

Projects benefit realisation through sustainable innovation: drivers and challenges

Alessandro Paravano, Giorgio Locatelli and Paolo Trucco
Politecnico di Milano, Milan, Italy

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Abstract

Purpose – Projects are increasingly becoming the key means of benefits realisation through sustainable innovation. Yet, the literature has predominantly focused on the “sustainability of projects”, emphasising traditional project short-term success metrics like time, cost and quality. This narrow perspective falls short of explaining how organisations should leverage sustainable innovation to generate broader project benefits. Our research addresses this gap by taking the recent “sustainability by project” conceptualisation. We answer the questions: (RQ1) “How do projects realise benefits through sustainable innovation?” and (RQ2) What are the drivers and challenges for organisations developing these projects?”

Design/methodology/approach – The empirical context is the European Space Economy. We performed a single case study regarding the European Space Agency Business application program, which aims to foster sustainable innovation to realise the benefits to society. Following a grounded theory approach, we conducted and analysed 44 interviews with managers and triangulated them with secondary data.

Findings – We build a theoretical framework explaining how projects realise benefits through sustainable innovation. We found that the drivers for benefits realisation are (1) envisioning a common sustainable future and (2) opening to the project ecology. Challenges are (1) struggling to take off sustainable innovation and (2) having a short-sighted view of the future. We also identified the practices and conditions managers consider antecedents of the drivers and challenges.

Practical implications – Managers may implement the identified practices to activate key drivers and navigate challenges in achieving project benefits through sustainable innovation. Policymakers could utilise these insights to shape policies that foster a project ecology conducive to sustainable innovation and long-term benefit realisation.

Originality/value – Our paper contributes to reconciling sustainable innovation and project benefit realisation. We offer a new empirical-grounded perspective to pivot from the “sustainability of projects” toward the “sustainability by projects”, showing the drivers and challenges for project benefits realisation.

Keywords Project benefits, Value, Sustainability, Corporate social responsibility, Complex projects, Satellite

Paper type Research paper

1. Introduction

Addressing grand challenges, particularly those related to climate change and sustainability, is paramount and urgent in the contemporary global context (OECD, 2022). The consequences extend beyond environmental concerns, encompassing social, economic and geopolitical dimensions (Agrawal *et al.*, 2024). In response to recent challenges, the country leaders of UN COP 26 in 2021 committed to reducing greenhouse gas emissions by at least 55% by 2030 (European Commission, 2021). In the upcoming decade, \$32 trillion of investment in decarbonisation will be needed to start a net-zero path (UNCC, 2021). Projects leveraging sustainable innovation will be vital in achieving this goal (Mondal *et al.*, 2024; Shaukat *et al.*, 2022). Sustainable innovation is defined as the innovation that reconciles economic, social and

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The main topic of the call addressed: Drivers and challenges of sustainable innovations in projects.



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environmental goals (Cillo *et al.*, 2019; Oliveira-Dias *et al.*, 2022). Developing sustainable innovation implies upending established organisational values, structures, and practices to generate outcomes which realise economic, social and environmental benefits (Adams *et al.*, 2016; Calza *et al.*, 2023).

The urgency and relevance of leveraging sustainable innovation to realise project benefits underscore a paradigm shift in project conceptualisation (Locatelli *et al.*, 2023a). Traditionally, projects have been conceptualised as temporary endeavours to achieve a desired outcome within time and budget constraints (Gerald and Söderlund, 2018). Thus, projects have been seen as non-agential entities and investigated as the primary level of analysis (Ika and Pinto, 2022; Turner and Zolin, 2012). Recently, scholars have argued that projects should be conceptualised in relation to their surrounding context (Cıdık *et al.*, 2024; Pinto *et al.*, 2022). Thus recognising projects as agents that change the context in which they are developed (Brookes *et al.*, 2017) by impacting the economic, societal and environmental present and long-term future (Comi and Whyte, 2018; Whyte and Mottee, 2022). It implies broadening the level of analysis to the project ecology (Paravano *et al.*, 2024a), that is, the relational space between projects and their context (Grabher, 2002; Winch, 2014).

This shift in project conceptualisation has had a transformative impact on two main streams of project literature: project sustainability and project success. On the one hand, the main body of knowledge regarding project sustainability (cfr. Khalifeh *et al.*, 2020, Malik *et al.*, 2023, Zhang *et al.*, 2024) focuses on understanding the adoption of sustainable practices in project design and development. The focus is on ensuring the “sustainability of projects,” emphasising the project’s ability to continue delivering benefits during its lifecycle without exhausting resources or causing detrimental impacts (Cillo *et al.*, 2019) and, consequently, the adoption of sustainable practices in project management (Mansell *et al.*, 2020). Recently, the debate has moved toward understanding “sustainability by project” (Silvius *et al.*, 2017), where projects are viewed as catalysts for broader sustainable development. This perspective recognises that projects can drive significant environmental, social and economic benefits beyond their immediate outcomes (Eskerod and Ang, 2017; Zwika and Huemann, 2023). On the other hand, scholars claim to depart from the deterministic iron triangle project management success metrics (Ika and Pinto, 2022), broadening the project scope from outcomes to benefits realisation (Pinto *et al.*, 2022; Turner and Zolin, 2012). As clarified by Keeyes and Huemann (2017), “Benefits are the source of value creation (Lusch *et al.*, 2008) for which the amount of value created depends on the subjective perceptions of actors or stakeholders—individual, organisation or society (Lepak *et al.*, 2007)” (p. 1197). For example, a farm company benefits from adopting a satellite-based service to monitor water consumption and crop production (output of the satellite project), realising benefits for the company (reducing environmental impact by efficiently managing water consumption).

Despite the recent conceptualisation of “sustainability by projects” and the growing call to investigate project benefits realisation (Aubry *et al.*, 2021; Friedrich, 2023), there is a confused body of knowledge, lacking empirical support (Sandberg and Alvesson, 2011), discussing how organisations should leverage sustainable innovation to generate broader project benefits. Indeed, although inherently related, project sustainability and project success literature streams have progressed along independent parallel paths. We argue that reconciling project sustainability and project benefits is essential to ensure that projects achieve their objectives for the project stakeholders and deliver long-term economic, social and environmental benefits to society. To this end, our paper answers the questions:

RQ1. How do projects realise benefits through sustainable innovation?

RQ2. What are the drivers and challenges for organisations developing these projects?

We investigated a single case study regarding the European Space Agency Business application program, aiming to foster the development of satellite-based projects based on sustainable innovation to realise societal benefits. Satellite-based projects consist of developing products

and services that integrate satellite and digital technologies to collect, transmit and analyse data regarding land, water and the atmosphere (Paravano *et al.*, 2023). For example, satellites like Copernicus monitor deforestation, helping to conserve forests and reduce carbon emissions, measure groundwater changes and aid sustainable water management (Copernicus, 2023). Precision farming benefits from satellite data on soil moisture and crop health, optimising irrigation and fertilisation (EUSPA, 2022).

Our paper has three principal theoretical contributions. First, we reconcile project sustainability and benefits realisation literature by developing a theoretical framework explaining how projects realise benefits through sustainable innovation and identifying the drivers and challenges to make it happen. Second, we extend the project sustainability debate by empirically showing that “sustainability by projects” has the explanatory power to reconcile sustainable innovation with project benefits realisation. Third, we extend the sustainable innovation literature by showing that the relational dimension between the organisation and its context is fundamental in realising benefits in the context of temporary organisations. Regarding practical implications, managers may implement the identified practices to activate key drivers and navigate challenges in achieving project benefits through sustainable innovation. Policy-makers could utilise these insights to shape policies that foster a project ecology conducive to sustainable innovation and long-term benefit realisation.

