The Nexus of Sustainability and Project Success

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Project sustainability and project success are among the most prominent subjects in relevant literature nowadays. Project product sustainability pertains to the sustainability of projects' outcomes or deliverables, whereas project process sustainability concerns the sustainability of project-interrelated activities and management processes.

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1. Introduction

Sustainability represents one of the most notable challenges in our current era. There are many definitions of sustainability, some of which focus on the environmental dimension, others on the social or economic dimension [1]. However, this research agrees with the triple-bottom-line (TBL) view of Elkington [2]. In short, there is a need to care for and balance the three dimensions simultaneously. This means protecting the environment and financial resources and respecting present and future human/social needs as a base to attain short- and long-term success.

Many companies are now looking seriously at integrating sustainability into their business as a new innovative methodology and tool for reducing costs and having a competitive advantage [3][4]. In this context, it should be noted that projects form around 30% of global economic activities [5]. Therefore, the potential effect of integrating sustainability into projects (or what is called project sustainability) is inconceivable, and it is a must for a more sustainable future. Likewise, various authors agree with the pressing need for project sustainability because projects are an effective tool for managing change and they have a lot of resources and intense interaction with their surroundings. In the last two decades, the literature has witnessed considerable attention being paid to project sustainability, and several contributions have created a solid foundation for supporting this intellectual orientation in managing projects [6][7].

However, some researchers debate that the long-term endeavour of sustainability may contradict the short-term endeavour or temporary nature of projects, and perhaps they are not naturally compatible. Sustainability may stretch the cost and time constraints, negatively affecting projects' success [8][9][10]. Others argue that integrating sustainability into projects means greater overheads [11][12][13], extra specifications and additional variations in design [14][15][16], and increased tension between stakeholders and expectations [17][18]. Such authors, as a result, deduce that project sustainability could negatively influence project success.

Conversely, authors, including Almahmoud et al. [19] and Kometa et al. [20], argue that factors related to sustainability, such as environmental performance, health, safety, and other corporate social responsibility practices, are crucial for project success. Michaelides et al. [21] maintain that sustainability is a key success factor, with major corporations like Nike, Zara, and Toyota integrating sustainability into projects to boost their reputation in the markets, leading to successful projects and increased market share. Furthermore, empirical studies [22][23][24] found significant positive correlations between sustainability and the success of projects. Others discovered that adopting sustainability does not inevitably result in higher budgets; and by employing optimal methods and cutting-edge technology to use resources effectively, it is possible to reduce costs and increase profitability [25][26][27][28][29][30].

Nonetheless, there are conflicting views about project sustainability, especially concerning its influence on project success. It is vital to carefully integrate sustainability into projects, as project success is vital and significantly impacts the overall success of organisations [31][32][33]. Project success ranks among the highest priorities, drawing significant attention in the literature on project management [34][35][36][37]. The 2016 and 2017 International Project Management Association (IPMA) conferences recently highlighted sustainability and project success as key research subjects [38]. Nevertheless, the relationship between these two subjects remains insufficiently investigated, with the sparse existing research mainly concentrating on construction and manufacturing projects [1][39].

2. Project Sustainability

Two views can be identified in project sustainability literature, namely project product sustainability and project process sustainability. Project product sustainability means the sustainability of deliverables/outcome of projects, whereas project process sustainability is defined as the sustainability of project interrelated activities and management processes [7][40][41].

However, integrating sustainability into projects is a complicated process because decisions have to be taken cautiously from both views above, based on various stakeholders, and with consideration of economic, environmental, and social interests. Decision-makers face high pressures with different needs from different parties (e.g., environmental agencies, governments, workers, communities, and consumers). These pressures should be beside the need for an acceptable return on investment with long-term viability [10][42][43][44]. Therefore, tools for supporting project management practitioners and other decision-makers are essential for integrating sustainability into projects [22].

In this regard, some well-known frameworks, for instance, the Indicators of Sustainable Development and the Sustainability Reporting Guidelines (SRG), are available. Companies can use these frameworks as tools to select TBL-related aspects (e.g., energy efficiency, financial benefits, green outsourcing, human rights, resource utilisation, waste, and ethical behaviour) for more sustainable business practices [41][45]. Similarly, many authors have developed TBL-related aspects as an approach for integrating sustainability into projects [43][44][46][47][48][49].

3. Software Project Sustainability

The origin of most of the existing works on project sustainability is the construction and manufacturing sectors. In the software sector, contributions are far fewer and need more effort. However, like the construction and manufacturing fields, two views can be noticed in the literature on the sustainability of software projects, which are: software sustainability and software process sustainability. The first view means the sustainability of software project outcomes (the sustainability of the software itself as a product), whereas the second view is the sustainability of project processes and interrelated activities when creating or developing a software product. The following two sections will discuss these two perspectives in detail.

3.1. Software "Product" Sustainability

Relevant software literature links sustainability to the quality characteristics of software products, considering it as a non-functional [4][50][51][52][53][54][55]. The IEEE-610 standard defines non-functional requirements as the level to which software fulfils the expectations or needs; they can be seen as the "How" of software products, such as security, maintainability, performance efficiency, and reliability, whereas functional requirements represent the software's fundamental operations to process inputs and produce outputs; they essentially address the "What of a software product" [4][52].

