

Association for Information Systems

## AIS Electronic Library (AISeL)

---

UK Academy for Information Systems  
Conference Proceedings 2024

UK Academy for Information Systems

---

Spring 7-10-2024

# Project Materiality and Integrated Analytics in Sustainability Augmented Portfolio Management

Javed Afzal Mohammad

University of West London, 21434312@student.uwl.ac.uk

Laden Husamaldin

University of West London, laden.aladin@uwl.ac.uk

Ikram Ur Rehman

University of West London, ikram.rehman@uwl.ac.uk

Follow this and additional works at: <https://aisel.aisnet.org/ukais2024>

---

### Recommended Citation

Mohammad, Javed Afzal; Husamaldin, Laden; and Ur Rehman, Ikram, "Project Materiality and Integrated Analytics in Sustainability Augmented Portfolio Management" (2024). *UK Academy for Information Systems Conference Proceedings 2024*. 13.

<https://aisel.aisnet.org/ukais2024/13>

This material is brought to you by the UK Academy for Information Systems at AIS Electronic Library (AISeL). It has been accepted for inclusion in UK Academy for Information Systems Conference Proceedings 2024 by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# Project Materiality and Integrated Analytics in Sustainability Augmented Portfolio Management

Javed Mohammad, Laden Husamaldin and Ikram Ur Rehman

School of Computing and Engineering, University of West London, U.K.

Email: [21434312@student.uwl.ac.uk](mailto:21434312@student.uwl.ac.uk) , [laden.aldin@uwl.ac.uk](mailto:laden.aldin@uwl.ac.uk),

[ikram.rehman@uwl.ac.uk](mailto:ikram.rehman@uwl.ac.uk)

## Abstract

*The integration of sustainability within project environments has emerged as a central concern in contemporary project management literature and practice. This research paper examines the critical issue of sustainability integration and its impact on project success. Inadequate contextual knowledge often leads to ineffectual strategies, unsustainable outcomes, and unsuccessful projects, giving rise to practices like greenwashing and regulatory non-compliance. As the project environment (PE) transforms, sustainability is poised to become an enduring feature of project management (PM). This research closely examines tactical versus strategic, product versus project lifecycle approach, and PM versus project portfolio management (PPM) for a sustainable PE. Thus, this research paper introduces 'Sustainability Augmented Portfolio Management' (SAPoM) as a strategic approach leveraging Project Materiality assessment derived from sustainability reporting standards to create a sustainability-driven PE and enhanced PPM decision-making through integrated analytics. The SAPoM-based conceptual framework proposed here aligns projects with organisational objectives and sustainability principles, offering a strategic solution for the complex challenge of integrating sustainability within PEs.*

**Keywords:** Sustainability, Project portfolio management, Analytics, Project Materiality, decision-making

## 1.0 Introduction

Across the globe, international entities, governments, and industry organisations are playing an active role in shaping the landscape of sustainability reporting. Their collective aim is to encourage transparency and accountability in the way businesses conduct their activities. This movement towards sustainable reporting is not occurring in isolation; instead, it draws inspiration and borrows key concepts from financial reporting standards (Elliott and Elliott, 2022). Much like financial reports provide a structured and standardised way to communicate an organisation's financial health and performance, sustainability reporting is emerging as a similar framework that discloses an organisation's commitment to, and impact on the environment, economy and society.

The EU's Corporate Sustainability Reporting Directive (CSRD) and the UK's Sustainability Disclosure Requirements (SDR) are notable examples of regulations that are on the horizon (European Commission, 2023; Financial Conduct Authority (FCA), 2022). Compliance with these regulations is, as a matter of course, necessary for maintaining competitiveness and financial stability (Turan *et al.*, 2008). In a recent development, the Global Reporting Initiative (GRI) and the European Financial Reporting Advisory Group (EFRAG) now offer interoperable and complementing standards (EFRAG, 2023). This transformation will lead to a lasting reconfiguration of corporate strategy and operations, with a primary emphasis on prompting business leaders to recognise the significance of incorporating sustainability into the project environment (PE).

In contemporary project management (PM) research, sustainability is frequently seen as a comprehensive and context-sensitive notion. This poses challenges in developing universally applicable knowledge or approaches for its integration - a problem rooted in the hermeneutics of sustainability. Researchers struggle to define the boundaries of what constitutes sustainability and sustainable practices within project management. Existing research often views sustainable PM from a project-oriented standpoint, limiting sustainability integration. This dilemma leaves scholars and practitioners contemplating whether PM or project portfolio management (PPM) is more effective for enduring sustainability outcomes.

This research is grounded on the premise that materiality assessment derived from sustainability reporting standards provides a platform for smoothly integrating sustainability into the project environment creating the capacity and capability to remain in step with the evolving nature of sustainability while delivering an organisation's strategic objectives. This research paper

critically evaluates both tactical and strategic approaches, emphasising the importance of considering project outcomes from a broader product lifecycle perspective. Moreover, it incorporates analytics to support informed decision-making throughout the process. This holistic approach will ensure the delivery of oven-ready outcomes for disclosure and regulatory scrutiny.

The research paper is structured into five sections, commencing with this introduction following the abstract. The second section, Background, comprises two parts, exploring extant literature and its limitations relevant integration of sustainability within the project environment, and project materiality. The third section explains the methodology adopted for this research, while the fourth section extensively addresses the proposed conceptual framework of SAPoM, encompassing sustainability reporting standards, project materiality, the integration of analytics and stakeholder engagement with SAPoM. The fifth and final section examines the research's impacts and serves as the conclusion of the paper.

## 2.0 Background

### 2.1 The Evolving Notion of Sustainability

Sustainability is a versatile but sometimes contentious concept, drawing scepticism from both researchers and practitioners due to its lexical ambiguity (Sze, 2018). At its core, sustainability involves maintaining, supporting, enduring and enhancing the well-being of humanity within the constraints of available resources. While this ambiguity might risk rendering sustainability meaningless (Silvius, 2017), it has also broadened its application, inspiring more actions in its name in the absence of a rigid definition (Cadenasso and Pickett, 2018).

It is almost inconceivable to write about sustainability without mentioning the Brundtland Report by the World Commission on Environment and Development (WCED) which established a universally accepted definition underscoring the inseparable link between environment and development. It emphasises the imperative of ‘meeting the needs of the present generation without compromising the ability of future generations to meet their own needs’ (Brundtland, 1987, p.16). However, this foundational definition has spawned a multitude of interpretations in various contexts, spanning ethics, philosophy, strategy, climate change, and more. In 2012, Kilbert *et al.* documented at least seventy sustainability definitions, a number that surged to over three hundred by 2019 (Kilbert *et al.*, 2012; Per, 2019).

Sustainability embodies the Triple Bottom Line (TBL) principles of economic performance, environmental protection, and social equity (Elkington, 1997, 1999; Hubbard, 2009; Høgevoid *et al.*, 2015; Padin *et al.*, 2016; Ghannadpour *et al.*, 2021). Taking a hermeneutical perspective of interpreting sustainability entails incorporating the Triple Bottom Line (TBL) principles collectively in research, rather than treating them as separate and isolated principles (Padin *et al.*, 2016; Al-Marri and Pinnington, 2022). While TBL aids in operationalising sustainability (Marcelino-Sadaba *et al.*, 2015; Silvius, 2017), encouraging organisations to assess and manage their performance holistically across these three dimensions. It helps organisations recognise that long-term success requires not only financial viability but also consideration of environmental and social impacts.

Measuring, reporting, and acting on economic, environmental, and social indicators, helps organisations to make informed decisions that contribute to sustainability and responsible business practices. From project management (PM) integration perspective, materiality assessment (Wu, Shao and Chen, 2018; Sardianou *et al.*, 2021; To and Chau, 2022), industry-

relevant indicators and criteria (Kuzemko and Britton, 2020), global applicability, qualitative and quantitative insights should be integral to the process. As it can enhance the necessary changes for achieving sustainable development, therefore, bridging the gap between the two domains.

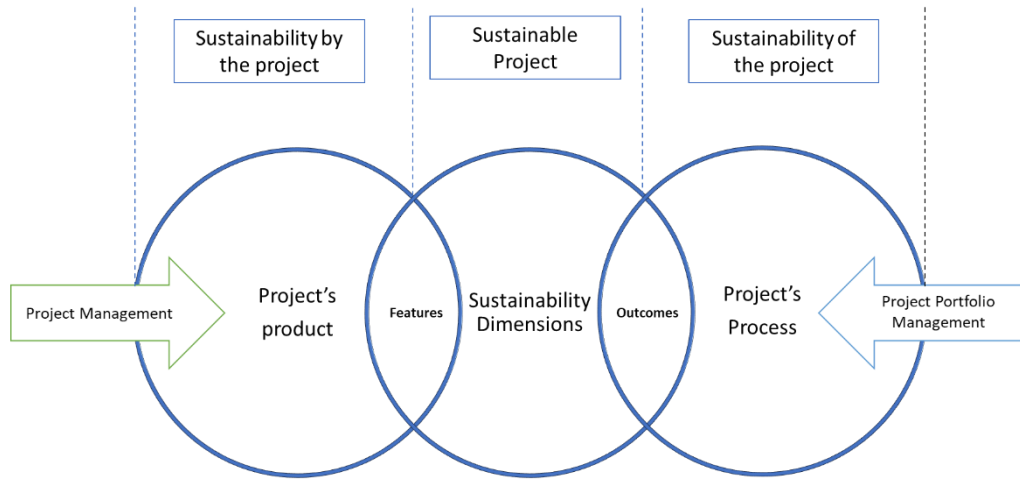
## **2.2 Sustainability at the Crossroads of Project and Portfolio Management**

This research paper examines projects by focusing on two domains: project portfolio management (PPM) and project management (PM). The primary aim is to acquire a comprehensive insight into the rationale for incorporating sustainability into the project environment. The term ‘project environment’ is central to this discussion, encompassing several elements, including project teams, stakeholders, resources, constraints, risks, governance, interdependencies, external environment, culture, policies, and organisational support.

