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# A systematic literature review concerning the different interpretations of the role of sustainability in project management

Kevin Friedrich<sup>1</sup> 

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## Abstract

The concept of sustainable development is widely accepted as one of the most important topics of our time. Although significant research has already been conducted within the field of integrating sustainability into project management, different interpretations of the role of sustainability appear. This is a major issue for the scientific community, as due to these varying interpretations it is difficult to put publications into context; accordingly, it might lead to communication issues within the community. With this research study we want to help solve this issue. We conduct a systematic literature review and identify 293 relevant publications. Using a synthesis approach based on grounded theory, we define three different categories of interpretations of the role of sustainability in the current state of research. The literature is then assigned back to these interpretations. Following this approach we are not only able to review the development of each interpretation over time, but also to identify that many publications contain multiple interpretations. Based on our findings, we give recommendations for the reflection of the existing literature, the writing of new publications and communication in the research field. We also redefine the concept of ‘sustainable project management’ based on a major theoretical characteristic we synthesise during our grounded theory approach to give guidance to future researchers.

**Keywords** Sustainable project management · Systematic literature review · Sustainability · Project management

**JEL Classifications** M10 · M14 · O22 · Q01 · Q56

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✉ Kevin Friedrich  
kevin.gerd.friedrich@fau.de

<sup>1</sup> Corporate Sustainability Management, University of Erlangen-Nuremberg, Findelgasse 7, 90402 Nuremberg, Germany

## 1 Introduction

The concept of sustainable development is widely accepted as one of the most crucial topics of our time and increasingly important in corporations worldwide (United Nations 2016). Multiple companies have integrated sustainability into their organisation but bringing those sustainability aspects into the daily operational business is a significant challenge within praxis and theory. The current state of research offers several different approaches to combat this. One approach is to include sustainability into project management: the field of project management itself is increasingly located in the centre of everyday business in most organisations (Haniff and Salama 2016; Kerzner 2013). It is argued that up to 1/3 of global GDP is realised through projects (Turner et al. 2010).

Though sustainability and project management are in the centre of public interest to a greater degree, there are some major differences between the theoretical background of both, as we wish to demonstrate.

When evaluating the sustainability literature, it is obvious that multiple definitions of sustainability and sustainable development exist (Labuschagne and Brent 2005). However, the most commonly applied definition of what is ‘sustainable’ with regard to development originated in the Report of the World Commission on Environment and Development, also known as the Brundtland report (World Commission on Environment and Development 1987, para. 1): “to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.” This anthropocentric definition already sets a theoretical frame for sustainability and implies a holistic view in time, including short term (preserve today) and long term (to save for future generations) considerations. But within the report one can also discover that sustainable development has a spatial character by considering impacts of an action taken from a local and global view. In his book ‘Cannibals with Forks: the Triple Bottom Line of 21st Century Business’, John Elkington describes the aspects of sustainable development with the concept of a triple bottom line; sustainability is about balancing economic, social and environmental goals. These pillars are also known as ‘Triple-P (People, Planet, Profit)’ (Elkington 1997). Thus, sustainability can be seen as a holistic, multidimensional concept considering economic, social and environmental aspects with no restrictions in either time or space.

When evaluating the project management literature, a project can be defined as “a temporary endeavour undertaken to create a unique product, service, or result” (Project Management Institute 2013, p. 3). This definition identifies projects as restricted in time and scope. In 1969, Dr. Martin Barnes first defined the theoretical concept of the iron triangle regarding the efficiency in projects in his course entitled ‘Time and Money in Contract Control’ (Barnes 2007). In the later widely accepted version, it describes projects as restricted in time, cost and quality. Moreover, most project management approaches have a one-dimensional focus for monetary goals by maximising the outcome and minimising the required input. Thus projects can conventionally be seen as an endeavour with focused (quality) goals and scope that are limited in time and cost (Haniff and Salama 2016).

In summary, on the one hand there is the in time and space holistic, multidimensional concept of sustainability and, on the other hand, the one-dimensional focus and restricted frame in time, cost, scope and quality of the conventional project management concept. This seems to be in contrast when trying to define the relationship and integration possibilities of sustainability in project management (Silvius et al. 2012a). Long term issues that might even be only detected by future generations should already be considered in a temporary endeavour like a project. Furthermore, both the multidimensional sustainability and project goals that define the original scope might be contradictory.

Because of the growing importance of project management and sustainability, as argued above, these contrasts between the concepts have a high relevance for the scientific community. Silvius even describes sustainability as a new school of thought in project management (Silvius 2017).

Although many contributions already exist in the research field of integrating sustainability into project management (Aarseth et al. 2017; Goel et al. 2019; Silvius and Schipper 2014), there exists a gap in research as the role of sustainability in project management is interpreted as conceptually different within the research field, as we will present in detail in the next section. For example, on the one hand, some researchers include an interpretation of the role of sustainability as an additional cost (Hand et al. 2015; Otegi-Olaso et al. 2015). On the other hand, other researchers show an interpretation of the role of sustainability as an economic benefit (Fiksel et al. 1999), a chance for financial success (Robichaud and Anantatmula 2008) or an investment (Robichaud and Anantatmula 2008) that could help to decrease operational costs (Bachour and Chasteen 2010; Eid 2002). To the best of our knowledge, this gap in the interpretation of the role of sustainability in project management was never a central part of an existing research study. Still, we see it as a major challenge in the research field, because due to these different interpretations it is difficult to put scientific publications into context and, accordingly, it might lead to communication issues within the scientific community.

We want to close this gap by defining categories of the different interpretations of the role of sustainability and, furthermore, by defining sustainable project management based on a main theoretical characteristic to give assistance in the research field.

Therefore, the research question this paper wants to answer is: How can the existing literature for integrating sustainability into project management be conceptually structured regarding the interpretation of the role of sustainability? The first aim of this paper is to conduct a systematic literature review (SLR) (Brereton et al. 2007; Hart 1998; Moher et al. 2009; Okoli 2015a; Rousseau et al. 2008; Xiao and Watson 2017) for the development of conceptual categories that reflect the different interpretations of the role of sustainability in the research field. As a second aim, we want to systematise our results and reflect whether there is a structural order to these conceptual categories and review the definitions of sustainable project management to give guidance to future researchers. In addition, we will identify as of yet undiscussed topics and knowledge gaps for the field of research which should be tackled.

In the upcoming chapters, we will give a short introduction to the current state of research and the different interpretations of the role of sustainability in project

management we could identify in the first instance. We will then describe why we have chosen the method of an SLR, how we conducted it and how we intended to structure our results. Afterwards, the selected literature used for the analysis will be presented and described. Later on, the synthesis will be described and results will be shown. Based on these results, in a final step the research question will be discussed, conclusions will be drawn and we will close our study with an agenda for future research and the identified limitations.