However, the findings show that most software sustainability research has focused on only one or two pillars rather than all three pillars of the TBL framework. For example, Jansen et al. [56] and Koziolek [57] focused on the economic pillar through non-functional quality characteristics such as compatibility, modifiability, portability, maintainability, functional suitability, evolvability, and interoperability as necessary requirements for long-living software products.

On the other hand, Koçak et al. [58] and Cabot et al. [59] concentrated on the environmental pillar—or in some cases, they call it green performance—and linked it to several non-functional quality characteristics (e.g., reliability, resource and capacity optimisation, performance efficiency, and usability). A similar concern is in the works of García-Mireles et al. [60], Roher and Richardson [61], and Taina [62].

A step further was taken by Beghoura et al. [63], Venters et al. [52], and Amsel et al. [50] by focusing on the economic and environmental pillars together. At the same time, the social pillar was the main concern of Ahmad et al. [64], Al Hinai and Chitchyan [65], Duffy [66], and Johann and Maalej [67]. Several quality characteristics are proposed for software social sustainability in their works, such as availability, security, safety, privacy, compatibility, resilience, acceptability, reliability, and accessibility. However, only a few contributions focused on the three pillars of TBL (e.g., [49][68][69][70][71][72]), but there is a lack, or absence of empirical evidence in considering the sustainability of software process and product at the same time.

Most non-functional requirements used for software sustainability, for instance, "Boehm's quality model", "Systemic Quality Model", "The UcSoftC Model", "Dromey's Quality Model", "ISO 9126 and 25010", "Pragmatic Quality Factor

(PQF)", and "McCall's Quality Model", came from well-known quality standards and models. However, it is detected that none of these standards or models addressed or considered the sustainability of software products [7].

3.2. Software "Process" Sustainability

Many authors assert that project sustainability should include specific aspects related to project process sustainability besides the sustainability aspects of project products to deliver projects in a more economical, environmental, and social way [1][10][40][41][73]. Relevant software literature shares a similar perspective, endorsing an environmentally friendly process that leads to an eco-friendly product [4]. Naumann et al. [74] stressed the necessity of a software-engineering procedure that aligns with sustainability goals to produce sustainable software. Similarly, Mahmoud and Ahmad [75] posit that all the processes within a software product's life cycle must themselves embody sustainability to yield a sustainable software product. Therefore, there is a demand for frameworks and models encompassing pertinent aspects of software process sustainability [7][55][63][76].

However, few contributions are available, and unfortunately, the focus primarily was on the environmental pillar aspects (e.g., pollution, waste, and carbon footprints), not on the TBL (e.g., [62][75][77][78][79]).

Social and economic aspects, for instance, working conditions, health, social insurance, education, satisfaction, trust, access to services, payments, economic risks, financial performance, and asset management, should also be included for software process sustainability. Such aspects can be observed in Kern et al. [80], Dick et al. [81], and Naumann et al. [68], where the TBL was considered.

Furthermore, several related aspects (e.g., fairness, respect, honesty, human rights, compliance with the law, social welfare, ethical behaviour, accountability, transparency, and integrity) can be found in the Sustainability Checklist of the Sustainability Reporting Guidelines (SRG), the IPMA and PMI Codes of Ethics and Professional Conduct, and the ISO 26,000 standard [10][82][83]. However, software process sustainability is still in its early phases and needs more effort.

4. Project Success

The traditional criteria for measuring project success are cost, time, and requirements (also called specifications, scope, or quality). These criteria are called triple constraints or the "iron triangle" [84][85][86]. However, these criteria are subject to massive criticism when considered alone, as they only measure project management success (the success of how a project was managed, so-called project efficiency), not the project outcomes, so-called project effectiveness [1][32][36][87][88][89].

Nonetheless, the evolution of the literature reveals additional success criteria for evaluating project outcomes, such as aligning with business strategic goals and objectives; fostering new technology, markets, or opportunities; satisfying stakeholders; and generating positive environmental and social impacts. These criteria place greater importance on the judgments of multiple stakeholders (e.g., owners, clients or users, senior management,

sponsors, project managers, and project teams) and emphasise the assessment of project outcome success or its effectiveness over time [34][90][91][92].

Hence, project success ought to be evaluated based on its efficiency and effectiveness, and the measurement of project success should include both project management success and project outcome success [1][93][94].

Numerous theories, models, and techniques exist for assessing project success, including Pinto and Slevin's [89] systematic method, Wateridge's [85] set of criteria, Lim and Mohamed's [95] macro and micro perspectives, Baccarini's [93] logical framework method (LFM), Atkinson's [86] square route framework, Shenhar et al.'s [96][97] multi-dimensional framework, Collins and Baccarini's [98] dual perspectives, Nelson's [99] retrospective technique, Müller and Turner's [100] success criteria, Thomas and Fernandez's [3] model, Shenhar's [92] strategic approach, and Dalcher's [84] four-tier model. In addition, widely employed tools such as the 'balanced scorecard' and 'key performance indicators' (KPIs) play a crucial role in determining project success [36][101][102][103]. Nevertheless, as highlighted by Silvius and Schipper [39] and Davis [104], the most frequently referenced of the 199 contributions for assessing project success are those by Shenhar and Dvir [105], Shenhar et al. [96][97], and Pinto and Slevin [89].

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