Project management (PM) as defined by the Project Management Institute, (2021) is a temporary endeavour that entails the application of knowledge, skills, tools, and techniques to meet project requirements within the defined constraints of time, cost and scope or quality (Martinsuo and Lehtonen, 2007). Hence, PM is primarily centred on the product itself (Pensenstadler and Femmer, 2013; Doorasamy, 2017), concentrating on project objectives and ‘sustainability by the project’ (Huemann and Silvius, 2017). Project practitioners recognise that once these objectives are met, the project serves no further purpose. The Association of Project Management underscores that tactical projects should only be undertaken if they align with strategic objectives (APM Portfolio Management SIG, 2019). Sustainability often involves much broader, ethical and long-term questions about responsible resource use, equity, and the moral obligations of organisations. These have limited relevance to the project’s immediate goals. Achieving these aims is contingent upon projects operating within the more strategic domain of project portfolio management (PPM).

Project portfolio management (PPM), as defined by the Project Management Institute, (2021) is the organisation of a collection of projects and programs aimed at achieving strategic objectives (Clegg et al., 2018). Cooper et al., (2001) underscores the functional role of PPM in selecting, controlling, prioritising, and monitoring projects to align resource allocation and managing risks to gain strategic advantage. Crucially, PPM's process-centric and ‘sustainability of the project’ approach (Huemann and Silvius, 2017) transcends individual project lifecycles and PM, emphasising a broader strategic outlook. Additionally, a notable research gap exists regarding the utilisation of PPM as a process that can effectively be applied across the entire

product lifecycle. Such research would be pivotal in the seamless integration of sustainability into the project environment as presented in Figure 1.



**Figure 1. Product versus Process sustainability in the project environment**

Sustainability adopts a strategic perspective, with far-reaching consequences spanning environmental, economic, and social domains (Silvius and Marnewick, 2022). Sustainability goes beyond individual project timelines, requiring alignment with the organisation's overarching sustainability strategy. If conventional project management falls short in addressing sustainability due to its temporal constraints, inflexibility, and limited impact on deliverables, it becomes imperative to seek a more strategic solution free from these confines. Enter Sustainability Augmented Portfolio Management or SAPoM.

Before this research paper describes SAPoM as a solution for integrating sustainability in the project environment (PE), it would like to present Project Materiality as a key element that bridges the gap between sustainability and portfolio management.

### **2.3 Project Materiality: The Key to Sustainability and Portfolio Management Integration**

In sustainability-related academic literature, there exists a substantial body of research dedicated to exploring the concept of materiality. Materiality is widely acknowledged as a pivotal element in sustainability, intimately connected with the norms and guidelines governing sustainability reporting. In traditional project portfolio management, it is a common practice to

define a set of decision criteria and attributes for screening, prioritising, selecting, and discontinuing projects within a portfolio, while also ensuring their alignment with the organisation's strategic goals (Bible and Bivins, 2011; Petit, 2012; Lister, 2015; Moustafaev, 2017a; Project-management.pm, 2017; Clegg *et al.*, 2018; Martinsuo and Geraldi, 2020). Diverse project evaluation techniques align with organisational strategies. Senior executives promote sustainability in goal setting. Resources are allocated judiciously to meet sustainability prerequisites, ensuring transparency and accountability in reporting for Corporate Social Responsibility (CSR) (Delbard, 2008; Ashrafi *et al.*, 2018; Paun, 2018; Christensen, Hail and Luez, 2019; Bahu, 2020; Al-Marri and Pinnington, 2022). A significant research gap exists in the effort to introduce materiality as a comprehensive substitute for the traditional decision criteria approach.

This research paper introduces the concept of project materiality as a means to incorporate sustainability into project portfolio management. Conventional decision-making criteria, in the context of sustainability integration, do not adequately account for social and environmental factors, market dynamics, risk evaluation, financial viability, stakeholder implications, and alignment with a sustainability-focused approach. This paper, therefore, conceptualises project materiality as integral to sustainable project portfolio management. As project materiality comprehensively covers economic, environmental and social aspects, it replaces the traditional decision criteria process currently practised.

Materiality is a concept borrowed by the Global Reporting Initiative (GRI) and other sustainability reporting standards from financial reporting (Wu, Shao and Chen, 2018; Kuzemko and Britton, 2020). It reflects the significant economic, environmental, and social impacts of a company and how these affect the assessments and decisions of stakeholders. Distinguishing materiality within the context of financial reporting from materiality in sustainability reporting is essential for comprehending the rationale behind its adoption in sustainability reporting, drawing on principles borrowed from the financial realm.

This differentiation is necessary as it sheds light on why materiality concepts, traditionally associated with financial matters, have been integrated into sustainability reporting. It enables the appreciation of underlying motivations and benefits of incorporating financial reporting practices into sustainability frameworks. Materiality, a concept deeply rooted in financial contexts, has been repurposed to better address the multifaceted environmental, social, and



economic concerns inherent to sustainability, emphasising the importance of understanding this transition in reporting approaches.

In financial reporting, information is considered material if its absence or misrepresentation could impact the financial decisions made by users relying on financial statements, as outlined by the IASB Framework (International Accounting Standards Board (IASB), 2018). Conversely, in the context of sustainability, materiality pertains to issues that can exert substantial effects on a company, encompassing both advantageous and detrimental outcomes (Rifkin, 2019). Materiality is fundamental to sustainability, facilitating impartial decision-making and the pursuit of ethical and genuine actions (To and Chau, 2022).

Additionally, in the context of Sustainability Augmented Portfolio Management (SAPoM), it delineates the issues that are significant to an organisation while assessing the complexity and subjectivity of sustainability within project portfolio management (PPM). It also raises questions about the consistency and comparability of sustainability within projects within the portfolio, as different stakeholders may interpret materiality differently. This lack of standardisation is a significant issue for sustainability integration and requires ongoing critical consideration by stakeholders.

For this research, project materiality is defined as:

*Project materiality refers to a set of factors within the project environment (PE) that have substantial influence in terms of strategic, economic, environmental, and social consequences. These factors significantly influence project and portfolio management and shape stakeholders' determinations concerning an organisation's strategic direction and its capacity to withstand sustainability-resilience challenges and uncertainties.*

Sustainability resilience from a PE perspective refers to the project's ability to withstand and adapt to various sustainability challenges and changes over time while still achieving its long-term sustainable objectives (Espiner, Orchiston and Higham, 2017; Nüchter *et al.*, 2021). The importance of sustainability-resilience within the Project Environment (PE) focuses on the lifecycle of deliverables and not just the project itself. Project practitioners are, therefore, required to revisit and evaluate materiality factors continually in the face of environmental, regulatory and strategic shifts, anticipate and mitigate risks, and account for ethical and social factors. Sustainability-resilience should be seen as a paradigm shift in project and portfolio management.

Further, for this research, Project Materiality Assessment is defined as:

*Project materiality assessment is the systematic evaluation and analysis of the factors within the project environment (PE) that possess substantial influence concerning strategic, economic, environmental, and social outcomes. This assessment aims to comprehensively understand and quantify how these factors impact projects, programmes and portfolios, stakeholders' determinations concerning an organisation's strategic orientation and its ability to navigate sustainability-resilience challenges and uncertainties.*

## **2.4 Highlighting the Challenges and the Limitations**

In this research paper, the challenge encompasses three main dimensions. Firstly, it involves the integration of sustainability principles into the project environment, requiring organisations to align and adapt their project management practices with sustainability objectives. Secondly, it necessitates the application of analytics to enhance decision-making processes, bridging the gap between sustainability and project portfolio management (PPM). This aims to develop advanced prediction models, data-driven decision-making, and the delivery of sustainable project outcomes. Finally, organisations are confronted with the task of restructuring PPM practices within their operational frameworks.

These challenges are further compounded by the emergence of new and forthcoming regulatory requirements mandating organisations to disclose their activities and their environmental and social impacts. This, in turn, requires organisations to innovate and shift their existing practices towards sustainability principles right from the project's inception. PPM must evolve to become data-driven and focused on delivering sustainable outcomes through projects. Therefore, this paper seeks to examine these challenges, and their implications, and propose strategies for organisations to effectively respond to the demands for sustainable project outcomes while ensuring compliance with evolving sustainability standards and regulations.

Finally, summarising the limitations within the existing literature and practice can be delineated as follows:

- The current body of research fails to adequately address the incorporation of analytics within the realm of sustainable project portfolio management (PPM).

- Ambiguities persist regarding the most effective means of achieving sustainable outcomes, whether through the product-oriented approach of Project Management (PM) or the process-oriented approach of Project Portfolio Management (PPM). This necessitates further investigation.
- The translation and measurement of sustainability-related quantitative data (including economic and environmental aspects) and qualitative data (of social factors) concerning an organisation's short and long-term strategic objectives require clarification and exploration.
- Bridging the gap between sustainability reporting tools, such as the Global Reporting Initiative (GRI), and strategic business processes to facilitate practitioners in the quantitative and qualitative evaluation of sustainability remains a challenge. The absence of any materiality assessment from a project environment (PE) perspective creates further complexities. The question arises as to how such an analytics-based framework can enhance reporting accuracy and support more effective sustainability assessments.