The paper is structured as follows: after the Introduction, we discuss in the Background the sustainable innovation, project benefits, and project sustainability literature streams. Then, we present the empirical case, data collection and analysis in the Methodology. In the following section, we present our findings, answering our research questions and the discussion highlighting the main contribution to theory and practice. Concluding with recommendations for future research and limitations.

2. Background

2.1 Project benefits realisation

Project benefit management is a research area that emphasises the strategic roles of projects in organisations to create a sustainable future (Zwikaël, 2016). Benefits are desirable outcomes (i.e. a measurable end-effect generated by a project output) generated by projects for the actors who can receive them (Zwikaël and Huemann, 2023). While projects have traditionally been viewed as tools to deliver specific outputs against a predefined scope, they are now increasingly conceptualised as vehicles for benefit realisation for society and the environment (Bahadorestani *et al.*, 2020; Martinsuo *et al.*, 2019a; Vuorinen and Martinsuo, 2019). Notably, shifting the attention from output delivery to benefit realisation (Laursen and Svejvig, 2016) invites taking into consideration the subjectivity and multidimensionality of benefits (Calza *et al.*, 2023; Green and Sergeeva, 2019), including long-term societal benefits for those not actively involved in the project development (Laursen, 2018; Paravano *et al.*, 2024a). This perspective emphasises that the benefits realised by a project should be seen not just as an output of the project but as an input to achieve sustainable development for the context in which they are developed (Mondal *et al.*, 2024; Svejvig and Schlichter, 2020). In other words, project benefits can only be understood in light of the project ecology (Cıdık *et al.*, 2024; Hedborg and Gustavsson Karrbom, 2020). Despite this recent conceptualisation, developing projects that foster sustainable innovation and generate benefits for multiple actors is challenging (Pinto *et al.*, 2022).

Project benefits have been examined from both outcome-based (Eweje *et al.*, 2012; Lipke *et al.*, 2009; Zerjav *et al.*, 2021) and system lifecycle-based perspectives (Artto *et al.*, 2016; Martinsuo *et al.*, 2019b). From an outcome-based perspective, a project realises benefits only for its stakeholders by achieving the desired outcomes defined during the project front-end (Brones *et al.*, 2020). The desired outcomes focus on the economic value for individual actors and short-term project success criteria, such as adhering to schedule, budget, and scope. The system lifecycle-based perspective considers the project benefits realised during and after

project completion for the project ecology (Artto *et al.*, 2016; Friedrich, 2023), specifically in the operations phase. This perspective extends beyond economic benefits for stakeholders, including tangible and intangible benefits for various actors fostering sustainable innovation (Malik *et al.*, 2023). Indeed, projects produce outputs (e.g. the GPS satellite) that can sustain operations and generate additional value-creating activities even decades after the project phase ends (Locatelli *et al.*, 2023b) (e.g. creating new businesses and improving people mobility). Yet, broadening the level of analysis toward the context in which projects are developed implies that the specificity, attainability, and comprehensiveness of benefits may have blurred boundaries, depending on the actors considered (Zwikaël and Huemann, 2023), and it is therefore challenging. Practically, this implies the imperative of involving actors to develop sustainable innovation and realise project benefits (Whyte and Mottee, 2022). Conceptually, as deepened in the following section, it is necessary to conceive projects as agents that enable sustainable innovation, realising long-term benefits for businesses, society and the environment.

2.2 From “sustainability of projects” to “sustainability by project” conceptualisations

The ontology of projects is undergoing a transformative journey. Initially viewed as tools or social and technological endeavours for output delivery (Zerjav *et al.*, 2021) whose success was measured according to the time, cost, and quality parameters (Locatelli *et al.*, 2023b), the perspective evolved to recognise projects as agents of change (Brookes *et al.*, 2017) and vehicles of benefits realisation (Zwikaël, 2024), shaping the present and realising benefits for business, society and the environment (Locatelli *et al.*, 2023a).

The scientific community is discussing the role of projects for sustainability. On the one hand, the majority of scholars claim the relevance of investigating the “sustainability of projects” and how to implement sustainable practices and innovation in project management (Khalifeh *et al.*, 2020; Klaus-Rosińska and Iwko, 2023; Mavi and Standing, 2018; Shaukat *et al.*, 2022). On the other hand, recently, scholars suggested broadening the perspective, including the transformative capacity of projects (Huemann and Silvius, 2017), suggesting investigating the “sustainability by projects” and how projects enable sustainable innovation and could generate benefits for business, society and the environment (Goel *et al.*, 2020; Kafetzopoulos, 2023; Malik *et al.*, 2023; Silvius and Schipper, 2014). Whyte and Mottee (2022) claim to move from the deterministic view of project social and technological undertakings toward the interventions in the social and natural environment (Whyte and Mottee, 2022). Projects should not be viewed as isolated entities (Grabher, 2004; Paravano *et al.*, 2024a), necessitating consideration of their context, being future-oriented to ensure long-term benefits (Ika and Pinto, 2022) and maintaining a strong connection with sustainable innovation (Kafetzopoulos, 2023).

While the first perspective is more than appropriate in fostering project sustainability, it lacks in engaging in debates regarding project benefits realisation (Aubry *et al.*, 2021; Fu and Gil, 2023; Zerjav *et al.*, 2021) claiming that the success of a project should embrace a broader perspective, including the impact on society and the benefits of the project outputs even after the project’s completion (Locatelli *et al.*, 2023b; Pinto *et al.*, 2022), which is fundamental to explain and justify project development to tackle long-term goals, such as tackling grand challenges like climate change (Ika and Munro, 2022). The “sustainability by projects” concept allows for considering two fundamental aspects that the “sustainability of projects” conceptualisation is limited in explaining.

First, projects depend on history and its embeddedness in an organisational context (Agostini *et al.*, 2023; Turner and Zolin, 2012). Consequently, rather than viewing projects as isolated and closed systems, they should be conceived as contextually embedded open systems characterised by temporal and spatial openness (Ika and Munro, 2022). This discourse has been recently extended by the project ecologies literature (Grabher, 2002; Hedborg and Gustavsson Karrbom, 2020), according to which projects and project benefits (which are

subjectively perceived by different actors) can only be conceived in their mutual relationships (Zwikaël and Huemann, 2023). Benefits realisation is achieved when the needs of the individuals, organisations and institutions related to the project are met by the project output (Paravano *et al.*, 2024a). Second, projects have present and future connotations. By intervening in the physical world, they actively intervene and produce significant impacts, often with lasting effects (Comi and Whyte, 2018). Scholars posit a pressing need for fundamentally innovative approaches to conceptualising projects (Pinto *et al.*, 2022), framing them as deliberate interventions into nature and concurrently exploring novel methodologies for sustainable innovation (Comi and Whyte, 2018). This paradigm shift is a notion that has already previously been exposed in project studies. Shifting the perspective to prioritise the project connection with nature and considering the experiences of future generations (Sabini *et al.*, 2019), is challenging because of the substantial uncertainty and dynamicity of the context in which projects are developed (Daniel and Daniel, 2018) and in which organisations operate (Dattée *et al.*, 2018). While early perspectives envisioned the future as subject to scientific planning (Aubry *et al.*, 2021), recent sociological and organisational studies have embraced non-rationalistic approaches that acknowledge the inherent uncertainty of futures (Agrawal *et al.*, 2024; Whyte and Mottee, 2022). Recognising that projects inherently involve uncertainty and ignorance about the future, directs attention to a tradition emphasising the limitations in planning and the significance of side effects (Love *et al.*, 2024).