## 2 State of research

When reviewing the literature, it is obvious that various definitions of sustainable project management already exist. Tam (2010, p. 176) defines sustainable project management as “the promoting of positive and minimizing of negative sustainability impacts (economic; environmental; and social) within the process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realized and contributing to a sustainable society.” Meanwhile, Silvius and Schipper (2014, p. 79) define sustainable project management 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 realising benefits for stakeholders, and performed in a transparent, fair and ethical way that includes proactive stakeholder participation.” Armenia et al. (2019, p. 12), on the other hand define it as “the managerial practice aiming at pursuing project objectives by maximizing economic, social, and environmental benefits through the proactive involvement of stakeholders, the consideration of the extended life cycle of resources, processes, and effects, and continuous organizational learning.”

These definitions present a first frame for the research field of integrating sustainability into project management. In their publications, the authors of these definitions, as well as the entire research field (as we will see later), refer either directly or indirectly to the definition of sustainability from the Brundtland report, which we presented in our introduction.

But although all scientific contributions about integrating sustainability into project management act within the same field of research and base their research mostly on the same definition of sustainability, we see after a first evaluation of the literature that there exist different or even opposing interpretations of the role of sustainability as follows.

Some publications view sustainability issues “as a constraint or a low priority” (Verrier et al. 2014, p. 88) and research on how sustainability aspects as constraints remain in relation to the conventional constraints in project management manifested in the iron triangle (Atkinson 1999; de Silva 2015; Ebbesen and Hope 2013; Eid 2004; Grevelman and Kluiwstra 2010; Mishra et al. 2011; Otegi-Olaso et al. 2015; Tharp 2012; Zdanytė and Neverauskas 2012). Other publications interpret sustainability “as an opportunity for improvement throughout the project” (Fernández-Sánchez and Rodríguez-López 2010, p. 1193) and see sustainability more as a

genuine goal (Marnewick 2017) that should be part of the business case (Silvius and Schipper 2012).

Many authors contributed with multiple approaches of considering sustainability in the project risk management describing how sustainability related risks in the project delivery process or the project deliverable can be managed or mitigated by specific actions (Chawla et al. 2018; Fernández-Sánchez and Rodríguez-López 2010; Goedknecht 2013a; Tharp 2012). Despite this view, other authors argue that sustainability is less a risk than an opportunity (Bachour and Chasteen 2010; Crawford 2013) that makes an organisation more competitive (Obradović et al. 2018) and can increase its market value (Ghosh et al. 2014).

On the one hand, several publications have interpreted sustainability as a challenge where “a lot of effort [...] has to be involved in implementation” (Toljaga-Nikolić et al. 2016, p. 1092); on the other hand, some publications state that “some principles of sustainability are implicitly considered in project management” (Gareis et al. 2011, p. 63). Certain researchers have even interpreted sustainability as a mind or paradigm shift, as a completely new approach for project management (Eskered and Huemann 2013; Labuschagne and Brent 2008; Økland 2015; Silvius and Schipper 2014), focusing on the environmental aspect defining a ‘Green Project Management’ (Dai and Xu 2011; Maltzman and Shirley 2010) or establishing a new standard for sustainable project management (Carboni et al. 2013; Green Project Management® 2019).

While some see sustainability as something that creates tensions and contradictions (Gluch and Räisänen 2012), others say sustainability aspects “lead to synergies with other business interests.” (Byggeth and Hochschorner, 2006, p. 1421) Several researchers see a pressure to incorporate sustainability (Misopoulos et al. 2018; Taylor 2010), which might arise from legislation (Senner 2011), policies (Martens et al. 2016) or to avoid bad credibility or reputation (Schieg 2009). Other researchers encourage projects and project managers to address sustainable aspects (Goedknecht and Silvius 2012; Xu and Hua 2011). Table 1 summarizes these different interpretations.

Within the context of our research question, we intend to clarify which of the different interpretations of the role of sustainability in project management exist in the research field, how they can be categorised, what their relationship is and reflect the existing definitions of sustainable project management. Therefore, we decided to conduct an SLR. This method is particularly suited to capturing the relevant literature in a research field, deducing a conceptual order from it and measuring a distribution within this order, as is our goal.

Previous (systematic) literature reviews have already addressed relevant aspects of sustainability, just like for crowdfunding (Böckel et al. 2020), governance (Heidingsfelder and Beckmann 2020) and customer relationship management (Müller 2014). These literature reviews have shown that by including sustainability the complexity of the respective topic increases. This applies also to project management as previous literature reviews on sustainable project management have shown. These reviews though have a different focus than our approach. Most literature reviews focus on the relationship between sustainability and project management. For example, Ali et al. (2016) analyse the body of knowledge for the linkage between the

**Table 1** Opposing interpretations of the role of sustainability in project management (own source)

Sustainability aspects as constraints and risks	Verrier et al. (2014), Chawla et al. (2018), Fernández-Sánchez and Rodríguez-López (2010), Goedknecht (2013a) and Tharp (2012)	Versus	Sustainability as an opportunity and goal	Fernández-Sánchez and Rodríguez-López (2010), Marnewick (2017) and Silvius and Schipper (2012)
Sustainability as a challenge to integrate into project management	Toljaga-Nikolić et al. (2016)	Versus	Sustainability implicitly considered in project management	Gareis et al. (2011)
Sustainability creates tensions and contradictions	Gluch and Räisänen (2012)	Versus	Sustainability leads to synergies with other business interests	Byggeth and Hochschorner (2006)
(Legal, political, etc.) pressure to incorporate sustainability	Misopoulos et al. (2018), Taylor (2010), Semmer (2011), Martens et al. (2016) and Schieg (2009)	Versus	Address sustainable aspects for (business) benefits	Bachour and Chasteen (2010), Crawford (2013), Obradović et al. (2018) and Ghosh et al. (2014)

concepts of design for sustainability and project management and so develop potentials and needs arising from this relationship. Aarseth et al. (2017) identify that two perspectives exist in the literature, the perspective of the delivering project organisation and the perspective of the host organisation. The SLR then defines eight sustainability strategies adopted by project organisations and hosts (or both). Other SLRs focus on the creation of a conceptual framework, so for example to manage sustainable projects based on the four dimensions—namely processes, products, organisations and managers (Marcelino-Sádaba et al. 2015)—or to integrate sustainability performance into business (Morioka and Carvalho 2016). Armenia et al. (2019) develop a conceptual framework linking five dimensions of sustainable project management that are, as per their analysis, the principal research domains for the integration of sustainability into project management, to be specific corporate policies and practices, resource management, life cycle orientation, stakeholders' engagement and organisational learning. Some SLRs have a particularly generic approach and summarise constructs, variables or aspects of sustainability in project management (Martens and Carvalho 2014) or define critical parameters from sustainable project management, computational procedures, evolutionary algorithms and the inclusion of feedback functions for sustainability in project management (Chawla et al. 2018). Additionally, the impact of sustainability on project management is part of the research of some SLRs. For example, Silvius and Schipper (2014) identify from the literature areas of impact of sustainability on project management in general; Khalifeh et al. (2019) analyse the impact of project sustainability management on project success. Goel et al. (2019) possessed an industry focus conducting a morphological analysis categorising the literature of sustainability integration in the management of construction projects under the 7 dimensions of motivations, stakeholder orientation, organisational context, temporal orientation, benefits, barriers, risks and 31 variants thereof.