### **3.0 Methodology**

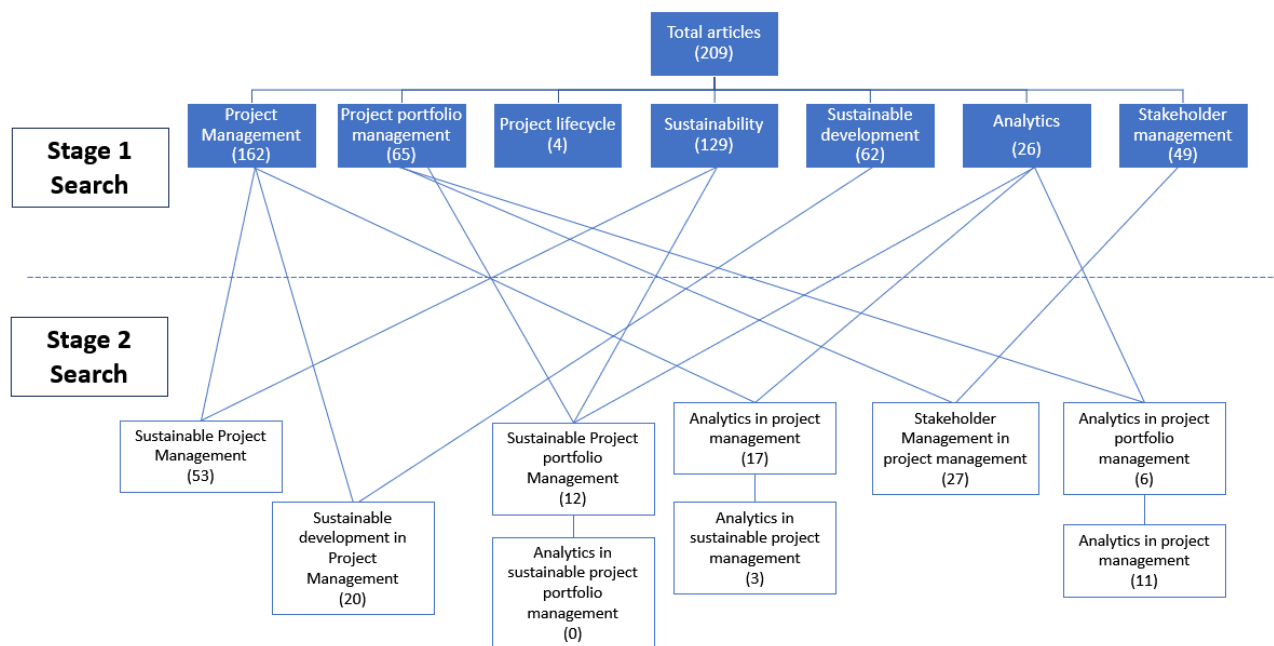
The literature search for the four interconnected concepts of sustainability, project portfolio management, materiality and analytics was conducted using a systematic approach to ensure comprehensive coverage of relevant research. After clearly defining the limitations of the current research, the following steps were followed:

1. Identifying Keywords and Search Terms: A set of keywords and search terms related to sustainability, project portfolio management, and analytics were identified. In the first step keywords were chosen to capture the core concepts and their various aspects. Next, literature with the concepts combined were selected e.g., sustainable project management, sustainable project portfolio management (PPM), sustainable project reporting, analytics in sustainable project decision-making, materiality in financial sector and sustainability reporting, stakeholder engagement in sustainable project management, sustainability reporting and project management, sustainability reporting and project portfolio management.
2. Selecting Databases and Resources: Multiple academic databases, such as EBSCO, Science Direct, ProQuest, JSTOR and Google Scholar, were selected to conduct the

literature search. Additionally, industry-specific platforms, organisational websites, and conference proceedings were considered for relevant literature.

3. Applying Inclusion and Exclusion Criteria: Inclusion and exclusion criteria were established to ensure that only the most relevant and high-quality sources were included in the search results. The criteria included publication date, language, study type, and relevance to the research questions. The aim was to find literature that included all four areas of study; however, as can be seen in Figure 2 below, out of 209 articles searched, only three articles covered sustainable project management and analytics while no article was found that covered the application of analytics in sustainable project portfolio management.
4. Conducting the Search: The identified keywords and search terms as seen in Figure 2 were used to query the selected databases and resources. The search was conducted systematically and consistently to retrieve relevant articles and publications. Other affiliated concepts which included definitions, best practices, business maturity models, business processes, regulatory consultations, web-based organisational resources, stakeholder management, and knowledge management were also studied for a more thorough and inclusive research.

Following is a breakdown of the research articles studied:



**Figure 2. Article search tree map**

5. **Screening Titles and Abstracts:** The retrieved articles' titles and abstracts were screened to determine their potential relevance to the research questions. Core concepts have been derived from the stage 1 searches, while blended and integrated concepts were part of the stage 2 searches as depicted in Figure 2 above. Stage 2 search applied Boolean operators (AND, OR, NOT) to combine terms and concepts effectively while irrelevant or unrelated sources were excluded at this stage. Sources with a more universal acceptance were preferred to those with regional scope.
6. **Reviewing Full-Text Articles:** The full-text articles of the selected studies were reviewed to assess their suitability for inclusion in the literature review. Articles that met the inclusion criteria were considered for analysis.
7. **Data Extraction and Synthesis:** Data from the selected articles were extracted and organised to identify key findings, themes, and interconnections between sustainability, sustainability reporting and analysis, project management, project portfolio management, and analytics. As the research aims to integrate different concepts, the synthesis process involves examining the relationships and interactions between these concepts to gain a corroborative and comprehensive understanding.
8. **Analysing and Reporting the Findings:** The extracted data and synthesised findings were analysed to draw meaningful conclusions and insights. The results have been presented clearly and coherently in the literature review, discussing the interrelationships and implications of interconnecting concepts, which concepts have more synergies while gaps in the literature have also been identified.

By following this systematic process, the literature search aimed to ensure a comprehensive exploration of the connections between sustainability, project portfolio management, and analytics while maintaining rigour and transparency in the review process.

## **4.0 Sustainability Augmented Portfolio Management (SAPoM)**

### **4.1 Conceptual Framework**

The fundamental considerations that underpin this research are:

- Organisations can now face rigorous assessments of their operational impact and their commitment to sustainability standards within defined reporting periods (Courtnell, 2019; Global Sustainability Standards Board, 2020; Global Reporting Initiative, 2021).
- Leveraging existing sustainability reporting standards eliminates the need for unnecessary reinvention. These industry-specific, sustainability-driven guidelines can be effortlessly integrated into the project environment (PE), streamlining the processes.
- The continuous evolution of reporting standards underscores their ability to stay in step with upcoming regulatory changes. This adaptability is essential as it allows these standards to not only keep up with but also proactively respond to the shifting regulatory landscape. They remain effective and relevant by adjusting and aligning with the changing requirements, ensuring that organisations can meet their reporting obligations in a dynamic and ever-changing business environment. This evolution serves as a proactive strategy to keep reporting practices in tune with the demands of the present and future regulatory frameworks.
- Project practitioners can be assured that they are always up to date when carrying out project materiality assessments of their projects and portfolios using these standards.

In short, the reporting standards employed by businesses have the power to drive sustainable results within the project environment. Consequently, SAPoM deliverables can be designated as products and services poised for sustainability, ready to make a meaningful impact.

### **4.2 SAPoM: The Imperative For An Integrated Approach**

SAPoM is a composite framework that aims to integrate analytics and project materiality into project portfolio management (PPM) planning and processes with minimal disruption. The conceptual framework is depicted in Figure 3. Similarly, the feedback can be fed back for further analysis to build best practices and maturity in planning and processes. The building blocks of this composite framework are stated below:

- **Integrated Analytics and Project Materiality**
  - Step 1: Sustainability criteria and metrics derived from sustainability reporting standards e.g., Global Reporting Initiative (GRI) or Sustainability Accounting Standards Board (SASB)
  - Step 2: Project Materiality Assessment
  - Step 3: Analytical tools to support insights to support materiality assessment and decision-making in processes within the PPM framework
- **Project portfolio management (PPM)**

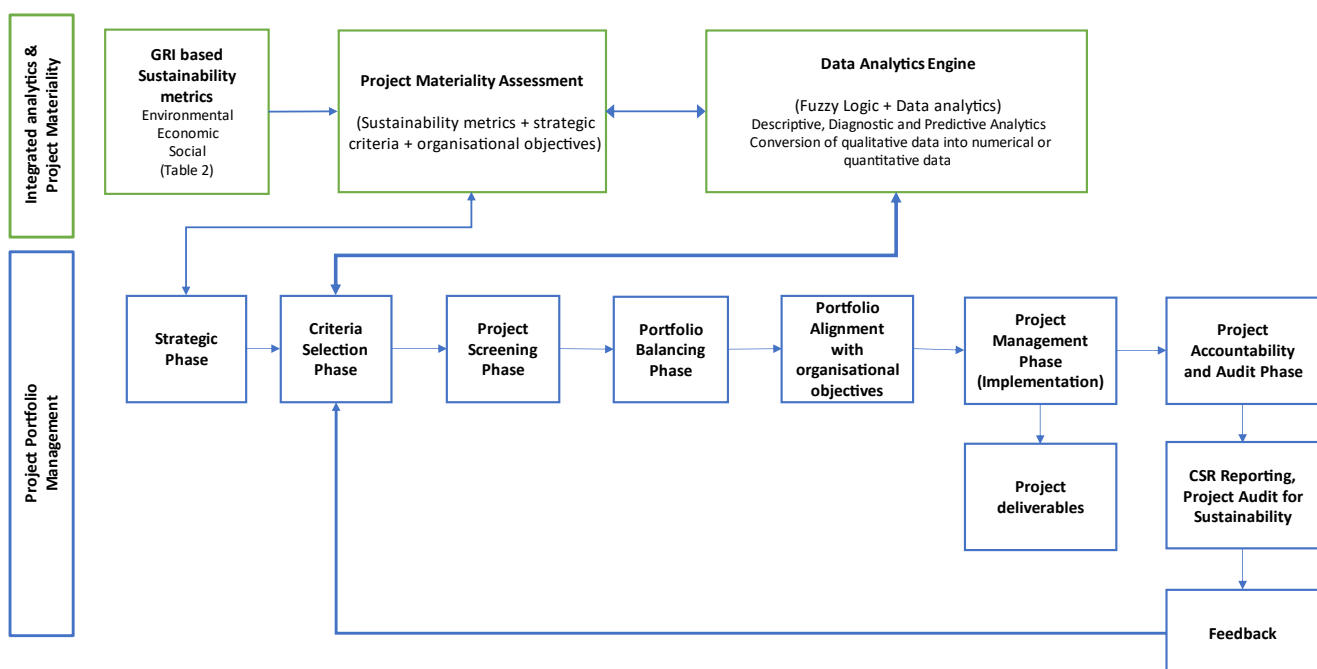


Figure 3. Conceptual Framework - Sustainability Augmented Portfolio Management (SAPoM)