2.3 Sustainable innovation

Sustainable innovation, is defined as the innovation that reconciles economic, social and environmental goals (Cillo *et al.*, 2019; Oliveira-Dias *et al.*, 2022), has emerged as a crucial research area in both general and project management, evolving in a trajectory similar to fields like project benefits realisation and project sustainability.

Sustainable innovation management has traditionally focused on internal managerial practices and performance evaluation. The internal management perspective emphasises how organisations align their processes and structures to foster sustainable innovation. Building on resource-based theory and dynamic capabilities (Oliveira-Dias *et al.*, 2022), this view posits that an organisation's internal resources and competencies, such as knowledge management, are essential for adapting to sustainable practices (Agrawal *et al.*, 2024). Recent studies suggest that sustainable innovation's success depends on these internal mechanisms, enabling firms to respond effectively to environmental and market changes (Zameer *et al.*, 2024). However, while the internal focus has facilitated an understanding of operational efficiency, it has limitations. Primarily, it does not account for organisations' systemic interdependencies with the context, which are often critical for addressing broader sustainability challenges (della Corte *et al.*, 2024). By focusing primarily on internal dynamics, these studies risk overlooking innovation's relational and networked nature (Calza *et al.*, 2023). Similarly to the project success debate, a recent body of sustainable innovation literature seeks to measure organisations' economic, environmental and social impacts and activities (Khanchel *et al.*, 2023). However, establishing consistent metrics for intangible benefits, such as environmental and social impact, remains challenging due to a lack of standardised measures that account for sustainability's long-term implications across diverse stakeholders (Mansell *et al.*, 2020).

Challenges to benefits realisations and sustainable innovation depend on sustainable innovation's novelty and radical transformative nature (Jain *et al.*, 2023; Markard *et al.*, 2012). For this reason, scholars have developed theories and tools to overcome it over the decades. In particular, sustainable innovation literature agrees on developing innovation within "protected" niches to promote their development and acceptance before competing in broader markets (Kemp *et al.*, 1998; Raven *et al.*, 2016). This process involves creating experimental spaces where innovations can evolve free from the pressures of mainstream regimes, allowing for the co-evolution of technological, social and organisational dimensions (Barbier *et al.*, 2024; Turnheim and Geels, 2019). It is nevertheless worth mentioning that even

if recent studies emphasise the importance of connecting these niche developments with broader organisational structures (Goel *et al.*, 2020; Seifert *et al.*, 2023), this approach tends to have an inter-organisational approach rather than an intra-organisational approach (Agrawal *et al.*, 2024; Borrero and Yousafzai, 2024).

Recently, there has been an emerging consensus that sustainable innovation also requires an external relational perspective (Kafetzopoulos, 2023), which involves organisations' interaction with their broader socio-economic and environmental context (Seuring and Gold, 2013). Scholars have underscored the importance of relational capital and intangible assets in fostering innovation through collaborations, stakeholder engagement and partnerships (Cillo *et al.*, 2019). Indeed, developing sustainable innovation implies upending established organisational values, structures and practices to generate outcomes which realise economic, social and environmental benefits (Adams *et al.*, 2016; Calza *et al.*, 2023), which can be fostered through the engagement of the organisational context. The growing interest in this perspective highlights the significance of sustainable innovation as a networked endeavour, wherein firms increasingly rely on their context to meet sustainability demands from society (Mondal *et al.*, 2024).

This evolution resembles the one in project management, as projects have a strong relationship with sustainable innovation (Sabini *et al.*, 2019). Examples of projects for sustainable innovation include the development of renewable energy infrastructure, enhancing energy efficiency, and fostering community well-being. The relationship with sustainable innovation represents an urgent dilemma for project management. Projects emerge as pivotal tools in fostering more sustainable business practices (Borrero and Yousafzai, 2024; Khanchel *et al.*, 2023), and the connection between sustainability and project management has been prominently acknowledged. However, the iron triangle remains imperative (Silvius *et al.*, 2017), while sustainability considerations are predominantly relegated to the bottom of project managers' priorities (Sabini and Alderman, 2021). Over time, there has been a growing consensus among scholars to broaden the conventional emphasis on project benefits (Ika and Munro, 2022), recognising the significance of involving a broader spectrum of actors who belong to the project ecology. The social license for a business to operate is heavily contingent on its efforts in social and environmental sustainability (Sabini and Alderman, 2021).

3. Methodology

We conducted exploratory research following a grounded theory approach (Strauss and Corbin, 1994). Indeed, as discussed in the Background, the existing theoretical constructs are limited in explaining how projects realise benefits through sustainable innovation. They have been developed focusing mainly on permanent organisations (e.g. companies) (Cillo *et al.*, 2019) rather than temporary organisations (e.g. projects), which have entirely different objectives and are characterised by different, especially in the long term when discussing benefits (Zwikaël, 2024). Moreover, adopting a grounded theory approach is particularly valuable to handling complexity by iteratively refining concepts to capture deeper underlying structures (Corbin and Strauss, 1990), in our case, in understanding who generates benefits and for whom through sustainable innovation. Additionally, the grounded theory is essential for grasping *processual dynamics* (Khan, 2014), which are fundamental to identifying patterns of change and interaction (e.g. drivers and challenges). Importantly, the grounded theory is built from *data* (Strauss and Corbin, 1994), addressing a significant gap in existing research by ensuring that the resulting insights are grounded in empirical evidence rather than preconceived notions.

We performed an exploratory single-case study (Martinsuo and Huemann, 2021; Yin, 2011) of the ESA Business Application Programme (ESA BASS). As further explained in Section 3.1, the ESA BASS is a paradigmatic case (Flyvbjerg, 2006) for studying how projects realise benefits through sustainable innovation. ESA BASS is a programme developed by the European Space Agency to generate benefits for the environment and society by promoting

projects that must leverage sustainable innovation (e.g. satellite data and algorithms for monitoring forestry) in developing their outcomes. We select the case based on the richness of satellite-based projects developed in different sectors (e.g. agriculture and energy), the main author's extensive multi-year experience in investigating this program (Yin, 2011), the availability of public secondary data (Long-Sutehall *et al.*, 2011) and the possibility of directly engaging managers (Zameer *et al.*, 2024) who developed projects within this project ecology. Furthermore, single case study research is widely adopted in project management literature to study similar phenomena (Martinsuo and Huemann, 2021).

The unit of analysis is the drivers and barriers of organisations developing satellite-based projects to generate benefits through sustainable innovation. Data collection and analysis followed an iterative grounded theory approach. We gathered extensive secondary data on the projects, realised benefits and sustainable innovations. We then interviewed 44 managers who developed the projects and triangulated them with collected or new secondary data. This iterative collection and analysis of secondary and primary data allowed us to develop the theoretical framework.

3.1 Empirical setting and case selection

The empirical setting of our research is the European Space Economy, where an increasing number of satellite-based projects are realising benefits through sustainable innovation (EUSPA, 2022). The ongoing trend of integrating space infrastructure with new digital technologies is driving the development of satellite-based projects that foster sustainable innovation and realise benefits in non-space sectors (European Space Agency, 2022; Paravano *et al.*, 2024b). Satellite-based projects are projects that leverage Earth Observation, Satellite Navigation, or Satellite Communication technologies. Earth Observation encompass a suite of satellite-based applications designed to systematically collect and analyse data about the Earth's surface, atmosphere and oceans. These technologies use various sensors to capture images (up to 30 cm square resolution) day and night. Satellite Navigation has revolutionised mobility, enabling various applications like smartphone navigation. Satellite Communication facilitate real-time communication and Internet access.