All these (systematic) literature reviews have the common feature of focusing on the relationship between the concepts of sustainability and project management and on integration possibilities. However, as we have seen, the interpretations of the role of sustainability in project management already differ in the existing literature, which creates a gap in the research field. We therefore wish to step in on another meta level with our SLR to close this gap. The need for this analysis was already identified by Chofreh et al. (2019, p. 6) who analyse in their review the importance of sustainable project management for organisations and focus specifically on the development of potential research themes and the gaps therein: "In the terminology research topic, a study that analyses the terms used in SPM [sustainable project management; author's note], their relationships, and categorisation would be valuable for academics and practices to clarify the ambiguity of terms."

It is our goal to systematise our results and reflect whether there exists a structural order of the different interpretations of the role of sustainability in project management. During our research process, the development of a stage model of the different interpretations proved to be the most reasonable approach, as we will discuss later. Within the research field, different stage models already exist.

The stage model of Silvius und Schipper (2010) reflects on how comprehensively the three dimensions of sustainability are included at the project level of resources,

business processes, business model and products/services sustainability. In a later developed model, the authors switch their focus from the project level/area of inclusion to the activity level of inclusion, defining stages from reactive to proactive, namely pre-compliance, compliance, beyond compliance, integrated strategy and purpose & passion (Silvius and Schipper 2018). The stage model of Kohl (2016) reflects to which extent in intensity sustainability is integrated in an (project) organisation from exposure to integration and transformation, while Siew et al. (2016) measure project sustainability maturity levels by a fuzzy-based approach. All these stage and maturity models have a more practical focus on the integration of sustainability than on the conceptual structure of the scientific literature, which is why our stage model is still needed.

In the following section, we will describe our research method in detail to synthesise the different interpretations of the role of sustainability in project management, create a stage model out of these and re-define sustainable project management.

### 3 Method

As we want to find all publications relevant to our research question, an SLR is the appropriate method. We followed the general recommendations of Fisch and Block (2018) for systematic literature reviews to structure our approach. An SLR must be designed to identify every research study that has been published addressing a specific research question during a specific period (Nightingale 2009; Schweizer and Nair 2017). As (systematic) literature reviews are concept-centric (Webster and Watson 2002), they are suitable to identify existing concepts. Furthermore, an SLR has a goal not only to identify but also to synthesise relevant literature on a topic (Toraco 2016), just like we want to bring the different interpretations of the role of sustainability in the research field in relation.

As recommended by different researchers, we executed a scoping study to set a frame for our approach (Okoli 2015a), to delimit the timeline, size, subject area and topic of the research field (Tranfield et al. 2003) and especially to finalise our research question (Denyer and Tranfield 2009).

In order to find appropriate keywords, we broke down the research question to its key components, 'sustainability' and 'project management'. We then listed the keywords found in existing (systematic) literature reviews in the research field, during the scoping study (Levy and Ellis 2006) enhanced by the main keywords for the research field as identified by de Toledo et al. (2019). In addition, a brainstorming session and synonym search was conducted to discover even more appropriate keywords and phrases fitting to the research question (Tranfield et al. 2003). We selected multiple search terms: 'Sustainability', 'Sustainable', 'Sustainable development', 'CSR', 'Corporate social responsibility', 'Ecological', 'Green', 'Three pillars', 'Project management', 'Project', 'Projects', 'Green project management', 'Agile', 'Project life cycle' and 'Scrum'. The search strings were adjusted by database regarding the database specific restrictions. We pooled our search queries for better efficiency and used the meta search platform HeBIS (Hessisches Bibliotheksinformationssystem), in particular, which includes e.g. EBSCO-Host, Web of Science and Science

Direct (-2018), among others.<sup>1</sup> This was expanded by search iterations on Scopus, Proquest, Google Scholar, the Google search engine and the PMI Library due to our experience in the scoping study.

It is generally recommended to conduct a forward and backward search for a (systematic) literature review (Levy and Ellis 2006; Webster and Watson 2002). We have chosen authors from the SLRs for the backward reference search enhanced with researchers mentioned as “key-contributors of the sustainability school (in project management)” (Silvius 2017, p. 1488). The forward author search was conducted within both Google Scholar and Web of Science. To ensure quality was high and to not miss any appropriate publications, the main contributors in the research field were contacted.

To set an appropriate scope for the SLR and identify the literature relevant to the research question, we decided to establish a practical screen with inclusion/exclusion criteria (Okoli 2015b). To ensure international comparability, we adjusted the search criteria of the databases so only literature published in English was searched. The search included all years until 2019. For the quality appraisal (Okoli 2015a), we decided to review the type of literature and included all potential literature (so peer-reviewed studies and articles, books and book chapters, but also scientific grey literature, not peer-reviewed studies and articles, conference papers and reviews, project management methodologies and frameworks like PMBOK/Prince2/ICB and editorials) with scientific relevance to the research question. We decided to do so since project management is a highly practical research topic compared to others and thus not to miss relevant literature. Non-scientific publications were excluded. To avoid doublings through a publication bias, we removed publications based on the same study and when in doubt contacted the author (Easterbrook et al. 1991; Song et al. 2000 as with Petticrew and Roberts 2006). In order to ensure only relevant papers were used for our full text analysis (Petticrew and Roberts 2006), we decided, similarly to Silvius and Schipper (2014, p. 65), to exclude publications “that did not discuss sustainability in the context of project management”. In particular publications with only project/industry/country specific content that could not be generalised were excluded. For the full text analysis, the studies were weighted via an A-B-C listing (Sutton et al. 1998 as with Petticrew and Roberts 2006):

- *A-List* publications are directly related to the research question
- *B-List* papers are relevant in the general context of the research question, but not as the main object of the research
- *C-List* papers are out of scope (‘nice-to-read’), because they are not in the context of the research question

Primary as well as secondary studies (Cronin et al. 2008) were included for further examination.

It was our decision to follow the approach of Petticrew and Roberts (2006, p. 100) regarding when to stop the search for further literature: “when the search

<sup>1</sup> The full list of databases is available under [http://info.ub.uni-frankfurt.de/fach\\_liste.html?fach=wiwi](http://info.ub.uni-frankfurt.de/fach_liste.html?fach=wiwi)

has covered all the most relevant databases and bibliographies, and when further searches of databases, and scanning of bibliographies of review papers do not add to the tally of included studies.”