## Integrated Analytics and Project Materiality

### Step 1: Employing Sustainability Reporting Standards into SAPoM

Sustainability criteria within reporting standards do not directly address the challenges of sustainability in the context of projects. These standards lack the incorporation of analytics for informed decision-making, which is essential. Regulatory frameworks primarily focus on reporting and labelling to meet compliance requirements. Noteworthy among them are:

- Global Reporting Initiative (GRI) (Dumay, Guthrie and Farneti, 2010; Courtnell, 2019; Global Reporting Initiative, 2021)
- Carbon Disclosure Project (CDP) (Carbon Disclosure Project, 2023)
- Task Force on Climate-related Financial Disclosures (Task Force on Climate-related Financial Disclosures (TCFD), 2022)
- Sustainability Accounting Standards Board (SASB) (Sustainability Accounting Standards Board, 2023)
- Integrated Reporting Framework by the International Sustainability Standards Board (ISSB)
- ESG Scoring (Tarmuji, Maelah and Tarmuji, 2016)

The challenge lies in bridging the gap between sustainability criteria and PPM, ensuring measurability, clarity, stakeholder engagement, and transparency without compromising project integrity. This calls for expertise in statistical analysis, strategic management, ethical sustainability practices, and data management to effectively apply these criteria within project frameworks. Reporting standards provide guidelines and standards for sustainability reporting, helping organisations assess and communicate their sustainability performance. Some of the key features of GRI reporting (Dumay, Guthrie and Farneti, 2010; Courtnell, 2019; Global Sustainability Standards Board, 2020) are:

- **Materiality Assessment:** This involves identifying the sustainability topics and issues that are most significant for the organisation and its stakeholders. Materiality helps organisations focus their reporting on what truly matters in terms of economic, environmental, and social impacts.
- **Reporting Principles:** These principles include transparency, materiality, completeness, and stakeholder inclusiveness. They emphasise the importance of reporting relevant, accurate, and comprehensive sustainability information.
- **Reporting Frameworks:** Sustainability reporting standards have developed several reporting frameworks that organisations can use to structure their sustainability reports. The most widely used is the GRI Standards, which cover a range of sustainability topics such as governance, ethics, labour practices, environmental impact, and societal contributions.



- **Indicators and Disclosures:** These include specific indicators and disclosures that organisations can use to measure and report on their sustainability performance. These indicators are organised by topic, making it easier for organisations to address the most relevant sustainability issues.
- **Stakeholder Engagement:** GRI emphasises the importance of engaging with stakeholders throughout the reporting process. Organisations are encouraged to identify their stakeholders, understand their concerns, and incorporate their feedback into sustainability reporting.
- **Integration with Other Standards:** GRI recognises that organisations may use other sustainability and reporting standards. The GRI framework is designed to be compatible with other standards, such as the United Nations Sustainable Development Goals (SDGs) (United Nations, 2001, 2015; Tsalis *et al.*, 2020) and the principles of the International Integrated Reporting Council (IIRC).
- **Assurance and Verification:** GRI encourages organisations to seek external assurance or verification of their sustainability reports. This adds credibility to the reported information and ensures that it has been independently assessed for accuracy and completeness.
- **Continuous Improvement:** GRI promotes a process of continuous improvement in sustainability reporting. Organisations are encouraged to set targets, track progress, and update their reports regularly to demonstrate their commitment to sustainability.
- **Global Applicability:** GRI's framework is designed to apply to organisations of all sizes and sectors, making it a globally recognised standard for sustainability reporting.

GRI examines sustainability by providing a structured framework for organisations to assess and report on their economic, environmental, and social impacts. It emphasises the importance of materiality, stakeholder engagement, transparency, and continuous improvement in the reporting process, making it a widely used and respected tool in the field of sustainability reporting. These standards can, however, be seamlessly integrated into project portfolio

management ensuring that projects align with sustainability tenets, regulatory requirements, and an organisation's sustainability strategy from the outset.

## **Step 2: Deriving Project Materiality Criteria from Sustainability Reporting Standards**

Literature reveals that the concept of materiality within sustainability draws its origins from the principles of financial materiality. This paper introduces the same influence within the domain of the project environment (PE) and more specifically Sustainability Augmented Portfolio Management (SAPoM). To gain a comparative understanding of the intricate evolutions in these contexts, it is imperative to present a comparative analysis illustrated in Table 1.

For this research paper, materiality topics from the Global Reporting Initiative (GRI) guidelines have been used as the basis for the study. This process involves systematically identifying the most significant sustainability topics for an organisation, the portfolio and the projects. Project Materiality topics are those issues that have the most significant impact on the portfolio and projects and are of significant concern to the stakeholders. Sustainability reporting standards like GRI provide a wealth of materiality-related topics which can be very helpful. Following are the steps to help derive materiality topics from GRI guidelines (Dumay, Guthrie and Farneti, 2010; Courtneil, 2019; Global Sustainability Standards Board, 2020).

Aspect	Financial Materiality	Sustainability Materiality	Project Materiality
<b>Definition</b>	Relates to financial impacts, focusing on financial consequences and disclosure in financial reporting	Pertains to environmental, social, economic aspects, particularly in sustainability reporting contexts	Involves influential factors within the project environment (PE) that impact organisational strategy as well as sustainability dimensions.
<b>Stakeholder Focus</b>	Primarily concerns investors, creditors and financial analysts	Addresses a broad spectrum of stakeholders including customers, employees, regulators and the public, reporting standards, regulatory fulfilment.	Focused on stakeholders' determinations regarding the organisation's strategic direction as well as the project and portfolio's management and sustainability-resilience capabilities.
<b>Purpose</b>	To assess the materiality of financial information in financial statements for decision-making	To identify significant sustainability issues for disclosure and reporting	To build a set of criteria that help in the selection, screening and termination of projects within a portfolio and to balance and align portfolios with organisational strategies
<b>Primary Focus</b>	Economic impacts, revenue, expenses, and financial performance indicators	Environmental, social, and economic consequences of business activities	Project-specific factors that affect projects, portfolios and the organisation's ability to manage projects to successfully deliver sustainable outcomes

**Table 1. A comparison between financial, sustainability and project materiality**

- **Identify Relevant GRI Indicators:** Understand and review the list of GRI indicators within the guidelines that provide a framework for reporting sustainability. These indicators cover a wide range of economic, environmental, and social topics. Identify the indicators that are most relevant to an organisation's industry, operations, and stakeholder interests.

Category	Economic			Environmental			
Aspects	EC1	Economic performance		EN1	Materials		
	EC2	Market presence		EN2	Energy		
	EC3	Indirect economic impacts		EN3	Water		
	EC4	Procurement practices		EN4	Biodiversity		
				EN5	Emissions		
				EN6	Effluents and waste		
				EN7	Products and services		
				EN8	Compliance		
				EN9	Transport		
				EN10	Overall		
				EN11	Supplier environmental assessment		
				EN12	Environmental grievance mechanisms		
Category	Social						
Sub-Category	Labor practices and decent work		Human rights		Society		Product responsibility
Aspects	LP1	Employment	HR1	Investment	S1	Local communities	PR1 Customer health and safety
	LP2	Labor/management relations	HR2	Non-discrimination	S2	Anti-corruption	PR2 Product and service labeling
	LP3	Occupational health and safety	HR3	Freedom of association and collective bargaining	S3	Public policy	PR3 Marketing communications
	LP4	Training and education	HR4	Child labor	S4	Anti-competitive behavior	PR4 Customer privacy
	LP5	Diversity and equal opportunity	HR5	Forced or compulsory labor	S5	Compliance	PR5 Compliance
	LP6	Equal remuneration for women and men	HR6	Security practices	S6	Supplier assessment for impacts on society	
	LP7	Supplier assessment for labor practices	HR7	Indigenous rights	S7	Grievance mechanisms for impacts on society	
	LP8	Labor practices grievance mechanisms	HR8	Assessment			
			HR9	Supplier human rights assessment			
			HR10	Human rights grievance mechanisms			

**Table 2. GRI Guidelines - Economic, Environmental and Social categories** (*Calabrese et al., 2019; Rifkin, 2019; Global Sustainability Standards Board, 2020*)

- **Conduct Stakeholder Engagement:** Engage with the organisation's stakeholders to understand their concerns, expectations, and priorities regarding sustainability issues. This can be done through surveys, interviews, focus groups, or other forms of dialogue.
- **Prioritise Sustainability Topics:** Use the information gathered from stakeholder engagement to prioritise the sustainability topics that are of greatest concern to the stakeholders. Consider their input in determining which issues are most material to the organisation.

- **Assess Impact and Significance:** Evaluate the impact and significance of each prioritised sustainability topic on the organisation. Consider factors such as potential risks, opportunities, reputational impact, regulatory requirements, and financial implications.
- **Rank Materiality Topics:** Rank the sustainability topics based on their materiality to the organisation. Focus on those topics that have the most significant impact and are of the highest concern to both the organisation and stakeholders. Materiality matrices can be applied to manage stakeholder expectations from the very outset of the process.