In line with this trend, over a decade ago, the European Space Agency (ESA) launched the ESA Business Applications Programme (ESA BASS) to promote the adoption of space technologies in non-space sectors and encourage sustainable innovation through commercial satellite-based projects. This program offers financial and managerial support to projects that leverage space data and technologies to develop projects in various domains, such as insurance, energy and healthcare, that benefit businesses, society and the environment. Nowadays, the ESA BASS has been instrumental in supporting the development of more than 600 satellite-based projects and fostering sustainable innovation (Paravano *et al.*, 2024b). Table 1 presents an overview of the sectors in which projects promoting sustainable innovation have been developed and the benefits generated through the ESA BASS.

3.2 Data collection

In line with the grounded theory approach (Strauss and Corbin, 1994), we iteratively collected and analysed data on how organisations within the ESA BASS program develop sustainable innovation. We used two distinct sampling criteria: one for selecting projects and another for identifying the managers involved in these projects. We employed purposive sampling (Coyne, 1997) to include satellite-based projects developing sustainable innovation. This selection process was informed by the extensive knowledge of the empirical setting held by two of the authors and by public documents and news sources (Long-Sutehall *et al.*, 2011). Managers were selected through purposive sampling (Palinkas, 2014; Patton, 2014), focusing on their roles in envisioning the benefit realisation of the project and direct involvement in the development of sustainable innovation through satellite-based projects. These criteria allowed us to engage with people who developed a complete understanding of the benefits generated by

Table 1. Summary of the satellite-based projects and benefits generated developed through the ESA business application programme

Sector	Projects promoting sustainable innovation	Benefits generated
Agriculture and food security	Precision farming technologies, crop monitoring systems, soil health management tools	Increased crop yields, optimised resource use, improved food security, reduced environmental impact
Energy	Renewable energy optimisation, innovative grid solutions, energy efficiency monitoring	Enhanced energy management, reduced carbon footprint, increased use of renewable resources, improved infrastructure reliability
Environmental management	Climate change monitoring systems, pollution tracking technologies, disaster response tools	Better environmental protection, improved disaster preparedness, enhanced ability to address pollution and climate issues
Transport and logistics	Satellite-based navigation and tracking, traffic management systems, logistics optimisation tools	Improved transportation efficiency, reduced travel times, optimised supply chains, enhanced safety and operational reliability

Source(s): Table by the authors

the project and leveraged sustainable innovation. [Table 2](#) summarises the projects and profiles of the interviewees.

We conducted 44 semi-structured interviews, each averaging 38 min ([Aguinis and Solarino, 2019](#)). Sampling continued until we achieved theoretical saturation ([Saunders et al., 2015](#)). The interview protocol was developed based on a literature review of project benefits and sustainability, and it was refined and validated through two test interviews with managers from other satellite-based projects ([Gubrium and Holstein, 2002](#)). All interviews were conducted online, with anonymity provided to all participants and organisations. We triangulated primary data with secondary sources, such as public and internal reports related to the projects ([Jick, 1979](#)). For example, if an interviewee referenced a specific satellite technology (e.g. the Sentinel 2 satellite), we gathered additional data on that project.

3.3 Data analysis

The data analysis followed the grounded theory approach, involving deep immersion in the data, iterative sorting, coding and comparison. Initially, we documented the characteristics of the selected projects – such as the prime contractor, nature of interventions and project benefits – in detailed table sheets. Subsequently, we transcribed each conversation and integrated it with notes taken during the interviews and relevant secondary data.

The analysis commenced with open coding, where we scrutinised individual words, phrases, and sentences to develop initial codes and categories. For instance, “A key driver is a long-term mission and its awareness in the everyday activities” (Int 32). We systematically compared and contrasted these codes to form increasingly complex and inclusive categories. The first author created analytic and reflective memos to document and enrich the analysis, making implicit thoughts explicit and expanding the data corpus. For example, one memo noted, “Int 6 appears sceptical about the environmental impact of their solution, which may affect their views on the project’s sustainable innovation benefits”. Subsequently, we performed axial coding, which involved reorganising and combining data and categories in novel ways ([Corbin and Strauss, 1990](#)), such as categorising “long-term vision”. This was followed by selective coding, an integrative process to determine core categories, such as “Drivers for sustainable innovation”. We adhered to [Strauss and Corbin’s \(1994\)](#) criteria for core categories, evaluating their centrality, frequency, inclusiveness, theoretical relevance and capacity to address variability in dimensions, properties, conditions, consequences and

Table 2. Projects and interviewees' profile

#	Project industry	Job role	Years of experience	Duration (minutes)
1	Agriculture and Forestry	General Manager	6–10	50–59
2	Agriculture and Forestry	Founder	21–25	50–59
3	Agriculture and Forestry	Founder	1–5	40–49
4	Agriculture and Forestry	Business Line Manager	6–10	50–59
5	Agriculture and Forestry	Business Line Manager	11–15	40–49
6	Agriculture and Forestry	Project Manager	11–15	30–39
7	Agriculture and Forestry	Product Manager	6–10	30–39
8	Agriculture and Forestry	Founder	6–10	30–39
9	Agriculture and Forestry	Project Manager	11–15	20–29
10	Agriculture and Forestry	CEO	16–20	20–29
11	Agriculture and Forestry	CEO	16–20	30–39
12	Agriculture and Forestry	Business Line Manager	16–20	40–49
13	Agriculture and Forestry	Founder	16–20	40–49
14	Agriculture and Forestry	Founder	11–20	30–39
15	Agriculture and Forestry	Project Engineer	16–20	40–49
16	Agriculture and Forestry	CEO	21–25	20–29
17	Agriculture and Forestry	Director	16–20	40–49
18	Agriculture and Forestry	CEO	10–15	30–39
19	Agriculture and Forestry	Project Manager	6–10	50–59
20	Agriculture and Forestry	Founder	6–10	30–39
21	Agriculture and Forestry	CEO	6–10	30–39
22	Agriculture and Forestry	Business Line Manager	11–15	40–49
23	Agriculture and Forestry	General Manager	11–15	40–49
24	Agriculture and Forestry	Director	11–15	30–39
25	Agriculture and Forestry	Business Line Manager	11–15	50–59
26	Energy and Utilities	General Manager	11–15	40–49
27	Energy and Utilities	Data Scientist	1–5	40–49
28	Energy and Utilities	Founder	6–10	50–59
29	Energy and Utilities	CEO	6–10	30–39
30	Energy and Utilities	CEO	6–10	50–59
31	Energy and Utilities	Director	11–15	30–39
32	Energy and Utilities	Business Line Manager	6–10	20–29
33	Energy and Utilities	Founder	6–10	20–29
34	Energy and Utilities	Business Line Manager	11–15	20–29
35	Energy and Utilities	CEO	6–10	30–39
36	Energy and Utilities	General Manager	16–20	30–39
37	Environment and Wildlife	Product Manager	1–5	20–29
38	Environment and Wildlife	Director	26–30	30–39
39	Environment and Wildlife	Project Manager	6–10	20–29
40	Environment and Wildlife	Project Engineer	11–15	20–29
41	Environment and Wildlife	Project Manager	6–10	30–39
42	Transport and Logistics	Director	6–10	30–39
43	Transport and Logistics	CEO	6–10	30–39
44	Transport and Logistics	Senior Researcher	11–15	40–49

Source(s): Table by the authors

strategies. Categories requiring further development were refined, and we continued sorting, comparing, and contrasting codes and categories until saturation was achieved, meaning no new codes emerged. All data were encompassed within the core categories of the grounded theory model (Corbin and Strauss, 1990).

