, including:

  - United Nations Universal Declaration of Human Rights
  - International Covenant on Civil and Political Rights (ICCPR)
  - International Covenant on Economic, Social, and Cultural Rights (ICESCR)
  - Convention on the Elimination of all Forms of Discrimination against Women (CEDAW)
  - ILO Declaration on Fundamental Principles and Rights at Work

- Vienna Declaration and Programme of Action
- The 2030 Agenda for Sustainable Development
- UN Sustainable Development Goals (SDGs)
- Sustainable Accounting Standards Board (SASB) Standards
- SA8000:2014 Standard (Social Accountability International)
- Ten Principles of the United Nations Global Compact
- Global Reporting Initiative (GRI) Standards
- Several ISO standards including ISO 20400:2017, ISO 37001:2016, and ISO 14001: 2015

Based on this broad background, P5 defines 11 assessment variables, specified in 46 indicators, organized in the TBL perspectives of economic, environmental and social sustainability. This set of perspectives and variables provides a holistic perspective on the impacts of the project being assessed.

- ***Consideration of different levels of impact***

  As shown from the P5 reporting format (Figure 5), P5 includes separate assessments of the impact of the project's process and product. With regards to the project's process, P5 identifies three specific aspects to be assessed: Effectiveness of project processes; Efficiency of project processes and Fairness of project processes.

- ***A context-specific approach***

  P5 aims to provide insights into a projects sustainability impacts and to "*contribute to the sponsoring organization's sustainability goals*" (GPM Global, 2019). This orientation on the organizational context of the project, however, is not implemented in the P5 assessment process. Neither are the options to adjust the impact indicators to the type of project being assessed, or to add a 'weight' to the individual impact indicators in order to show their relevance. P5 applies a generic list of sustainability criteria (Silvius et al., 2017), that appears to support a generic SIA process without any adjustments to the context of the project at hand or stakeholder's interests.

- ***A development approach***

  In the implementation guide to P5, the development orientation is strongly present. It states that "*A P5 Impact Analysis (P5IA) is used to define and prioritize sustainability impacts to:*

  - *Improve the project's expected benefits.*
  - *Increase positive impacts and reduce negative impacts to society, the environment, and the project's value*." (GPM Global, 2019).

  The guide further states that P5 "*gives key decision makers actionable information to justify changes to the project in socially, environmentally, and fiscally responsible ways*." (GPM Global, 2019). The generic character of P5 enables comparison and evaluation of assessment results and therefore organizational learning.

- ***An open process***

  The P5 implementation guide assigns the responsibility for performing the SIA of the project to the project team, without further elaboration of the process (GPM Global, 2019). It can be questioned whether the project team has enough insights into the organizational strategy and/or the interests of stakeholders to perform the analysis. And although it is not explicitly mentioned, it should, therefore, be expected that stakeholders are consulted in the SIA process. Nevertheless, a clear advice on this is lacking in P5.

- ***A comprehensive output***

  The primary reporting format of a P5 SIA (Figure 5) shows the assessed impact of both the project's process and product on all 11 impact variables in one comprehensive graphical overview. However, given the lack of contextual information, the overview does not directly show the areas that most prominently need to improve.

Applications of and experiences with the P5 model have been reported by Turan et al. (2017); Silvius et al. (2017a) and Rooijen (2019), whereas Sahimi et al. (2018), Turan and Johan (2016) and Turan et al. (2017b) applied P5 in further developments. In the study of Silvius et al. (2017), the results of project SIAs of 32 cases were reported, of which five cases applied the P5 model. Based upon these experiences, it was reflected that the instrument was confusing. The five 'P's

of P5 stand for "Planet", "Profit", "People", "Product" and "Process". Basically, these represent the TBL perspectives, plus two additional Ps to represent the project's process and product. However, also, the impact variables of the TBL perspectives cannot be assessed without considering the project's process or product. "Process" and "product" therefore, are *objects* of consideration in the assessment, and not perspectives of consideration. Treating process and product as separate assessment perspectives, next to the TBL perspectives, proved to be confusing and inconsistent.

4.4 Summary

Table 4 summarizes the assessment of the qualities and weaker points of the three reviewed project SIA instruments, based on the six best practices for SIA. All three SIA instruments use a holistic set of assessment criteria and assess both the project's product and process, although this last aspect is only implicit in Wa-Pa-Su. All three instruments are also oriented towards developing improvements to projects.