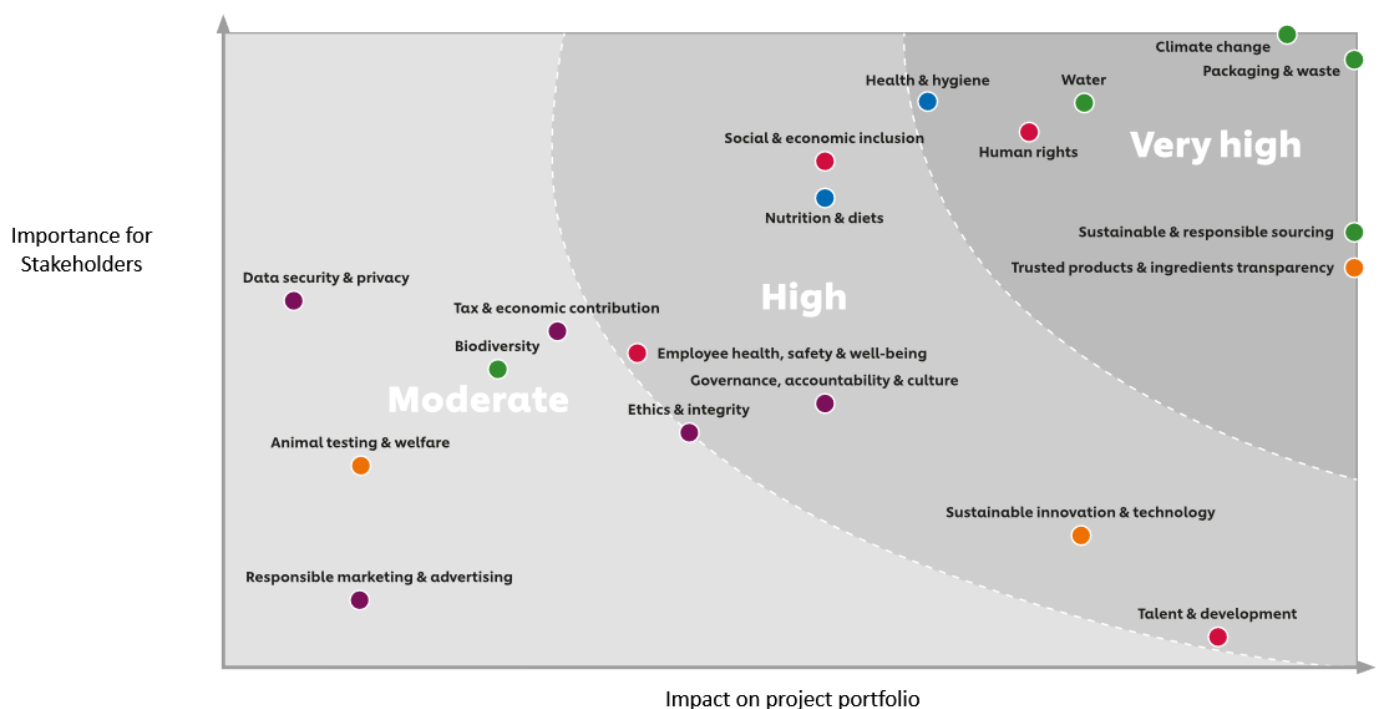


Figure 4. Project Materiality impact – a scatter graph representation

- **Validate with Key Stakeholders:** Validate the materiality assessment with key stakeholders, including internal and external parties. Ensure that the identified materiality topics align with stakeholder expectations and concerns.
- **Document the Materiality Assessment:** Document the materiality assessment process, including the criteria used, stakeholder input, and the rationale for prioritising specific material topics.
- **Integrate Materiality into Reporting:** Incorporate the identified materiality topics into an organisation's sustainability reporting. Report on these topics transparently and comprehensively, following the GRI reporting framework.

- **Regularly Review and Update:** Materiality is not static; it can change over time due to shifts in stakeholder priorities, industry trends, or organisational developments. Periodically review and update the materiality assessment to ensure its relevance.

By following these steps, one can derive materiality topics from the GRI guidelines that are aligned with an organisation's strategic context and stakeholder expectations. This process ensures that the principles, attributes and indicators of sustainability focus on the issues that matter most to the projects, portfolio, organisational strategy and its stakeholders, thereby enhancing transparency, accountability and meaningful buy-ins.

After conducting an extensive review of the existing literature on project management, project portfolio management, materiality and sustainability, it becomes evident that project materiality offers a range of significant advantages. The following advantages have been deduced from the insights gained by analysing and deducing relationships between these interrelated fields:

- **Leveraging Materiality Knowledge:** The materiality assessment concept, while firmly established in the financial sector and sustainability reporting standards, offers a valuable avenue for knowledge transfer into the project environment. Project practitioners can harness a wealth of existing knowledge and methodologies from these domains, leveraging the well-established principles of identifying and prioritising material issues. By integrating materiality assessment techniques into project management processes, practitioners can enhance their ability to identify and prioritise project-specific sustainability concerns and align them with organisational objectives, thus promoting more sustainable project outcomes. This knowledge transfer not only facilitates the incorporation of sustainability principles into project portfolio management but also fosters a more holistic and socially responsible approach to project execution, with the potential to yield positive impacts on both the project and the broader organisational sustainability agenda.
- **Alignment with organisational goals:** Materiality assessment has a broad reach covering not only an organisation's strategic objectives but also its sustainability objectives under one framework of assessment.
- **Enhanced Decision-making:** Materiality assessment supports data-driven decision-making. Organisations can allocate resources within portfolios more efficiently, prioritise sustainability initiatives, and ensure that the processes have a meaningful

impact. This, in turn, contributes to the organisation's long-term sustainability and competitive advantage.

- **Sustainable Strategy:** Helps build a sustainability strategy that looks beyond the project lifecycle to a more product-centric and product lifecycle approach.
- **Externalities and Risk Management:** Provide a better understanding of any negative externalities and an appropriate response from risk management.
- **Sustainable Deliverables:** Although the primary objective of the portfolio is not sustainability reporting, project deliverables and outcomes that have been materially assessed will be ready for sustainability reporting standards and regulatory scrutiny.
- **Creating Value:** Material assessment of projects will help create long-term net positive value for the portfolio, the organisation, markets and society.
- **Transparency and Stakeholder Management:** Effective communication with stakeholders is fundamental to sustainable portfolio management. Organisations conducting materiality assessments gain insights into what matters most to their stakeholders. Consequently, they can tailor their communication strategies to address these key concerns, thereby enhancing engagement, transparency, and trust.
- **Trade-offs and conflicts:** Sustainability often involves trade-offs and conflicts between strategic, economic, environmental, and social goals. Insights from materiality assessments will provide clarity to considerations associated with these trade-offs.
- **Cultural and Contextual Variations:** Sustainability practices and philosophies can vary significantly across cultures and regions. Materiality assessment can influence sustainability approaches and could add depth to the analysis.

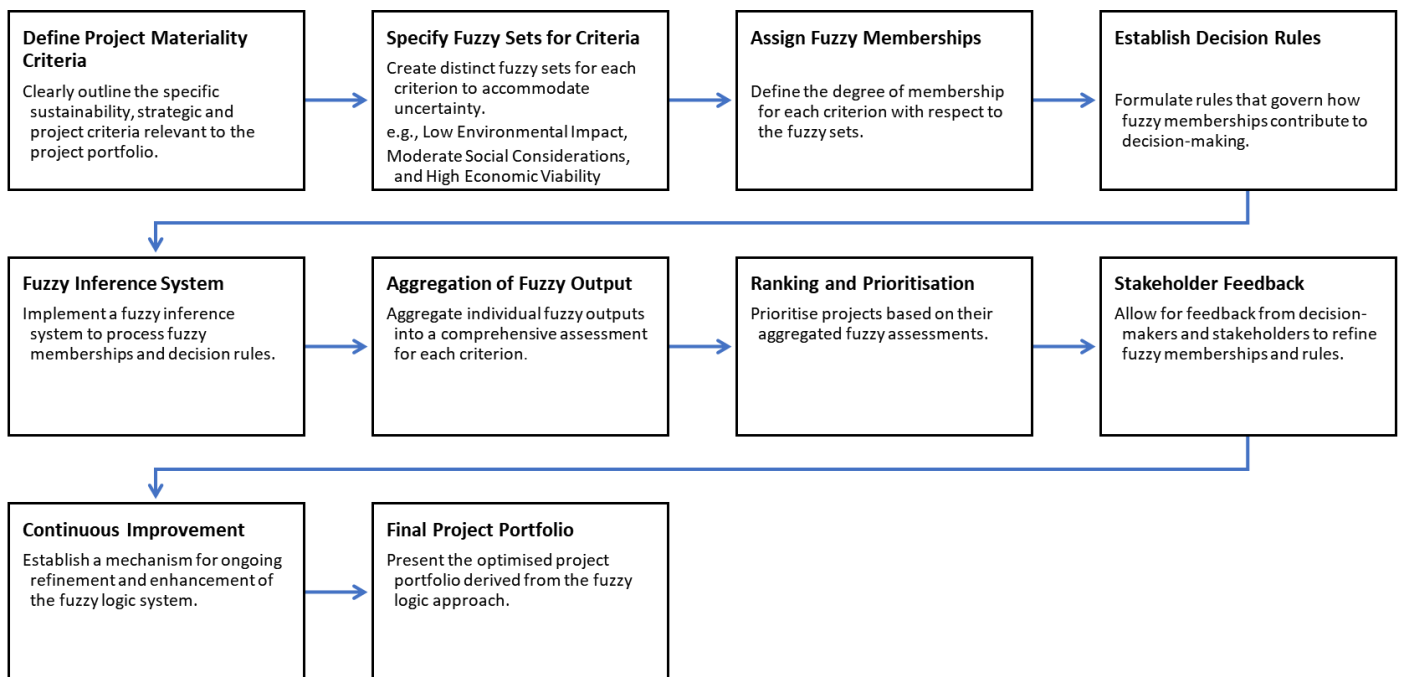
### **Step 3: Applying Analytics in SAPoM**

Project failures often stem from human bias, unrealistic goals, changing expectations, unclear requirements, lack of executive support, cost overruns, and schedule delays, among other factors (Peddada and Sharma, 2020). Data-driven analytics or Business Intelligence (BI) can introduce objectivity into decision-making processes (Marques, Gourc and Luras, 2011; Aldea *et al.*, 2019).