In conclusion, the grounded theory approach enabled us to develop a comprehensive theoretical framework that explains how projects realise benefits through sustainable innovation while identifying the key drivers and challenges organisations involved in these initiatives face. This inductive approach, grounded in empirical evidence, allowed us to

overcome the limitations of existing theoretical frameworks and the confusion generated by the evolution of the project sustainability and project benefits literature streams.

4. Findings

4.1 Drivers for benefit realisation of projects fostering sustainable innovation

We found that the drivers for benefits realisation consist of (1) envisioning a common sustainable future and (2) opening to the project ecology. Table 3 summarises our findings, presenting the drivers for benefit realisation (corresponding to the selective coding), their antecedents (corresponding to the axial coding), their description and a representative quote.

Sustainable innovation thrives when all involved share a unified vision for the future. This requires more than just organisational buy-in; it necessitates the active engagement of people at all levels, “*Because it’s all about people*” (Int4). Our data suggest that by involving individuals in the process, projects can better address current needs while aligning with future interests and realising benefits. The journey towards sustainable innovation often begins with small steps. Recognising that adopting new technologies can be daunting, starting with manageable, low-cost initiatives is essential. This approach allows stakeholders to experiment with and understand the potential benefits of innovative technologies. “*Experimenting with the technology is fundamental in understanding the potential benefits of its adoption and is the first step before its adoption*” (Int38). Realising the benefits of sustainable innovation is greatly aided by using tangible tools that help stakeholders visualise and comprehend both present and future advantages. Concrete examples and practical demonstrations of innovative solutions can bridge the gap between abstract concepts and real-world applications. These tools make it easier for stakeholders to grasp the immediate benefits of sustainability initiatives and to envisage their long-term potential. The driver “Envisioning a common sustainable future” manifests differently across sectors, varying on the focus on sustainable innovation. For example, from our data, it emerges that the environment and wildlife sector places the most significant emphasis on environmental impact, using satellite data for biodiversity conservation (Int 38), habitat preservation (Int 37, 40) and monitoring ecosystem changes (Int 39, 41). This sector’s sustainability focus is inherently environmental, aiming to align project benefits with safeguarding natural resources and biodiversity. Conversely, the transport and logistics sector focuses more on social impact, particularly in reducing emissions in urban areas (Int 43, 44) and improving supply chain transparency (Int 42). Here, satellite applications assist in optimising route planning, decreasing fuel consumption and minimising the sector’s carbon footprint, with a strong orientation toward social welfare and public health. Nevertheless, despite the different natures and the end of the of sustainable innovation, we observe the same driver as a key to the realisation of project benefits.

A favourable institutional context plays a crucial role in the success of sustainable projects. The global push toward sustainability and decarbonisation has led to the implementation of various supportive policies, including environmental regulations, energy policies, and carbon taxes. For example, in Europe, satellite data are nowadays used by authorities to monitor agriculture and the usage of land (ESA, 2023). These measures create a conducive environment for benefits realisation, encouraging organisations to pursue projects developing sustainable innovations. “*Sustainability is now a must-have, and there are a lot of incentives. This is a key driver for benefits realisation of our projects*” (Int 17). Collaboration with public institutions can significantly boost the success of sustainable innovation projects. Public institutions offer valuable financial support and access to a wealth of knowledge, which can enhance the credibility and reputation of project organisations, “*The ESA Incubation Centre has supported us, they support us in developing the innovation through financial support, but more importantly, by enriching our network*” (Int 12). Finally, market trends towards sustainability present a powerful opportunity for the diffusion of sustainable innovation and benefits realisation. “*Now there is the culture of sustainability, and companies and society are aware of their importance and avid of solutions*” (Int26). As demand for sustainable solutions

Table 3. Drivers for benefit realisation

Drivers for benefit realisation (selective coding)	Drivers' antecedents for benefit realisation (axial coding)	Description	Representative quotes
Envisioning a common sustainable future	Engaging with people, not just organisations	Sustainable innovation requires looking to the future and having everyone involved on the same page. Benefits are shaped through their engagement, embracing their present needs, and developing the project according to their future interests	<i>"We need to be on the same page to share what sustainability is and what we want to obtain. To benefits to realise, we engage people and possible future stakeholders"</i> [Int.14] <i>"The key aspect is to engage with people rather than just organisations. You need someone in the potential beneficiary organisations who understands the future potential of your innovation. They are the promotor of your satellite-based solution"</i> [Int 27]
	Starting small	Benefits realisations begin in the short term. Adopting sustainable innovation may be challenging, and it is necessary to start small. By decreasing adoption costs and resources required, stakeholders can experiment with innovative technology (e.g. satellite) and understand possible future benefits	<i>"The benefits are realised when, in the short term, I can experiment with the technology and start a pilot. To make this happen, the technology has to be cheap and easy to use"</i> [Int.31] <i>"The advantage of starting small with the development of sustainable innovation is that you can easily pivot to meet the better needs of the beneficiaries or, over time, engage other actors who you haven't engaged at the beginning"</i> [Int 1]
	Making sustainable innovation tangible	Adopting tangible tools to help stakeholders understand present benefits and imagine future ones facilitates benefit realisation	<i>"Envisioning the impacts and benefits of the projects at the beginning is fundamental. We typically create tools and platforms for monitoring renewable energy production. Our projects must have the environmental impact as the final goal, which will eventually generate revenues. We show it to stakeholders through images and collaborative tools"</i> [Int.25] <i>"We are developing an innovation to monitor forestry that intends to generate benefits in the long term for the environment and the society. Yet, we have to show municipalities how it works; we need to make them aware of the actual and potential benefits. Experimenting with them is probably one of the most effective ways to make it happen"</i> [Int 40]

(continued)

Table 3. Continued

Drivers for benefit realisation (selective coding)	Drivers' antecedents for benefit realisation (axial coding)	Description	Representative quotes
Opening to the project ecology	Experiencing favourable institutional context	The global shift towards sustainability and decarbonisation has brought about several benefits, including the implementation of environmental policies, energy policies, and carbon taxes. These elements favour benefit realisations	<i>"In the energy sector, incentives for the wind energy market translate into opportunities for our space projects. The increase in wind farms leads to a growing demand for satellite-based monitoring and maintenance services"</i> [Int.34] <i>"The new EU common agriculture policy that demands farmers to adopt satellite for crop monitoring was disruptive. It pushed our sustainable innovation and forced farmers to engage with us"</i> [Int 19] <i>"Receiving funding from public institutions to develop our projects is a significant advantage. This emerging support enables us to generate future benefits from our endeavours in the agriculture sector".</i> [Int. 15] <i>"One of the key issues is to identify present and future beneficiaries. The space agency supported us by connecting us with a community of final users in the agriculture sector"</i> [Int 23]
	Exploiting public institution's financial and knowledge support	The benefits of collaboration with public institutions favour the possibility of securing further investments for sustainable innovation, increasing the project organisation's reputation and credibility, and guaranteeing multiple sectors' knowledge	<i>"The organic agriculture market has seen a significant rise in demand recently, driven by a global push for sustainable farming practices to reduce environmental impact. This creates a favourable environment for our projects to thrive and generate future benefits"</i> [Int.02] <i>"Energy companies must decarbonise their business. We are nowadays in the right time and place to develop sustainable innovation supporting them, and thus realising benefits"</i> [Int 35]
	Leveraging market sustainable-trends	Leveraging sustainability market trends drives demand for sustainable innovations, thus enhancing technology diffusion and long-term benefits	

Source(s): Table by the authors

grows, organisations can capitalise on these trends to drive the adoption of their innovations. Organisations can enhance technology diffusion and ensure long-term benefits by aligning their projects with prevailing market dynamics. *“The space economy is booming, with growing interest in leveraging satellite data, particularly within the energy sector as it navigates the path to net-zero. This trend creates an ideal opportunity to engage potential clients and collaboratively develop solutions that deliver economic value and environmental and social impact, precisely aligning with their current priorities”* (Int 28).