After the data extraction, we synthesised the found literature (Brereton et al. 2007), which is called the most important step for (systematic) literature reviews (Okoli 2015b). Our goal was to synthesise the different interpretations of the role of sustainability in project management. Therefore, we largely followed the recommendations made by Wolfswinkel et al. (2013) for using the grounded theory approach by Glaser and Strauss (1967) in SLRs. The grounded theory approach follows the steps of open coding, axial coding and selective coding.

As we coded the existing literature via inductive open coding, we want to mention that existing categories, concept definitions, success factors, characteristics, dimensions, boundary conditions, etc., were described within the literature which we extracted in the first instance as codes (Bandara et al. 2015; Okoli 2015b). For the axial coding, we then identified the underlying concepts of the codes and aligned the publications to the concepts via a concept matrix (Webster and Watson 2002). We then defined categories for the concepts and later major categories which reflected the different interpretations of the role of sustainability.

In the next deductive step as part of our grounded theory approach, the literature was assigned to the interpretations identified during the axial coding. This way, we could verify the identified categories of the different interpretations of the role of sustainability. We then conducted a quantitative analysis of the categorised literature to review the development of each interpretation over time.

We subsequently conducted the selective coding according to our grounded theory approach. Therefore, we further condensed the synthesis by working through the identified interpretations and connected them to a main theoretical characteristic. Based on this main characteristic, we defined an order of the different interpretations in a stage model. In the last step, we created a definition of sustainable project management.

## 4 Results

### 4.1 Descriptive record of search results

We searched in multiple iterations. According to our exclusion criteria, unsuitable publications were removed. The remaining publications were selected for the synthesis. Regarding our iterations, we proceeded as seen in the following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Moher et al. 2009) statement and flow diagram, which is slightly adjusted according to our research approach (removing the duplicates after screening) (Fig. 1).

From the 293 publications, we extracted the following data. Most of the identified contributions (33 publications) were (co)authored by Gilbert Silvius. Over the years, publications increased discontinuously, though we still see sustainability in project management as a growing field of research (Fig. 2).

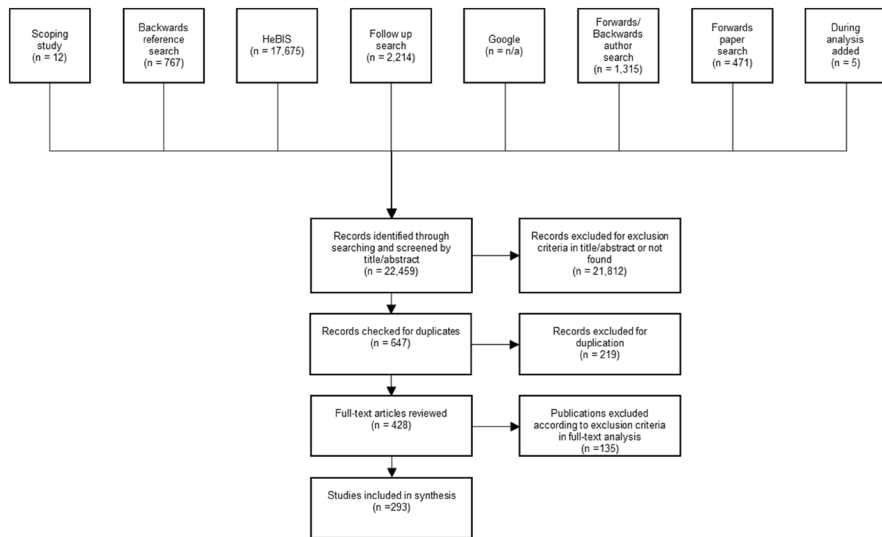


Fig. 1 PRISMA flow diagram [own source according to Moher et al. (2009)]

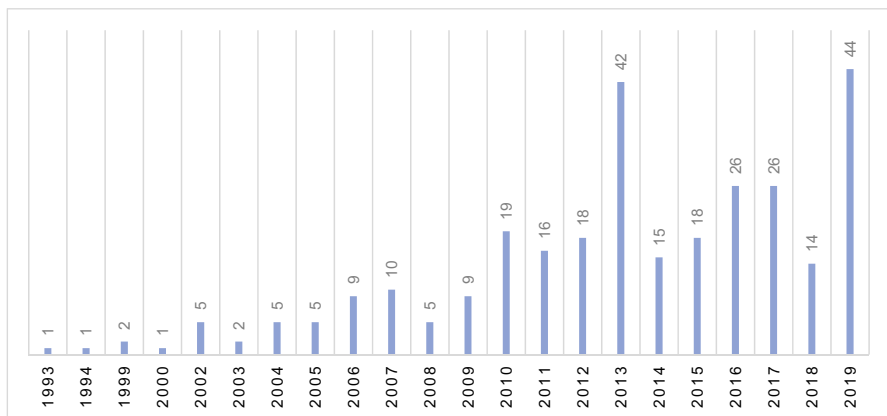


Fig. 2 Amount of publications by year (own source)

Most publications (24) were published in the ‘Journal of Cleaner Production’.<sup>2</sup>

During the past, multiple relevant studies on sustainable project management have been conducted, most about how sustainability is considered in the different project management areas. Some studies tried to identify in detail within which project management areas sustainability can be considered (Eid 2000; Hwang and Ng 2013) and multiple studies focus on or at least mention the relationship of

<sup>2</sup> The detailed list of publications is available to the readers upon request to the authors.

sustainability to specific project management areas. Examples for project management areas involved are procurement (Ojeda and Reusch 2013), supply chain management (Eid 2004), resource management (Chawla et al. 2018), quality management (Eid 2002; Rusinko 2005; Wang et al. 2014; Ho and Fan 2014; Molina-Azorín et al. 2009; Sam et al. 2009 as by Morioka and Carvalho 2016), cost management (Rodríguez-Olalla and Avilés-Palacios 2017), communication (Morfaw 2014; Wang et al. 2014), stakeholder management (Eskerod and Huemann 2013; Kampf and Thomsen 2008; Rahman et al. 2017; Silvius and Schipper 2014) and reporting (Eid 2004; Silvius et al. 2012b; Tufinio et al. 2013).

Other studies researched on indicators (Brent and Labuschagne 2004; Schipper and Silvius 2017, 2017; Talbot and Venkataraman 2011; Vatalis et al. 2012; Yao et al. 2011) or incentive models (Kivilä et al. 2017). There exist studies focusing on assessments (Daneshpour 2015; Pope et al. 2004), especially environmental impact assessments (Brent and Petrick 2007; Labuschagne and Brent 2004; Wilkins 2003) or decision making (Brent and Labuschagne 2004; de Brucker et al. 2013; de Magalhães et al. 2019; Khalili-Damghani and Sadi-Nezhad 2013). Other researchers focused on specific project management tools such as stage gates (Chawla et al. 2018; Eid 2004; Lotz et al. 2009) or on management tools modified to sustainable purposes such as the Sustainable Balanced Scorecard (Figge et al. 2002; Grevelman and Kluiwstra 2010; Kirchhof and Brandtweiner 2011; Morioka and Carvalho 2016).