The absence of data insights in project environments can lead to poor decision-making and project failures (Sharda, 2018). Data-based risk management, driven by statistical probabilities, can be challenging to estimate but is crucial for successful project outcomes. As Niederman (2021) highlighted, analytics can revolutionise project management by providing incremental

and disruptive advancements. Sharda (2018) emphasises the importance of data-based risk management, allowing for quick and economic scenario building and impact assessment (Gachie, 2019; Barghi and Shadrokh Sikari, 2020; Hartwig and Mathews, 2020; Peddada and Sharma, 2020).

Sustainability, especially the social elements, often subjective, should be assessed as a risk within SAPoM. Analytical techniques like Fuzzy logic (Dursun, Goker and Mutlu, 2022) can translate qualitative sustainability data into quantitative formats, enabling measurable data, empirical evidence, and objective assessments alongside other data (Papadopoulos and Balta, 2022). Figure 5 (*The SAPoM Analytics Decision Engine using Fuzzy Logic*) depicts the decision process using the criteria for project materiality i.e., the strategic criteria based on an organisation's objectives and sustainability-related criteria derived from GRI (Global Reporting Initiative) guidelines to include environmental, social and economic criteria.



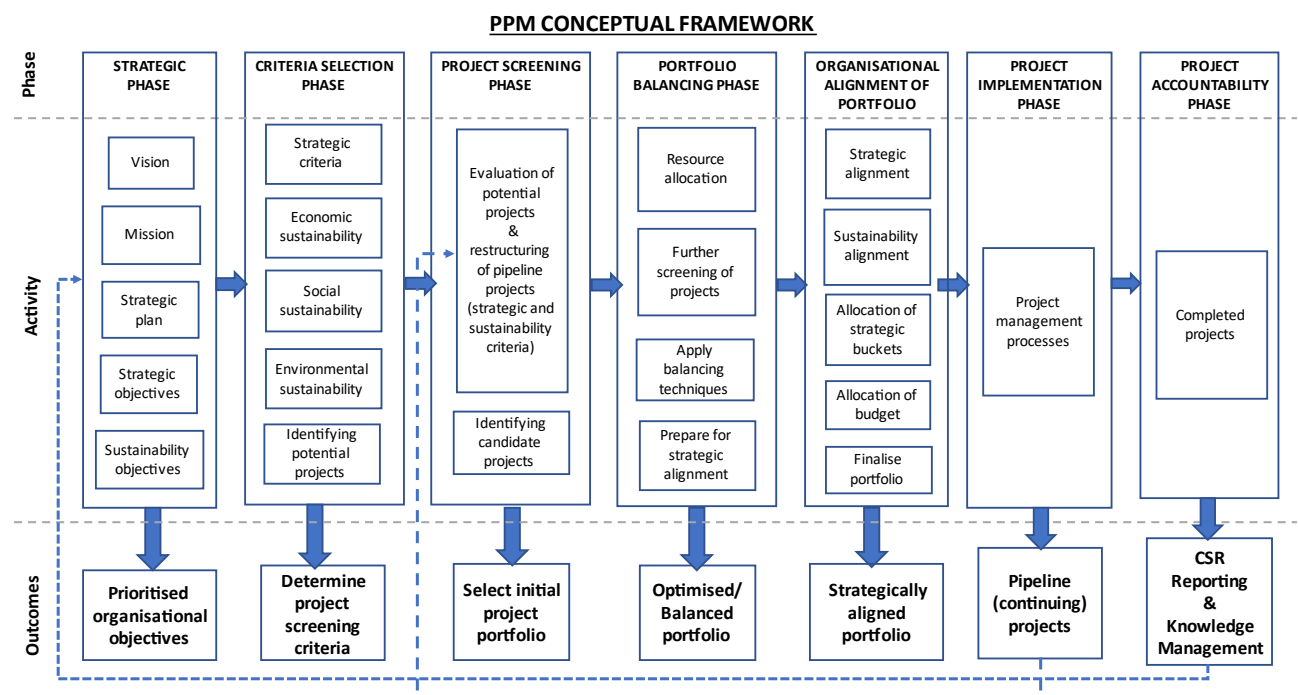
**Figure 5. The SAPoM Analytics Decision Engine flowchart applying Fuzzy Logic**

Applying a mathematical approach like Fuzzy Logic can assist with approximate reasoning and decision-making under uncertainty. This allows values to range between true and false rather than adhering to strict binary logic. Such a method can be hugely beneficial when considering the social criteria of sustainability which can have unclear or 'Fuzzy' boundaries. Analytics

integrated into project management, as highlighted by Nayebi et al., (2015), encompass domains, data access, validation, and result reuse. The three key types of analytics - descriptive, predictive, and prescriptive - enable data-driven decision-making and forecasting in project management. These analytics tools can uncover hidden risks and gaps in project assumptions, ultimately improving project success (Hartwig and Mathews, 2020; Luk *et al.*, 2021). Other data analytics tools like Microsoft Power BI and IBM-SPSS can aid practitioners in analysing, describing, and predicting project outcomes, enhancing project management practices.

## Project Portfolio Management (PPM) Framework

Several frameworks for project portfolio management (PPM) are currently in use. In the context of this research paper, provides a high-level overview of the key stages in the process, which are briefly outlined. The SAPoM conceptual framework can be segmented into the following phases, as illustrated in Figure 3, and a more comprehensive structure is presented in Figure 4:



**Figure 6. A Typical Project Portfolio Management Framework with Sustainability integrated in different phases (Mohammad and Pan, 2021)**



- **Strategic:** In this phase, senior executives define the organisation's vision, mission, and approved strategic plan, which must incorporate both strategic and sustainability objectives. The goal is to prioritise organisational objectives effectively.
- **Criteria selection:** This stage aims to create criteria for screening candidate projects, involving key stakeholders who assess criteria aligned with organisational strategic and sustainability goals established in the prior phase. It is recommended that sustainability criteria can be derived from the sustainability reporting standards e.g., GRI and SASB.
- **Project screening:** To screen projects, each strategic and sustainability criterion must have a measurable or quantifiable basis. The result of this phase is the selection of an initial project portfolio using the combined criteria. Candidate projects include potential projects, as well as previously postponed ones that may require restructuring or modifications and are brought back for screening in this phase.
- **Portfolio balancing:** The initial portfolio must undergo an evaluation to ensure it maximises benefits for the organisation, considering resource constraints (Bible and Bivins, 2011). This phase also addresses situations where an organisation has a mix of good projects alongside many smaller or less relevant ones, or large projects with low risk that fail to drive growth and high returns for the organisation.
- **Strategic alignment:** This process focuses on the organisation's rationale for selecting particular projects and assessing their alignment with broader objectives. This ensures that selected projects do not unnecessarily strain organisational resources and have a meaningful association with the overall objectives (Moustafaev, 2017b).
- **Project implementation:** This phase is related purely to project management processes and methodologies. A typical format is depicted in Figure 3 below.
- **Project accountability and audit:** Completed projects will move to the next phase and undergo assessment in the accountability phase to learn lessons and reporting. Projects still in the pipeline will be re-evaluated to gauge their overall progress and alignment

with organisational objectives. These projects will go through the project screening phase within the framework of the PPM process outlined in this conceptual framework.

#### **4.3. Engaging Stakeholders with SAPoM**

The perception and interaction of different stakeholders with the SAPoM (Sustainability Augmented Portfolio Management) framework can vary based on their roles, interests, and priorities. An overview of how different stakeholders might engage with SAPoM is as follows:

- **Project Managers and Project Teams:** Project managers may view SAPoM as a comprehensive tool that helps them integrate sustainability into project planning and execution. They will likely engage with the framework to align project goals with sustainability objectives, ensuring their projects contribute to broader organisational sustainability. SAPoM is designed to be flexible to integrate into existing practices and processes with the least disruption and change can be made incrementally.
- **Business leaders, Decision-Makers and Sponsors:** Decision-makers may see SAPoM as a strategic approach for aligning project portfolios with overall business strategies and sustainability goals. They might use SAPoM for decision-making, resource allocation, and ensuring that the organisation's portfolio reflects a commitment to sustainability. As mandatory regulation on sustainability reporting is enforced business leaders will be able to report with confidence the processes they have adopted to ensure sustainable deliverables through projects.
- **Sustainability Officers:** Sustainability officers may appreciate SAPoM as a tool that facilitates the systematic integration of sustainability principles into project management processes. They could actively contribute to defining sustainability criteria, ensuring that projects align with environmental, social, and economic sustainability goals.
- **Financial Analysts:** Financial analysts may see SAPoM as a way to evaluate the financial viability of projects within the context of sustainability. They might engage with the framework to assess the economic impact of projects and ensure alignment with financial objectives.
- **Stakeholders and Community Representatives:** External stakeholders may view SAPoM as a transparency tool, providing insights into how projects contribute to sustainability and community well-being. They may engage with the framework to

access information on the social impact of projects and hold the organisation accountable for sustainable practices.

- **Data Analysts:** Data analysts could see SAPoM as an opportunity to leverage analytics for better decision support. They might work on implementing and refining analytics components of the framework, ensuring that data-driven insights contribute to effective decision-making.
- **Regulators and Compliance Officers:** SAPoM can highlight any greenwashing practices within project management from the initiation of projects. Regulators may appreciate SAPoM as a tool that supports organisations in meeting sustainability reporting requirements. They may engage with the framework to ensure that projects adhere to regulatory standards and contribute to overall compliance.

Understanding and addressing the diverse needs and perspectives of these stakeholders is crucial for the successful implementation and acceptance of the SAPoM framework. Regular communication, training, and feedback mechanisms can enhance stakeholder engagement and collaboration.

## 5.0 Discussing Research Impacts and Conclusion

Sustainability will inevitably be a permanent feature in the project environment for the foreseeable future. Project management cannot continue in its current format and must embrace the principles of sustainability as an integral part of the strategies, practices, processes, and methodologies. This research delivers a platform for project professionals to accept the challenge of integrating sustainability within their processes and applying sustainability-led, data-driven decision-making for greater objectivity in their work.