As further discussed in [Section 5](#), Our data reveal that the mechanisms underlying the drivers “envisioning a common sustainable future” and “Opening to the project ecology” significantly influence the realisation of project benefits. These mechanisms enable managers to fundamentally shift their perspective, viewing the project as a catalyst within a more extensive system. *“Much like a chemical catalyst, when integrated into a reaction, the project magnifies outcomes, creating benefits that surpass the capacities of individual elements, or accelerates the speed at which these benefits unfold”* (Int 17). Indeed, benefits are usually realised after the project’s completion. These drivers enable managers to think about the impact and benefits of their projects and, more importantly, guarantee that in the limited temporal frame of the project, the necessary actions to realise these benefits are in place. *“Opening to the ecology allows you to realise benefits not just because you engage all the potential beneficiaries, but because through their engagement, you can envision the evolution of the context and the role you can play with your project”* (Int 26). It is worth noticing the practices adopted by managers, e.g. engaging with people, starting small, making sustainable innovation tangible (that are the drivers’ antecedents), grounding the future vision and project realisation, and positioning the project as an active agent for sustainability (or theoretically speaking enact the “sustainability by projects”).

4.2 Challenges for benefit realisation of projects fostering sustainable innovation

The challenges to benefits realisation are (1) struggling to take off sustainable innovation, and (2) having a short-sighted view of the future. [Table 4](#) summarises our findings.

Sustainable innovation often faces significant hurdles before achieving widespread adoption and realising benefits. One primary challenge is the lack of technical capabilities and assets among stakeholders. For instance, satellite-based projects require specialised technical knowledge and equipment that many stakeholders do not possess. This capability gap results in the inability to fully leverage the technology’s potential benefits. As highlighted by an example in agriculture, the absence of necessary tools and expertise – such as advanced sensors for soil analysis – prevents clients from effectively using the technology, despite recognising its value. Economic challenges are a significant barrier to the success of sustainable innovation projects. These challenges include difficulties recovering initial investments, high costs for acquiring premium commercial data and securing adequate funding. Communication gaps can impede the benefits of innovative solutions. Space companies, for example, frequently develop advanced technologies that do not align with the existing needs or solutions preferred by stakeholders. *“They (space companies) offered us a super sports car. Instead, we needed a compact car”* (Int14). This disconnect arises from ineffective communication and understanding of stakeholder requirements. An illustrative case is the development of an advanced air pollution monitoring system that remains underused because local businesses prefer traditional air quality monitors (Int38).

Identifying and engaging the correct beneficiaries is crucial for realising the benefits of a project. However, this task is complicated and costly, especially when considering stakeholders’ long-term impact and evolving needs. This short-sighted view can limit the ability to plan effectively for future benefits and stakeholders, making it challenging to align project outputs with future needs and opportunities. Uncertainty from external factors can significantly affect a project’s progress and ability to deliver benefits. *“Sustainable innovation projects are very uncertain. They may work or not. We have to learn to face it”* (Int 12).

Table 4. Challenges for benefit realisation

Challenges to benefit realisation (selective coding)	Challenges' antecedents for benefit realisation (axial coding)	Description	Representative quote
Struggling to take off sustainable innovation	Lacking technical capabilities	Satellite-based projects require technical capabilities and assets that stakeholders do not have. Resulting in a lack of benefit realisation	<i>"The key barrier to realising the benefits of our project outcome in agriculture is that our clients lack the necessary tools and expertise. Utilising our advanced soil analysis requires specific sensors and knowledge to interpret the data. Without these, they recognise the solution's value but cannot fully leverage it"</i> [Int 05] <i>"Often, we offer clients tools they don't fully understand or use to only a fraction of their potential—much like the average Excel user. It's not rocket science, yet this limits the realisation of true benefits, even in sectors more mature in technology use, such as transportation"</i> [Int 43]
	Experiencing financial issues	Economic challenges the analysed projects face, including difficulties in recouping initial investments, high costs for obtaining premium commercial data, and securing funding, hinder financial sustainability and, consequently, the realisation of benefits from sustainable innovation	<i>"Our transportation project demands substantial investments. If we fail to reach the break-even point, we may not achieve the anticipated benefits of the innovative solutions we aim to implement"</i> [Int 40] <i>"There's a dichotomy between the short term and the long term: while we aim to generate long-term benefits, we're judged on our ability to support the short term, which remains the priority. If the funds aren't there, progress simply doesn't happen"</i> [Int 24]
	Speaking different languages	Space companies often develop advanced technological solutions that fail to benefit stakeholders because existing complementary solutions are already available or do not address their needs. This issue arises primarily because these companies do not effectively communicate with or understand the stakeholders' requirements	<i>"We built an amazing tool to monitor air pollution levels. We created an advanced system for tracking air pollution levels. However, it remains unused because local businesses prefer traditional air quality monitors. We misunderstood their needs, and they didn't communicate their preferences to us"</i> [Int 16] <i>"We developed a system to monitor the coral reef and presented it to the coast guard, but they told us they prefer to conduct site visits to avoid job losses"</i> [Int 38]

(continued)

Table 4. Continued

Challenges to benefit realisation (selective coding)	Challenges' antecedents for benefit realisation (axial coding)	Description	Representative quote
Having a short-sighted view of the future	Identifying wrong beneficiaries	Barriers to realising benefits are closely linked to identifying who will benefit from our project output. Pinpointing and engaging stakeholders is challenging and costly, particularly considering those impacted decades after the project's completion and in future environments	<i>"Have you ever imagined the impact of the GPS on our lives? Thanks to this, we can save lives in an emergency or call Uber Eats when we do not want to go to the supermarket. Yet, in the beginning, predicting these benefits was not possible because many of the stakeholders did not even exist"</i> [Int 31] <i>"We developed a satellite-based solution for assessing climate risks to solar power generation facilities. Initially, we considered the primary beneficiaries to be the plant owners. In reality, however, the true advantages of the solution benefit insurers – who bear the financial losses in case of damage – and citizens, who avoid the impact of energy loss"</i> [Int 26]
	Facing greater uncertainty	External factors that negatively impact the project's progress can create uncertainty and limit the realisation of its benefits	<i>"Sentinel 1, one of the most used satellites of the EU commission, whose data are given for free, failed. How can we guarantee the benefits of our project that leveraged this data?"</i> [Int.35] <i>"One major hurdle in developing sustainable satellite-based environmental and wildlife protection solutions is the inaccessibility of key cadastral data in user-friendly formats. These land registry datasets should have been available years ago, but bureaucratic delays have significantly hindered access, limiting the project development and benefits realisation"</i> [Int 39]
	Failing to keep up with cultural changes	Challenges emerged from interactions with end users and partners, characterised by cultural resistance and scepticism towards new technologies like satellite data. The unpredictable nature of cultural transformation further intensifies this resistance	<i>"Initially, selling the concept of precision agriculture using drone technology to farmers was challenging because they were unfamiliar with the technology. Many farming businesses hesitated to adopt it, as they struggled to grasp its workings and were accustomed to traditional methods"</i> [Int.03] <i>"We face competition from established technologies (e.g. helicopter flyovers) and alternative solutions that emphasise short-term economic gains rather than focusing on long-term benefits"</i> [Int 28]