Most recent research seems to expand to the impact of sustainable project management on (project) success (Khalifeh et al. 2019; He et al. 2019) and to the motivation to include sustainability in project management by project managers (Marnewick et al. 2019; Silvius and de Graaf 2019; Poon and Silvius 2019) and project owners (Zhang et al. 2019). Our findings are summarized in Table 2.

## 4.2 Different interpretations of the role of sustainability in project management

In our description of the current state of research in Sect. 2 we showed that different or even opposing interpretations of the role of sustainability in the research field exist. One of our goals was to develop conceptual categories that reflect these different interpretations. To develop these categories, we synthesised the 293 publications via grounded theory. During the open coding we identified more than 4212 codes and created 397 memos from the publication regarding their interpretations of the role of sustainability in project management. To obtain a better understanding of the different interpretations, we first analysed from which project management and sustainability aspects the literature distances in these codes.

Approximately 76% of the total publications distance themselves directly or indirectly from a project management concept in which sustainability is not explicitly considered. Many publications (Moehler et al. 2018; Obradović et al. 2018; Otegi-Olaso et al. 2015; Toljaga-Nikolić et al. 2016) refer to this approach as ‘traditional project management’, but sometimes it is also named ‘conventional (project) management’ (Wang et al. 2014). Methodologies and frameworks like PRINCE2, PMBOK and ICB, but also the V-Model or Scrum can be described

**Table 2** Thematic topics of the research field of sustainable project management (own source)

(Environmental impact) assessments	Daneshpour (2015), Pope et al. (2004), Brent and Petrick (2007), Labuschagne and Brent (2004) and Wilkins (2003)
Cost management	Rodríguez-Olalla and Avilés-Palacios (2017)
Communication	Morfaw (2014) and Wang et al. (2014)
Decision making	Brent and Labuschagne (2004), de Brucker et al. (2013), de Magalhães et al. (2019) and Khalili-Damghani and Sadi-Nezhad (2013)
Impact on (project) success	Khalifeh et al. (2019) and He et al. (2019)
Incentive models	Kivilä et al. (2017)
Indicators	Brent and Labuschagne (2004), Schipper and Silvius (2017) (2017, Talbot and Venkataraman (2011), Vatalis et al. (2012) and Yao et al. (2011)
Motivation to include sustainability	Marnewick et al. (2019), Silvius and de Graaf (2019), Poon and Silvius (2019) and Zhang et al. (2019)
Procurement	Ojeda and Reusch (2013)
Reporting	Eid (2004), Silvius et al. (2012b) and Tufinio et al. (2013)
Resource management	Chawla et al. (2018)
Stage gates	Chawla et al. (2018), Eid (2004) and Lotz et al. (2009)
Stakeholder management	Eskerod and Huemann (2013), Kampf and Thomsen (2008), Rahman et al. (2017) and Silvius and Schipper (2014)
Supply chain management	Eid (2004)
Sustainable Balanced Scorecard	Figge et al. (2002), Grevelman and Kluiwstra (2010), Kirchhof and Brandtweiner (2011) and Morioka and Carvalho (2016)
Quality management	Eid (2002), Rusinko (2005), Wang et al. (2014), Ho and Fan (2014), Molina-Azorín et al. (2009), Sam et al. (2009) as by Morioka and Carvalho (2016)

as such. Sustainability aspects can be added and integrated to those, as will be explained, but are not part of the initial concept.

A smaller number of publications, around 5%, distance themselves from 2010 onwards from a sustainability concept, which simply raises awareness for sustainable issues without taking further action. The publications distance from those, who simply pay lip service (Crawford 2013) and see sustainability as ‘nice to have’ or needing extra effort (Gareis et al. 2011). The so-called ‘Greenwashing’ can also be located here, as it is more about documenting and monitoring than taking sustainability actions and, as Silvius (2015, p. 311) mentions, “‘greenwashing’ [...] is not a solution”. In the following we will not focus any further on the analysis of this differentiation but recommend it for further research.

Then we tried to find similarities within the remaining codes and further condensed them during the axial coding, by finding synonyms and codes that have a similar focus on sustainability (such as the impact of sustainability on project success, sustainability as an investment, benefits to introduce sustainability, sustainability as a risk, etc.). In doing so, we were able to develop first categories. We then clustered the categories in a concept matrix and assigned the existing

codes to those categories. In this way and by going back and forth in the literature, new categories emerged (such as a pressure to introduce sustainability, sustainability as a challenge, a business case for sustainability, sustainability as improvement, etc.). During this process, we discovered that some categories seem to assign a more positive connotation and value to sustainability while others allocate a more negative value. Out of this, we were able to define the first major category of ‘Sustainability as a constraint’, in which more negative than positive value is assigned to sustainability. When reviewing the literature for the positively connoted value to sustainability, we had to make a distinction. On the one hand, sustainability is seen in the literature as an instrument to reach a specific goal or gain (business) benefits by for example cost reduction or synergies, but not as a genuine goal. On the other hand, sustainability aspects are seen as an intrinsic value and all sustainability dimensions are described as equal (genuine) goals. Out of these two different views, we were able to synthesise the other two major categories of ‘Sustainability as instrumental value’ and “Sustainability as intrinsic value”.

These three major categories ‘Sustainability as a constraint’, ‘Sustainability as instrumental value’ and “Sustainability as intrinsic value” reflect the different interpretations of the role of sustainability and will be described in the following.

#### 4.2.1 Sustainability as a constraint

When analysing the literature, we saw ‘Sustainability as a constraint’ as a first interpretation of the role of sustainability in project management. Here sustainability is seen as something that hinders the actual project goal or as a potential risk. As such, sustainability has a negative connotation in this regard. The aspects of sustainability come from outside of the project. Thus there exists always an extrinsic motivation for the interpretation of the role of sustainability as a constraint. After reviewing the current state of research, many of the statements and interpretations mentioned in Sect. 2 seem to follow sustainability as a constraint: By seeing sustainability as a cost (Otegi-Olaso et al. 2015), as a challenge (Toljaga-Nikolić et al. 2016), even as “a major challenge, especially in large projects” (Martens and Carvalho 2016, p. 29), as a constraint (de Magalhães et al. 2019; Verrier et al. 2014), as a risk (Chawla et al. 2018; Fernández-Sánchez and Rodríguez-López 2010; Goedknecht 2013a; Silvius and Schipper 2014; Tharp 2012) or as something that creates “tensions and contradictions” (Gluch and Räisänen 2012, p. 136). In this category, we also include studies that identify a pressure to incorporate sustainability (Misopoulos et al. 2018; Taylor 2010); this pressure might arise from very different sources (Martens et al. 2016; Schieg 2009; Senner 2011). In conventional project management, major constraints already exist as defined in the iron triangle of time, cost and scope. Multiple authors have researched the relationship between sustainability and the other constraints in the iron triangle (Atkinson 1999; de Silva 2015; Ebbesen and Hope 2013; Grevelman and Kluiwstra 2010; Mishra et al. 2011; Otegi-Olaso et al. 2015; Tharp 2012; Zdanytė and Neverauskas 2012).