The evaluation of project materiality within the project environment (PE) goes beyond merely ensuring alignment with an organisation's overarching objectives and strategies. It extends to embracing the tenets of sustainability, equipping the organisation to proactively address the impending sustainability reporting regulations introduced by governmental and international entities. The incorporation of analytics into project materiality assessments holds the potential to transform qualitative information derived from environmental and social sustainability dimensions into quantitative data, thus providing a standardised framework for practitioners to

comprehensively evaluate all materiality aspects. Analytics will improve forecasting of project outcomes and weed out unsustainable projects to avoid ‘greenwashing’, ‘conspicuous consumption’ and other unsustainable practices.

This research aims to establish a connection between sustainability and projects, facilitating their integration through a data-driven, impartial decision-making mechanism. The teams engaged in this process will enhance their understanding of sustainability principles within the project context and ready themselves to apply these principles across various aspects of their respective roles, encompassing routine business operations or business-as-usual (BAU) processes. The proposed research will have the potential to be developed as a Software as a Service (SaaS) for the benefit of project practitioners and strategy builders alike.

As sustainability disclosures become obligatory due to regulations, organisations can prepare themselves for impending changes. A mindset of 'sustainability in, sustainability out' should be developed into practitioners' approach to organisational operations. While it is undeniable that organisations will need to engage in post-activity sustainability reporting, the emphasis lies in instilling sustainability into processes and functions right from their inception. This proactive approach not only ensures that sustainability is addressed in a timely and comprehensive manner but also paves the way for a more holistic and sustainable organisational culture.

The research will serve as a catalyst for innovation and exploration within the field of sustainable project management, providing fresh opportunities for academic and research endeavours, and practical application. It aims to unlock uncharted pathways that can benefit scholars, researchers, and industry practitioners. This research is poised to expand the horizons of knowledge and practice in sustainable project management.

Consumer confidence and trust in organisations delivering sustainable products and services will be enhanced. As sustainability ‘labelling’ becomes part of government-led regulatory requirements, products and services delivered through projects can be labelled as ‘Sustainable projects’ ensuring that organisations do not conflict with anti-greenwashing regulations.

It would also be prudent to highlight some of the challenges and limitations in implementing SAPoM (Sustainability Augmented Portfolio Management) in the real world:

- The need for organisations to adapt their existing project management processes to integrate sustainability seamlessly. This involves a cultural shift and may encounter resistance from established practices.

- Due to the inherent complexity and context-sensitive nature of sustainability, stakeholder opinions, interpretations and value perceptions, subjectivity may not be eliminated from the decision-making process.
- The implementation of SAPoM requires a robust data infrastructure and analytics capabilities, which may be lacking in some organisations.
- Obtaining accurate and comprehensive sustainability data for project materiality assessment could be another hurdle, especially if such data is not readily available or if organisations have not traditionally focused on sustainability reporting.
- The successful implementation of SAPoM also depends on the willingness of stakeholders to embrace sustainability as a core aspect of project decision-making.
- The effectiveness of SAPoM may vary across different industries and project types, requiring tailored approaches for diverse contexts.
- Addressing these challenges necessitates a strategic and phased approach to implementation, considering both organisational and project-specific factors.

In conclusion, the incorporation of sustainability principles into project management strategies and processes is a vital step in navigating the ever-evolving landscape of sustainable project management. SAPoM, with its data-driven approach, serves as a valuable platform, promoting objectivity in project environments while aligning them with organisational objectives and anticipated disclosure regulations. This paradigm shift towards sustainability-oriented practices not only encourages organisations to embrace sustainability reporting but also positions them as frontrunners in their respective markets, gaining a competitive edge.

Moreover, the research that bridges sustainability and projects through data-driven processes stimulates innovation and opens doors for scholarly exploration in sustainable project management. This, in turn, boosts consumer confidence and trust in organisations that offer sustainable products and services. With government-mandated sustainability labelling becoming more prevalent, projects can play a pivotal role in ensuring compliance with anti-greenwashing regulations, further enhancing the competitive position of organisations in their markets. The acceptance of sustainability-driven practices leads to a wider adoption of sustainability disclosure, underscoring the essential role of sustainability in the future of project management. It not only positions organisations for success in a sustainability-conscious world but also reinforces the significance of transparency, responsibility, and sustainability in today's business environment.

## References

- Aldea, A. *et al.* (2019) 'Multi-Criteria and Model-Based Analysis for Project Selection: An Integration of Capability-Based Planning, Project Portfolio Management and Enterprise Architecture', *2019 IEEE 23rd International Enterprise Distributed Object Computing Workshop (EDOCW)* [Preprint]. Available at: <https://doi.org/10.1109/EDOCW.2019.00032>.
- Al-Marri, M. and Pinnington, A.H. (2022) 'Managing Sustainability Projects for Social Impact from a Corporate Social Responsibility Perspective', *Sustainability (Switzerland)*, 14(11). Available at: <https://doi.org/10.3390/su14116418>.
- APM Portfolio Management SIG (2019) *Portfolio Management - A Practical Guide*. 1st edn. Princes Risborough: APM.
- Barghi, B. and Shadrokh Sikari, S. (2020) 'Qualitative and quantitative project risk assessment using a hybrid PMBOK model developed under uncertainty conditions', *Heliyon*, 6(1). Available at: <https://doi.org/10.1016/j.heliyon.2019.e03097>.
- Bible, M.J. and Bivins, S.S. (2011) *Mastering Project Portfolio Management - A Systems Approach to Achieving Strategic Objectives*. 1st edn. Fort Lauderdale, FL: J. Ross Publishing.
- Brundtland, G.H. (1987) *Report of the World Commission on Environment and Development: Our Common Future*, United Nations general Assembly Document A42/427. Oslo.
- Cadenasso, M.L. and Pickett, S.T.A. (2018) 'Situating sustainability from an ecological science perspective', in J. Sze (ed.) *Sustainability: Approaches to Environmental Justice and Social Power*. New York: New York University Press, pp. 29–52.
- Calabrese, A. *et al.* (2019) 'Materiality analysis in sustainability reporting: A tool for directing corporate sustainability towards emerging economic, environmental and social opportunities', *Technological and Economic Development of Economy*, 25(5), pp. 1016–1038. Available at: <https://doi.org/10.3846/tede.2019.10550>.
- Carbon Disclosure Project (2023) *Carbon Disclosure Project*, *cdp.net*. Available at: <https://www.cdp.net/en/info/about-us> (Accessed: 29 January 2023).
- Clegg, S. *et al.* (2018) 'Practices, projects and portfolios: Current research trends and new directions', *International Journal of Project Management*, 36(5), pp. 762–772. Available at: <https://doi.org/10.1016/j.ijproman.2018.03.008>.
- Cooper, R., Edgett, S. and Kleinschmidt, E. (2001) 'Portfolio Management for New Product Development: Results of an Industry Practices Study', *R and D Management*, 31(4), pp. 361–380. Available at: <https://doi.org/10.1111/1467-9310.00225>.
- Courtneil, J. (2019) *GRI Standards for Sustainability Reporting: What They Are and Why They Matter*, *Process Street*. Available at: <https://www.process.st/gri-standards/> (Accessed: 12 May 2021).
- Doorasamy, M. (2017) 'Product Portfolio Management Best Practices for New Product Development: A Review of Models', *Foundations of Management*, 9, pp. 139–148. Available at: <https://doi.org/10.1515/fman-2017-0011>.

- Dumay, J., Guthrie, J. and Farneti, F. (2010) 'GRI sustainability reporting guidelines for public and third sector organizations: A critical review', *Public Management Review*, 12(4), pp. 531–548. Available at: <https://doi.org/10.1080/14719037.2010.496266>.
- Dursun, M., Goker, N. and Mutlu, H. (2022) 'Evaluation of Project Management Methodologies Success Factors Using Fuzzy Cognitive Map Method: Waterfall, Agile, And Lean Six Sigma Cases', *Original Research Paper International Journal of Intelligent Systems and Applications in Engineering IJISAE*, 10(1), pp. 35–43. Available at: <https://doi.org/10.1039/b000000x>.
- EFRAG (2023) 04/09/2023 - EFRAG-GRI JOINT STATEMENT OF INTEROPERABILITY, [efrag.org](https://www.efrag.org). Available at: <https://www.efrag.org/News/Public-444/EFrag-GRI-Joint-statement-of-interopability-> (Accessed: 16 September 2023).
- Elkington, J. (1997) *Cannibals with Forks: The Triple Bottom-line of 21st Century Business*. 1st edn. Oxford: Capstone Press.
- Elkington, J. (1999) 'Triple bottom-line reporting: Looking for balance', *Australian CPA*, 69(2), pp. 18–21.
- Elliott, B. and Elliott, J. (2022) 'Integrated reporting: sustainability, environmental and social', in *Financial Accounting and Reporting*. 20th edn. Harlow, UK: Pearson Education Limited.
- Espiner, S., Orchiston, C. and Higham, J. (2017) 'Resilience and sustainability: a complementary relationship? Towards a practical conceptual model for the sustainability–resilience nexus in tourism', *Journal of Sustainable Tourism*, 25(10), pp. 1385–1400. Available at: <https://doi.org/10.1080/09669582.2017.1281929>.
- European Commission (2023) EUR-Lex - Directive 32022L2464. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022L2464> (Accessed: 31 January 2023).
- Financial Conduct Authority (FCA) (2022) *Sustainability Disclosure Requirements (SDR) and investment labels*. London. Available at: [www.fca.org.uk/cp22-20-response-form](http://www.fca.org.uk/cp22-20-response-form).
- Gachie, W. (2019) 'Project sustainability management: risks, problems and perspective', *Problems and Perspectives in Management*, 17(1), pp. 313–325. Available at: [https://doi.org/10.21511/ppm.17\(1\).2019.27](https://doi.org/10.21511/ppm.17(1).2019.27).
- Ghannadpour, S.F. *et al.* (2021) 'Appraising the triple bottom line utility of sustainable project portfolio selection using a novel multi-criteria house of portfolio', *Environment, Development and Sustainability*, 23(3), pp. 3396–3437. Available at: <https://doi.org/10.1007/s10668-020-00724-y>.
- Global Reporting Initiative (2021) 'A Short introduction to the GRI Standards', *GRI Standards* [Preprint]. Amsterdam: Global Reporting Initiative. Available at: [www.globalreporting.org](http://www.globalreporting.org) (Accessed: 10 October 2023).
- Global Sustainability Standards Board (2020) 'Consolidated Set of GRI Sustainability Reporting Standards 2020'. Amsterdam: Global Sustainability Standards Board. Available at: <https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/>.