Source(s): Table by the authors

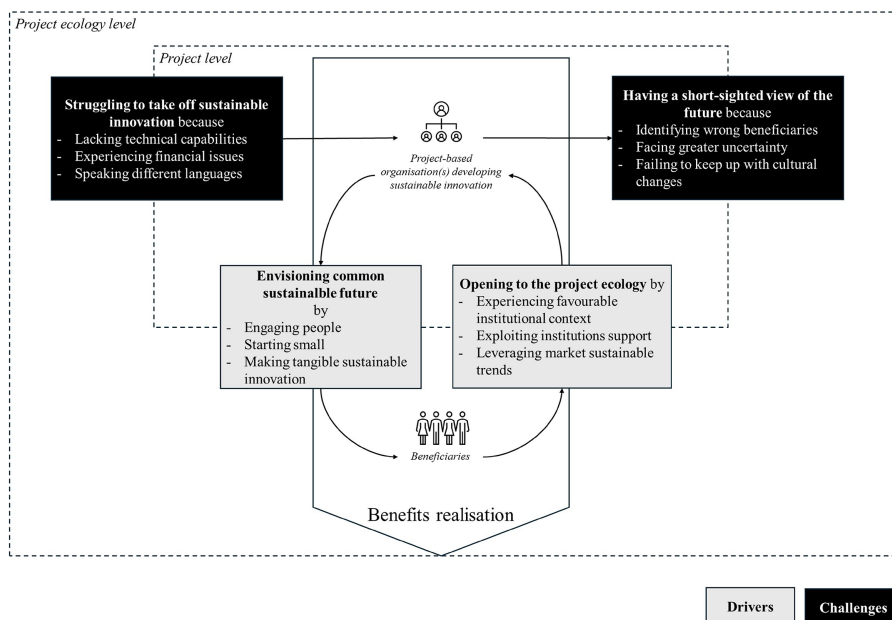
Uncertainty also depends on the regulatory landscape and its evolution. This may disincentivise organisations in developing sustainable innovation that generates long-term benefits rather than looking at the short term, *“You know today’s regulations and how your satellite-based solution can be used, you don’t know if tomorrow something will change, e.g. for privacy reasons, therefore you tend not to look at the long term but maximise your return in the short term”* (Int2). Cultural resistance and scepticism towards new technologies can impede the adoption of innovative solutions. Challenges often arise when stakeholders, such as end users and partners, hesitate to embrace new technologies due to their traditional practices and cultural norms. These particularly emerge from our data comparing the agriculture and forestry sectors which are relatively mature in leveraging satellite-based applications, particularly Earth observation for crop health monitoring (e.g. Int 4, 8, 13, 17 25), water management (e.g. Int 10, 23) and soil conservation (ESA, 2023). This maturity reflects a limited resistance to change (even due to the nature of the sector). By contrast, the energy and utilities sector, though beginning to integrate similar applications, shows less maturity in sustainable innovation adoption. Here, satellite applications are primarily used for asset monitoring (Int 28, 29, 31, 33, 34) and risk management (Int 26, 27, 30, 36), with fewer established frameworks for broader environmental goals.

The underpinning mechanisms of the challenges for project benefits realisation through sustainable innovation are related to the internal dynamics of projects. Our data shows that due to the temporal nature of projects and the complexity of sustainable innovation, it *“struggles to take off”* (Int 3). Indeed, *“If you lack the capabilities and the money and don’t even know how to speak the same language as potential beneficiaries, how could you realise benefits for them? Sustainable innovation is meaningless without a beneficiary of this innovation”* (Int 32). It resembles the challenge of having a “short-sighted view of the future” as project organisations and managers tend to look at short-term success criteria, *“I’m usually evaluated on my ability to deliver on time and within the budget constraints. If someone will use my satellite-based application, it is not my concern”* (Int 16). Moreover, the short-sighted view is a challenge for benefits realisation because it fosters managers in conceiving the innovation as a short-term product development rather than a broader catalyst for benefits realisation: *“Often we see innovation as instrumental in developing a product or a service, not as something that can transform society. The fact that we are in temporary endeavours amplifies this perception because, after the completion, we are no more responsible for the outcome”* (Int 41).

5. Discussion and contributions

Based on the grounded theory approach, we build a theoretical framework (Figure 1) explaining how projects realise benefits through sustainable innovation, highlighting the drivers and challenges of these projects for benefits realisation. The ontological elements of the framework are the selective and axial coding elements presented in the previous section.

Our framework shows that drivers and challenges for benefits realisations should be sensemade in the relationship between the project actors (e.g. project-based organisation developing the project) and the project ecology (Grabher, 2002; Paravano et al., 2024a) actors (e.g. beneficiaries). Our data show a virtuous cycle regarding drivers for benefits realisation. Indeed, organisations envision a sustainable future (and the benefits) by engaging with beneficiaries, providing them tangible proof of the value of their sustainable innovation. Also, they are open to the project ecology and able to leverage institutional and market trends and, therefore, absorb capabilities and resources (Krystallis et al., 2022). Challenges include struggling to take off sustainable innovation because of a lack of technical capabilities, financial issues and speaking different languages, making it difficult for organisations to get from the project ecologies the resources needed to realise benefits (one in-bound arrow). Similarly, project organisations have a short-sighted view of the future because they identify the wrong beneficiaries, face more significant uncertainty and fail to keep up with culture change, showing difficulty engaging with the project ecology (one out-bound arrow). In this



Source(s): Figure by authors

Figure 1. Theoretical framework

section, we discuss the contribution of our theoretical framework in light of the benefits realisations (Aubry *et al.*, 2021; Zwikaël *et al.*, 2018) and sustainability by projects (Silvius *et al.*, 2017; Whyte and Mottee, 2022) debates.

5.1 Contribution to theory

Our paper has three principal theoretical contributions. First, we reconcile project sustainability and benefits realisation literature by developing a theoretical framework that explains how projects realise benefits through sustainable innovation and identify the drivers and challenges to making it happen. We found that envisioning a common sustainable future is a crucial driver to benefits realisation (Khalifeh *et al.*, 2020; Zerjav *et al.*, 2021), and is based on the innovation principles of starting small and making tangible artefacts to envision the value of objects (Khanchel *et al.*, 2023; Mondal *et al.*, 2024). Project sustainability and benefits realisations literature streams have traditionally investigated this phenomenon from two perspectives. This is mainly due to a traditional deterministic epistemological perspective on project benefits (Brones *et al.*, 2020; Eweje *et al.*, 2012; Pinto *et al.*, 2022) that tends not to consider benefits socially constructed. In the last few years, this position has been challenged by a constructivist approach (Goel *et al.*, 2020; Zwikaël, 2016), mainly adopted by sustainability scholars, who foster the adoption of participatory practices to envision and develop a sustainable future.