### 4.2.2 Sustainability as instrumental value

As another interpretation, we identified ‘Sustainability as instrumental value’. In contrast to the first interpretation, sustainability is seen less as a constraint that needs to be satisfied and more as an instrument that supports the actual project goal. Many of the aforementioned statements in Sect. 2 assign an instrumental value to sustainability in their interpretations.

Sustainability is interpreted as an opportunity (Bachour and Chasteen 2010; Crawford 2013; Fernández-Sánchez and Rodríguez-López 2010) that leads to synergies (Byggeth and Hochschorner 2006) or that makes an organisational structure like a project more competitive (Obradović et al. 2018) and can increase its market value (Ghosh et al. 2014). Sustainability is seen as an investment (Robichaud and Anantamula 2008) to decrease costs (Bachour and Chasteen 2010; Eid 2002), as an economic benefit (Fiksel et al. 1999) or a chance for financial success (Robichaud and Anantamula 2008). Among these interpretations it is commonplace that the actual organisational/project goal and as such the conventional project management approach remains and sustainability is seen as a possibility through which to better achieve the goal. In other words, sustainability contributes to the project success (Adriana and Ioana-Maria 2013; Carvalho and Rabechini 2017). As such, sustainability can also be seen in general as an improvement (Silvius et al. 2017), as something that leads to an improved reputation (Jugend and Figueiredo 2017) or “that considering SD [sustainable development; author’s note] principles results in an improved quality” (Gareis 2013, p. 129). However, sustainability can also bring about multiple other benefits such as reductions in waste generation (Verrier et al. 2014), energy efficiency (Lapinski et al. 2006), “improved compliance, competitive advantage, improved financial returns, and greater access to capital” (Kohl 2016, p. 21) and improved budget control (Hand et al. 2015).

Finally, this interpretation of the role of sustainability in project management as a supporting instrument can be further elaborated and analysed in an additional business case of sustainability: How can sustainability requirements support/fit the project’s goal?

### 4.2.3 Sustainability as intrinsic value

We synthesised a final interpretation called ‘Sustainability as intrinsic value’ in the current state of research. Here sustainability is interpreted as a genuine goal (Marnewick 2017); interpretations in this category go beyond the conventional project management by focusing on multi-dimensional economic, environmental and social sustainability goals in the project. All sustainable dimensions are ascribed such a high value that they are seen not as a constraint, instrument or secondary requirement to reach, but as equal goals in the very centre of the project. It is important that those environmental, social and economic goals are balanced and harmonised (Marnewick 2017; Silvius et al. 2017). There is no hierarchy of such goals, they exist on the same level with a holistic approach.

Sustainability is seen here as a part or dimension of project success (Silvius and de Graaf 2019) and not as a contributing element. Researchers encourage projects

and project managers to address sustainable aspects (Goedknecht and Silvius 2012; Helgadóttir 2008; Valdes-Vasquez and Klotz 2013; Xu and Hua 2011) or call it an imperative for project management (Ghosh et al. 2014), with an intrinsically motivated pattern (Marnewick et al. 2019) where "the project manager is intrinsically motivated to work on a sustainable project, and to achieve sustainable results" (Goedknecht 2013b, p. 279). It is even argued that "the intrinsic type of project owners' motivation is more effective than the extrinsic type" (Zhang et al. 2019, p. 651) in which "projects can contribute significantly to the mission of sustainable development" (Yao et al. 2011) and that projects are conducive to sustainable development (Silvius et al. 2017; Silvius 2017). As a result, the business case also changes in comparison to conventional project management (Goedknecht 2013a; Silvius and Schipper 2012) as sustainability should be part of the business case (Silvius and Schipper 2012). It is thus a business case *for* sustainability (Dyllick and Hockerts 2002; Eid 2002) rather than *of* sustainability, which Schaltegger and Wagner (2006) already described alongside a project management focus and which contained holistic, multidimensional components where each dimension is represented on the same level in one case.

At the beginning of the following section, we assign the literature to the different interpretations of the role of sustainability in project management for further analysis. In the last step, we then show the results of our selective coding, on the basis of which we ordered the different interpretations to a stage model and set a new definition of sustainable project management.

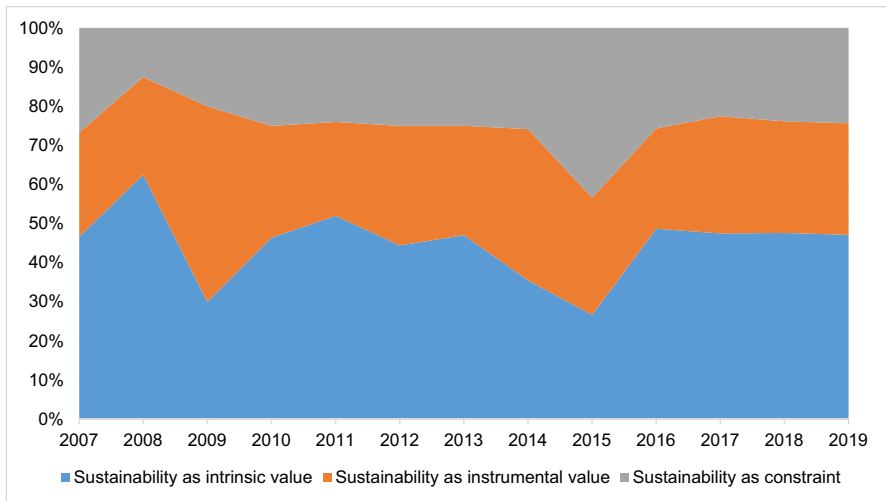
## 5 Discussion

### 5.1 Deductive verification in the literature

We have assigned the 293 identified publications to the synthesised interpretations described in Sect. 4.2. The literature was not discontinuously assigned, as one publication can contain multiple interpretations. Although 94% of the publications defining sustainability follow the same definition of sustainability (Brundtland Report), there exist different interpretations of the role of sustainability in the literature. With the help of an area diagram, the distribution of the interpretations found were shown over the course of time starting from 2007 before too few publications were found to draw conclusions (Fig. 3).

The interpretations in the research field are not equally distributed over the course of time. Although there are fluctuations, no clear trend can be derived in the relative distribution of interpretations over time, but also in relation to the number of publications over time shown in the descriptive record of search results in Sect. 4.1. As a first result, we can therefore state that the synthesised interpretations of the role of sustainability can be found in the literature. The distribution of these interpretation seems to remain relatively constant over time.