- Hartwig, S. and Mathews, S. (2020) 'Innovation Project Risk Analytics: A Preliminary Finding: Use risk analytics for new product development for high-risk innovation projects.', *Research Technology Management*, 63(3), pp. 19–23. Available at: <https://doi.org/10.1080/08956308.2020.1733901>.
- Høgevold, N.M. *et al.* (2015) 'A triple bottom line construct and reasons for implementing sustainable business practices in companies and their business networks', *Corporate Governance*, 15(4), pp. 427–443. Available at: <https://doi.org/10.1108/CG-11-2014-0134>.
- Hubbard, G. (2009) 'Measuring Organizational Performance: Beyond the Triple Bottom Line', *Business Strategy and the Environment*, 18, pp. 177–191. Available at: <https://doi.org/10.1002/bse.564>.
- Huemann, M. and Silvius, G. (2017) 'Projects to create the future: Managing projects meets sustainable development', *International Journal of Project Management*. Elsevier Ltd, pp. 1066–1070. Available at: <https://doi.org/10.1016/j.ijproman.2017.04.014>.
- International Accounting Standards Board (IASB) (2018) *Conceptual Framework for Financial Reporting*.
- Kilbert, C.J. *et al.* (2012) *Working toward sustainability : ethical decision making in a technological world*. Wiley.
- Kuzemko, C. and Britton, J. (2020) 'Policy, politics and materiality across scales: A framework for understanding local government sustainable energy capacity applied in England', *Energy Research and Social Science*, 62. Available at: <https://doi.org/10.1016/j.erss.2019.101367>.
- Lister, G. (2015) *Mastering Project, Program and Portfolio Management: Models for Structuring and Executing the Project Hierarchy*. 2nd edn. Upper Saddle River, NJ: Pearson Education Limited.
- Luk, J.W. *et al.* (2021) 'From everyday life predictions to suicide prevention: Clinical and ethical considerations in suicide predictive analytic tools', *Journal of Clinical Psychology*, 78(2), pp. 137–148. Available at: <https://doi.org/10.1002/jclp.23202>.
- Marcelino-Sadaba, S., Felipe Gonz Alez-Jaen, L. and P Erez-Ezcurdia, A. (2015) 'Using project management as a way to sustainability. From a comprehensive review to a framework definition', *Journal of Cleaner Production*, 99, pp. 1–16. Available at: <https://doi.org/10.1016/j.jclepro.2015.03.020>.
- Marques, G., Gourc, D. and Lauras, M. (2011) 'Multi-criteria performance analysis for decision making in project management', *International Journal of Project Management*, 29(8), pp. 1057–1069. Available at: <https://doi.org/10.1016/j.ijproman.2010.10.002>.
- Martinsuo, M. and Geraldi, J. (2020) 'Management of project portfolios: Relationships of project portfolios with their contexts', *International Journal of Project Management*, 38(7), pp. 441–453. Available at: <https://doi.org/10.1016/j.ijproman.2020.02.002>.
- Martinsuo, M. and Lehtonen, P. (2007) 'Role of single-project management in achieving portfolio management efficiency', *International Journal of Project Management*, 25, pp. 56–65. Available at: <https://doi.org/10.1016/j.ijproman.2006.04.002>.



- Mohammad, J.A. and Pan, Y.-C. (2021) 'Sustainability, the Fourth Pillar of Project Portfolio Management - A Holistic Approach', *Journal of Modern Project Management*, 9(2). Available at: <https://doi.org/10.19255/JMPM02710>.
- Moustafaev, J. (2017a) 'Introduction to Project Portfolio Management', in *Project Portfolio Management in Theory and Practice*. 1st edn. Boca Raton, FL: CRC Press, pp. 3–19.
- Moustafaev, J. (2017b) 'The Three Pillars of Project Portfolio Management', in *Project Portfolio Management in Theory and Practice*. 1st edn. Boca Raton, FL: CRC Press, pp. 21–47.
- Nayebi, M. *et al.* (2015) 'Analytics for software project management - Where are we and where do we go?', in *30th IEEE/ACM International Conference on Automated Software Engineering Workshops, ASEW 2015*. Lincoln, NE: IEEE, pp. 18–21. Available at: <https://doi.org/10.1109/ASEW.2015.28>.
- Nüchter, V. *et al.* (2021) 'The concept of resilience in recent sustainability research', *Sustainability (Switzerland)*, 13(5), pp. 1–21. Available at: <https://doi.org/10.3390/su13052735>.
- Padin, C. *et al.* (2016) 'Validating a triple bottom line construct and reasons for implementing sustainable business practices in companies and their business networks', *Corporate Governance*, 16(5), pp. 849–865. Available at: <https://doi.org/10.1108/CG-12-2015-0163>.
- Papadopoulos, T. and Balta, M.E. (2022) 'Climate Change and big data analytics: Challenges and opportunities', *International Journal of Information Management*, 63. Available at: <https://doi.org/10.1016/j.ijinfomgt.2021.102448>.
- Peddada, K. and Sharma, T.K. (2020) 'Project Risk Management Using Analytical Hierarchy Process : Illustrative Case Study', *Abhigyan*, XXXVIII(1), pp. 40–50.
- Pensenstadler, B. and Femmer, H. (2013) 'A Generic Model for Sustainability with Process and Product-specific Instances', in *GIBSE 13*. Fukuoka.
- Per, G. (2019) *The many definitions of sustainability and sustainable development*, *Tiime.org*. Available at: <https://www.tiime.org/single-post/2019/10/17/the-many-definitions-of-sustainability-and-sustainable-development> (Accessed: 9 May 2023).
- Petit, Y. (2012) 'Project portfolios in dynamic environments: Organizing for uncertainty', *International Journal of Project Management*, 30, pp. 539–553. Available at: <https://doi.org/10.1016/j.ijproman.2011.11.007>.
- Project Management Institute (2021) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)-and The Standard for Project Management*. 7th edn. Newtown Square, Pennsylvania: Project Management Institute.
- Project-management.pm (2017) *Portfolio Governance Management | Project-Management.pm, project-management.pm*. Available at: <https://www.project-management.pm/portfolio-management/portfolio-governance-management/> (Accessed: 12 May 2021).
- Rifkin, S. (2019) 'Sustainability Materiality Matrices Explained', *NYU Stern* [Preprint]. New York, NY.

- Sardianou, E. *et al.* (2021) ‘A materiality analysis framework to assess sustainable development goals of banking sector through sustainability reports’, *Sustainable Production and Consumption*, 27, pp. 1775–1793. Available at: <https://doi.org/10.1016/j.spc.2021.04.020>.
- Sharda, R. (2018) *Business intelligence, analytics, and data science : a managerial perspective*. 4th Edition. Pearson.
- Silvius, G. (2017) ‘Sustainability as a new school of thought in project management’, *Journal of Cleaner Production*, 166, pp. 1479–1493. Available at: <https://doi.org/10.1016/j.jclepro.2017.08.121>.
- Silvius, G. and Marnewick, C. (2022) ‘Interlinking Sustainability in Organizational Strategy, Project Portfolio Management and Project Management A Conceptual Framework’, in *Procedia Computer Science*. Elsevier B.V., pp. 938–947. Available at: <https://doi.org/10.1016/j.procs.2021.12.095>.
- Sustainability Accounting Standards Board (2023) *About Us - SASB*, [sasb.org](https://www.sasb.org). Available at: <https://www.sasb.org/about/> (Accessed: 30 January 2023).
- Sze, J. (2018) *Sustainability: approaches to environmental justice and social power*. Edited by J. Sze. New York: New York University Press.
- Tarmuji, I., Maelah, R. and Tarmuji, N.H. (2016) ‘The Impact of Environmental, Social and Governance Practices (ESG) on Economic Performance: Evidence from ESG Score’, *International Journal of Trade, Economics and Finance*, 7(3), pp. 67–74. Available at: <https://doi.org/10.18178/ijtef.2016.7.3.501>.
- Task Force on Climate-related Financial Disclosures (TCFD) (2022) *Task Force on Climate-Related Financial Disclosures | TCFD*, [fsb-tcfd.org/](https://www.fsb-tcfd.org/). Available at: <https://www.fsb-tcfd.org/> (Accessed: 30 January 2023).
- To, C.K.M. and Chau, K.P. (2022) ‘Characterizing sustainability materiality: ESG materiality determination in technology venturing’, *Sustainable Technology and Entrepreneurship*, 1(3). Available at: <https://doi.org/10.1016/j.stae.2022.100024>.
- Tsalis, T.A. *et al.* (2020) ‘New challenges for corporate sustainability reporting: United Nations’ 2030 Agenda for sustainable development and the sustainable development goals’, *Corporate Social Responsibility and Environmental Management*, 27(4), pp. 1617–1629. Available at: <https://doi.org/10.1002/csr.1910>.
- Turan, F.K. *et al.* (2008) ‘Organizational Sustainability: A New Project Portfolio Management Approach that Integrates Financial and Non-Financial Performance Measures’, in *Industrial Engineering Research Conference*.
- United Nations (2001) *Indicators of Sustainable Development: Guidelines and methodologies*.
- United Nations (2015) *Transforming our world: the 2030 Agenda for Sustainable Development*.
- Wu, S.R., Shao, C. and Chen, J. (2018) ‘Approaches on the screening methods for materiality in sustainability reporting’, *Sustainability (Switzerland)*. MDPI. Available at: <https://doi.org/10.3390/su10093233>.