The strong quality of Wa-Pa-Su is its flexibility and adaptability, which makes it easy to tailor to specific contexts. This tailoring is for P5 its poorest quality. P5 is a generic project SIA instrument that does not express the relevance or weights of the assessment indicators in the assessment process and reporting format. In P5, the tailoring to the relevance of specific impacts to the nature of the project, the strategy of the organization or the interests of stakeholder needs to get a place in the interpretation of the assessment results, after the actual assessment. SPM3 also does not include a weight of impact variables in its assessment, but supports the alignment with organizational strategies and stakeholder's interests in its reporting format. With regards to the reporting format of the three instruments, SPM3 and P5 both report the assessed project's impact in a comprehensive graphical format which supports the identification of and discussion about improvement opportunities. Wa-Pa-Su reports in a more detailed quantitative format.

SIA best practices	Project SIA instruments reviewed		
	Wa-Pa-Su Project Sustainability rating system	**Sustainable Project Management Maturity Model (SPM3)**	**P5 Standard for Sustainability in Project Management**
A holistic set of assessment criteria	++	++	++
Consideration of different levels of impact	**0**	++	++
A context-specific approach	++	++	- -
A development approach	**0**	++	++
An open process	++	+	**0**
A comprehensive output	+	++	+

Table 4. Assessment of the reviewed project SIA instruments.
(++ = Very strong, + = Strong, 0 = Neutral, - = Weak, -- = Very weak)

An overall reflection on the reviews of the three instruments reveals the challenge to balance the specificity of a project SIA, tailored to the type of the project, the strategy of the organization and the interests of stakeholders, with the opportunity to compare and benchmark SIA results in order to develop as an organization or as an industry. Improving SIA practices beyond the level of an individual project requires a SIA instrument that provides a framework or structure that allows for the data collection with some level of unambiguous uniformity. A highly tailored SIA approach quite likely hurts this uniformity.

A second reflection of the project SIA instruments is that more attention to the process of SIA needs more attention. A project SIA cannot simply be a scoring sheet. Stakeholder participation is a key element of SIA and this should more clearly be reflected in the project SIA instruments.

5. CONCLUSION

This study set out to review the published instruments that are specifically developed for SIA on the level of a project. Our study showed that the development of project SIA instruments is still very much in its infancy. Based on a search of the academic literature we identified 16 project SIA instruments of which three were identified as more impactful. These three selected project SIA instruments, the Wa-Pa-Su Project Sustainability rating system (Poveda and Lipsett, 2013), the SPM3 Sustainable Project Management Maturity Model (Silvius and Schipper, 2015) and the P5 Standard for Sustainability in Project Management (GPM Global,

2014), were subsequently reviewed, based on a set of six SIA best practices that were derived from the literature on impact assessment.

Our review showed that all three instruments had incorporated the best practices of assessing sustainability impacts based on a holistic set of criteria and the consideration of different levels of impact of the project: process and product. All three instruments also shared a development orientation and were aimed at identifying improvement opportunities in projects. The instruments differed in the specificity of their assessment, with the Wa-Pa-Su instrument including strong tailoring to the type of project and the interests of stakeholders, the SPM3 instruments including strong orientation on the sustainability strategy of te organization and also the interests of stakeholders and the P5 instruments taking a more generic approach.

Compared to the SIA literature, the project SIA instruments are light on their description of the SIA process. In this process, stakeholder participation is a key element, and this should be addressed more clearly.

The practical orientation of the study also includes a limitation, as the study's interpretive approach inevitably introduces an element of subjectivity. The authors are aware of this and have provided transparency in their argumentation so that the reader can form his or her own opinion on the qualities and weaknesses of the reviewed instruments. The contribution the study makes is that it provides insight into practically applicable frameworks and instruments for the consideration of sustainability in project management and the identification of improvements of projects. It thereby answers to the appeal made by Silvius (2019) to 'package' the sustainability perspective in practically applicable tools, "*in order to change the behavior of project managers*".

The study also made clear that further research on instruments for SIA on the project level is necessary. Especially the balance between specificity of a SIA and uniformity of structure and data collection needs further development. For a specific project, and the improvement of this project, specificity and context orientation is required, however, for the development of project SIA practices and the build-up of more generalizable insights, uniformity is required. A project SIA instrument should provide a foundation for both applications.

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Ron Schipper (1971) is an experienced project and program manager and an independent researcher. `Different projects for a better life` captures his drive, defining and realizing sustainability strategies through projects his daily practice. He is one of the well-known recognized experts in the field of sustainability in project management with over a dozen academic papers and several books published and various practical contributions towards organizations adopting this topic. He was awarded the 2014 Sustainability Award of the international Green Project Management organization. Ron is also an external examiner in the Master of Informatics and Master of Project Management in HU University of Applied Science. He holds a master degree in Computer Sciences.

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