However, as previously mentioned we assigned the discontinuous literature not disjunct, because one publication can contain multiple interpretations. Additionally, we noted one yet crucial attribute of the distribution of the interpretations.



**Fig. 3** Interpretations of the role of sustainability in project management/publications by year (own source)

Approximately 50% of the publications (in total 150) exclusively follow a single interpretation of the role of sustainability either as a constraint (22), instrumental value (30) or intrinsic value (98). For the other half of the publications (in total 143), we found two (95) or even all three interpretations (48) within one publication. We do not want to preclude that one publication cannot contain multiple interpretations. For example, a publication can list the benefits and disadvantages of including sustainability (Hwang and Tan 2012). Furthermore, some publications explicitly distance other interpretations from their point of view just as they distance themselves from sustainability as not relevant or as mere lip service. As such, they, for example, mainly follow the interpretation of the role of sustainability as instrumental value but explicitly distance it from others, “viewing it as a cost and not fully examining the potential long-term and difficult-to-measure benefits” (Rogers et al. 2013, p. 974) or state that others “still consider environmental issues as a constraint or a low priority, instead of using them as a real opportunity for progress” (Verrier et al. 2014, p. 88). Certain publications even describe the attitudes and perspectives on sustainability of different actors in project management (Sabini et al. 2017). Still, all those publications explicitly distinguish the different interpretations of the role of sustainability.

But publications where this happens implicitly, so for example highlighting the intrinsic value of sustainability in one paragraph and in the next paragraph describing it as a high constraint in project management, can lead to irritations and misunderstandings during the reading (though it does not necessarily have to have a direct impact on the research result of those publications).

Overall, it is important for the research field to reflect on the different interpretations in order to gain an understanding of the research subject and among each other’s work. Different interpretations make it difficult to compare and evaluate

results. It also prevents researchers from building on the study results of others and complicates communication between researchers. It is therefore vital to pay attention when analysing a publication which interpretation is currently addressed. It is also important to determine which interpretation one wants to follow before writing a publication or to explicitly name (or distance from) other interpretations within the publication. The same applies to communications between researchers.

## 5.2 Selective coding and stage model

As the final step of our synthesis, we conducted selective coding with the interpretations found to define an order among them. We synthesised as a common theoretical basis the term ‘value ascribed to sustainability aspects in project management’ as the main theoretical characteristic for the interpretation of the role of sustainability in the research field. In this section, we will further describe this value characteristic in the sustainability context.

In the extant literature, various aspects were identified of what is of value in project management, so for instance the process outcome, the return on investment, the level of (stakeholder) satisfaction and so on (Thomas and Mullaly 2007). Sustainability aspects would enhance this view on value for project management. The more a sustainable development, situation or outcome is desired by a project organisation, the more value the organisation ascribes to it.

Value refers to the project sponsor, as well as to other stakeholders of a project. We understand the project sponsor as one of the main drivers (Project Management Institute 2013) and (as ‘Executive’ in PRINCE2) main responsible (AXELOS 2017) of the business case, including the stakeholders’ interests in such way as to reach the main project goal(s) and a stakeholder as “an individual, group, or organization who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project” (Project Management Institute 2013, p. 29). In traditional project management, the project manager is responsible for the project goals and the fulfilment of the business case(s).

Value ascribed to sustainable development can be positive or negative and must be considered for the entire period of a project (and product) life cycle (Shen et al. 2002). On the one hand, this value ascription becomes manifested in the investment by an organisation to reach the required sustainable situation or outcome. The more value an organisation ascribes to sustainability, the more this organisation invests. This investment might occur largely in monetary terms but could also include social or environmental capital. On the other hand, it is not only about the value invested, it is especially about the value gained as an organisation from sustainability as well. Currently organisations ascribe the most value to monetary factors (Dinu 2017) and value profit above the sustainability dimensions (Marnewick 2017). Despite this, assigning value to sustainability does not only mean assigning value to economic but also to social and environmental interests. Thus, an organisation has to decide the most valuable benefits that could be gained. One can gain value by tangible benefits, like cost savings, for example by the reduction of waste/energy costs, lower lending rates and attracting green investors or an increase in sales by attracting green

consumers, as well as by intangible benefits, for example through a better reputation, through the avoidance of an unproductive relationship with activist groups or the government, the avoidance of lawsuits and fines, negative headlines and possible decreases in sales or higher employer involvement. Still, there is value creation that one cannot attribute directly to the organisation like a healthy environment (Aarseth et al. 2017) or social impact out of the organisational scope (Atkinson 1999). Therefore, an organisation has to decide which value creation it includes in its considerations for how much value is invested into sustainability actions. It also has to be considered that actions and value for sustainable development are difficult to quantify in monetary terms (Sánchez 2015). This makes the ratio of investment and benefit in monetary terms very difficult to determine.

As stated previously, it is our goal to systematise our results and reflect if there is a structural order of the different interpretations of the role of sustainability in project management. Therefore, we reflected upon the different interpretations of the role of sustainability in project management based on the aforementioned characteristic of ‘value ascribed to sustainability aspects in project management’.

For the interpretation of ‘Sustainability as a constraint’, there is value ascribed to sustainability but with a negative connotation. Sustainability is seen as a risk or cost that hinders the project goal, which is ascribed the prime value. Although sustainability broadens the field of stakeholders, following the interpretation of the role of sustainability as a constraint the responsibility of the project manager still seems to be focused towards the project sponsor.

Regarding the interpretation of ‘Sustainability as instrumental value’, there is positive value ascribed to sustainability in project management and thus sustainability is more highly valued than the interpretation of ‘Sustainability as a constraint’. It is seen as a benefit, opportunity or instrument that supports the actual project goal. It remains, however, an instrument and not in the centre of the project.

Finally, for the interpretation of ‘Sustainability as intrinsic value’, there is significant value ascribed to sustainability, which is seen as a dimension of project success or genuine goal to maximise in the very centre of the project and thus sustainability is even more valued than the other interpretations. The project is based on a business case for sustainability rather than a business case of sustainability being created. Furthermore, the responsibility of the project manager seems to be shifted from the project sponsor towards an extended set of stakeholders.

Since each interpretation ascribes a different value to sustainability, they can be ordered along this value dimension. To represent this order, a stage model is most reasonable. The order in our stage model reflects the ascending value ascribed to sustainability aspects in project management by each interpretation and starts with ‘Sustainability not explicitly considered’ where no value is ascribed to sustainability aspects in the project management (Fig. 4).

In the literature, as mentioned in Sect. 2, extant stage models have a practical focus on the integration of sustainability, which is of great value for the research field. Our stage model concentrates on the different interpretations of the role of sustainability, with a focus on the more conceptual structure of the scientific literature and the communication between researchers and also practitioners. Though our stage model is not based on the others, it enhances these by adding the dimension



**Fig. 4** Stage model interpretations of the role of sustainability in project management (own source)

of the access to the term sustainability; it broadens the view of how deep sustainability in general is integrated to how deep the different interpretations of the role of sustainability are integrated in project management aspects. This way the level of integration can be much more clearly reflected, which is why our stage model is also beneficial for the research field. It also shows that by including sustainability into project management the complexity increases, which confirms the findings of previous literature reviews and thus links directly to the latest research on sustainability as described in Sect. 2.

In the following section, we will base our definition of sustainable project management on the synthesised term of value ascribed to sustainability in project management.

### 5.3 New definition of sustainable project management

All the definitions mentioned in Sect. 2 place the sustainability dimensions in the centre of their definition, which is why they have a particularly holistic view. They include all interpretations of the role of sustainability in project management which we extracted from the publications in the research field. In our opinion, however, a definition of sustainable project management should have a more differentiating focus on these interpretations.

On the one hand, the interpretations of the role of sustainability as a constraint and as instrumental value lead to the *management of sustainability in traditional project management*. Sustainability interpreted as a constraint would be managed as a possible risk or issue, while sustainability interpreted as instrumental value and realised by a business case of sustainability would be managed as an opportunity or benefit. On the other hand, when sustainability is interpreted as intrinsic value, sustainability lies at the very centre of a project, seen as a dimension of project success with a business case for sustainability and thus creating *sustainable project management*. Additionally, the development of these different interpretations is no short-term trend but instead remains relatively stable over time.

Therefore, we suggest a more value-oriented definition of sustainable project management to distinguish from traditional/conventional project management. We base this definition on the synthesised term of value ascribed to sustainability in project management and the interpretation of the role of sustainability as intrinsic value that underlines sustainable project management as a paradigm shift: Sustainable project management is a project management approach of ascribing intrinsic value to sustainability aspects by including all sustainability dimensions as equal parts of the project's success and therefore creating a business case for sustainability.

As we have now discussed our results, we will outline a short summary and conclude our study.

## 6 Conclusion

Integrating sustainability into project management is a relatively new, but very relevant and growing field of research. Still, it seems that different interpretations of the role of sustainability exist in the research field. This is a challenge as it is difficult to put scientific publications into context and accordingly communication issues might arise. The aim of our research was to give researchers and practitioners guidance regarding the identification and order of the varying interpretations, as well as the development of a new definition for sustainable project management.

The SLR as our research method was necessary to develop those interpretations and to assign them back to the literature. We found more than 293 publications that we included in our analysis. Using this dataset, we identified three different interpretations that reflected the publications' understanding of sustainability: 'Sustainability as a constraint', where sustainability is seen as a restriction, 'Sustainability as instrumental value', where sustainability is seen as an instrument that supports the actual project goal, as well as 'Sustainability as intrinsic value', where sustainability is interpreted as a genuine goal for creating a business case for sustainability. We also identified that the literature sets itself apart from a project management concept where sustainability aspects are not considered and sustainability is paid as mere lip service, where awareness is only raised for sustainable issues without taking further action. It is therefore important to identify in a publication or in communication what interpretation is addressed and determine which interpretation oneself wants to follow in one's work.

We then synthesised the main theoretical characteristic, 'value ascribed to sustainability aspects in project management', as a common theoretical basis for the different interpretations of the role of sustainability. Based on this characteristic, the different interpretations of the role of sustainability were reflected and ordered in a stage model. In the final step, we reviewed the existing definitions of sustainable project management and compared them to our results. On the one hand, the interpretations of the role of sustainability as a constraint and as instrumental value lead to the management of sustainability in traditional project management. On the other hand, sustainability interpreted as intrinsic value led to a business case for sustainability and thus to sustainable project management. Because the existing definitions do not reflect this circumstance, we redefined sustainable project management.

The theoretical contribution of this study is its guidance for researchers in the field of sustainability in project management. We identified different interpretations of the role of sustainability in project management through which the literature on sustainable project management can be conceptually structured. This allows existing contributions to be better connected and communication in the research field to be clarified. The development of the interpretations over time was illustrated using an area diagram and the interpretations were ordered in a stage model. In addition, recommendations were given for the interpretation of existing literature, the writing

of new publications and communications between each other. Finally, the definition of sustainable project management in contrast to traditional project management can be used as guidance in the research field.

Based on our study, we created an agenda for future research to further develop the field of sustainable project management. First, the identified interpretations were extracted from the existing scientific literature. To better identify practical implications, it would be of value for future research to analyse by interviews if the interpretations are also present in practice and if the stage model can be transferred or if a different model appears. Especially between the stages of sustainability as a constraint and as instrumental value it could be researched if other interpretations exist in practice, which we did not find in the literature and how a transition between the stages might occur. Based on this, as an outlook for future research for the different interpretations synthesised, it could be of interest to analyse by another literature review the citation of the publications in the research field. Using this method, the different streams that follow the same interpretation and that exist in the research field could be observed. Within the newly defined sustainable project management, it would be of high value then to investigate the exact definitions and responsibilities of project management roles, as well as the possible remaining roles of the construct of the iron triangle, as well as the relationship between traditional/conventional and sustainable project management. As the business case in sustainable project management within our definition is expanded by multidimensional components, we would encourage future research to further define the responsibility for the business cases for/of sustainability and the fulfilment thereof.

In addition, during our research we identified the absence of a separation between agile project management and traditional (waterfall) project management in the publications. Future research could examine by interviews how this separation could affect the inclusion of sustainability into project management. From a methodological point of view, more literature reviews than empirical work exist in our finding of the current state of research, which confirms the findings by Khalifeh et al. (2019) and which is why we would encourage future researchers to use empirical methods such as interviews, surveys, case-studies, or experiments. Finally, there exist several open fields of discussion concerning how to define the project frame for multidimensional goals, e.g. how to measure progress (Hwang and Ng 2013; Xu and Hua 2011), the motivation of the project manager to include sustainability and how to define the project end because of the holistic approach or the distinction between weak and strong sustainability in project management.

We see several limitations of our study. The first regards the inclusion criteria in the search as we only focused on English literature. There is also a language and country bias (Petticrew and Roberts 2006) by which we might have missed relevant literature in other languages. Although we selected the keywords regarding our research question and defined the search strings with great care, it cannot be guaranteed that all relevant literature was found. The same applies to the selection of databases, search engines and websites, as well as the exclusion criteria according to the type of literature and content.

The citation or reference bias exists when publications that support a beneficial effect are more often cited than unsupportive ones (Song et al. 2000). For our

backward search, we see the possibility of this bias, but as we also searched directly in databases, websites and search engines we minimised the risk of being affected by the bias. Particularly as the search and synthesis was completed by one person, we see the risk of limited reliability. Therefore, during our research we frequently presented and discussed our approach and findings within a doctoral colloquium. Though this procedure does not substitute the benefit of multiple researchers working on this publication, it reduced the limitation.

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**Declaration**

**Conflict of interest** Not applicable.

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