Our findings highlight, among the drivers and challenges, antecedents that can be reconducted to the traditional metrics for project success (Pinto *et al.*, 2022; Shaukat *et al.*, 2022) and the “sustainability of projects” (Silvius and Schipper, 2014), namely, institutional support, technical and capabilities limitations, and financial issues. Benefits realisation can be achieved only if the project is technically and economically sustainable (Mavi and Standing, 2018; Zwikaël, 2024). Yet, our results can only be understood in light of the emerging

discourse on project sustainability (Friedrich, 2023; Sabini *et al.*, 2019), according to which it is necessary to consider all the sustainable dimensions in dealing with benefits realisation (Seifert *et al.*, 2023; Zwikaël and Huemann, 2023).

Second, we extend the project sustainability debate by showing that “sustainability by projects” has the explanatory power to reconcile sustainable innovation with project benefits realisation. Remarkably, our findings highlight the dynamic interplay between project organisations and their broader project ecologies (Aubry *et al.*, 2021). This echoes the idea that sustainable innovations intend to change current culture, values, products, processes, and organisational practices to enhance their capability to collectively create and realise sustainable outcomes, i.e. social, environmental and economic benefits (Calza *et al.*, 2023; Oliveira-Dias *et al.*, 2022). Furthermore, benefits realisation through sustainable innovation requires a shift toward recognising projects as socially constructed (Ma *et al.*, 2022) that embrace the complexity and uncertainty of projects and their context (Hedborg *et al.*, 2020; Zwikaël, 2024). Project benefit realisation is shaped by continuous interactions among parties with diverse perspectives and needs, each striving to advance their interpretations and interests in sustainable innovation (Aubry *et al.*, 2021; Bahadorestani *et al.*, 2020).

Projects are temporary organisations characterised by structural complexity, differentiation and interdependency (Daniel and Daniel, 2018), and uncertainty (Love *et al.*, 2024). This literature is based on the concept that projects are not islands (Brookes *et al.*, 2017), and to realise benefits, projects should leverage a constellation of actors (Laursen, 2018; Svejvig and Schlichter, 2020), adopting co-creation practices (Lenfle and Söderlund, 2019). However, project stakeholder theorists have recently acknowledged the existence of collective action problems among stakeholders involved in joint value creation (Keys and Huemann, 2017). In these situations, stakeholders might be inclined to prioritise their interests over maximising joint value creation (Aubry *et al.*, 2021; Malik *et al.*, 2023). We extend these debates, showing a key challenge is having a short-sighted view of the future influenced by project ecology uncertainty and complexity (Daniel and Daniel, 2018; Winch, 2014). Indeed, despite engaging stakeholders can mitigate benefits realisation uncertainty (Dattée *et al.*, 2018), stakeholders’ cultural or interests change at a different pace of the organisation developing the project (Ma *et al.*, 2022).

Third, we extend the sustainable innovation literature by showing that, in temporary organisations, the relational dimension between the organisation and its context (Kafetzopoulos, 2023; Seuring and Gold, 2013) is fundamental in realising benefits. Literature on niche innovation management provides valuable insights into the development and diffusion of sustainable innovation within niches for permanent organisations (Kemp *et al.*, 1998; Raven *et al.*, 2016). Our findings complement this literature (Klaus-Rosińska and Iwko, 2023) by showing that projects must extend beyond immediate stakeholders into the broader ecology in temporary organisations, influencing sustainable innovation acceptance and integration (Barbier *et al.*, 2024; Turnheim and Geels, 2019). Such an approach demands stakeholder engagement within the niche and a deep understanding and navigation of the broader institutional, social, and economic contexts (Markard *et al.*, 2012) that determine the long-term benefits of sustainable innovation (Adams *et al.*, 2016). This reframes sustainable innovation in projects. From a primarily niche-centred to a holistic perspective (Lipke *et al.*, 2009), it is recognised that sustainable innovation requires not just niche protection but engagement and openness toward the broader socio-technical context (Jain *et al.*, 2023; Zameer *et al.*, 2024).

Our findings contribute to the underinvestigated sustainable innovation literature stream about the role of external relationships (Agostini *et al.*, 2023; Khanchel *et al.*, 2023; Seuring and Gold, 2013) of the organisations toward its context that today lack empirical support. We show the critical relevance of organisations to open toward the context (i.e. the project ecology). Despite these aspects being deeply discussed in open innovation literature (Jain *et al.*, 2023; Khanchel *et al.*, 2023), it is recently gaining momentum in project literature (Hedborg and Gustavsson Karrbom, 2020), we extend to recent debate regarding project

benefits (Martinsuo *et al.*, 2019b; Zwikael and Huemann, 2023) showing the relevance of focusing not only on the impacts of projects toward sustainability, but on the influence of the context in shaping sustainable-oriented benefits (Locatelli *et al.*, 2023b; Zhang *et al.*, 2024). In the New Space Economy, institutions shape the context in which projects are developed and favour integration among sectors (Paravano *et al.*, 2023), enabling benefits realisations for stakeholders not part of the traditional space industry. Here, a key challenge for project organisations is to speak the same language as potential beneficiaries (Lenfle and Söderlund, 2019). Therefore, reflective participatory practices could become useless if they cannot interact correctly. Literature regarding stakeholder engagement and innovation intermediaries could shed light on this issue that is quite common in cross-industry innovation, especially for sustainable development (Sabini and Alderman, 2021).

5.2 Contribution to practice

Managers may implement the identified practices (drivers and challenges' antecedents presented in Table 3 and Table 4) to activate key drivers and navigate challenges in achieving project benefits through sustainable innovation. From our findings, managers can foster deeper connections and collaborative efforts that enhance project benefits realisations by prioritising engagement with individuals rather than just organisations. Starting small with experimental technologies and solutions allows for manageable pilot initiatives that can demonstrate tangible outcomes to stakeholders, enabling pivot actions toward them to realise benefits through the sustainable innovation developed. Additionally, making the envisioned benefits tangible, through, for example, clear metrics and visualisations, can help managers show and communicate the benefits of the projects. Furthermore, our findings show that organisations developing the project should exploit the knowledge support available from public institutions that can provide essential resources to overcome limitations in technical capabilities, which are typical of new sustainable innovation. Managers can refine their stakeholder engagement strategies by addressing challenges such as differing languages and cultural shifts, identifying the proper beneficiaries and cultivating a shared understanding of project goals. It could be done by hiring people from other sectors or leveraging innovation intermediaries (e.g. universities or space agencies) that support space and non-space organisations' engagement and project development.

Our findings show the crucial role of the institutional context in driving or challenging the realisation of project benefits through sustainable innovation. Policy-makers could utilise these insights to shape policies that foster a project ecology conducive to sustainable innovation and long-term benefit realisation. In particular, it is necessary to design policies that foster cross-industry applications and realise benefits through sustainable innovation, such as the European regulation for agriculture monitoring through satellites. Furthermore, our findings show that public institutions such as space agencies are fundamental to providing financial support and becoming key actors for project benefits realisation by providing knowledge to the organisations developing the project and their beneficiaries.

6. Conclusions

Our paper investigates the drivers and challenges of projects developing sustainable innovation to realise benefits, taking the recent "sustainability by project" conceptualisation. We build a theoretical framework explaining how and why complex projects realise benefits through sustainable innovation. We found that the drivers for benefits realisation consist of (1) envisioning a common sustainable future and (2) opening to the project ecology. Challenges are (1) struggling to take off sustainable innovation and (2) having a short-sighted view of the future.

Our findings reveal that benefits realisation through sustainable innovation is deeply influenced by the interactions between project actors and their external environments.

Specifically, our data illuminate how drivers and challenges for benefits realisation emerge from these interactions. We observe a virtuous cycle where project organisations that effectively engage with beneficiaries and leverage institutional and market trends can achieve sustainable innovation benefits. This interaction allows them to gather the necessary capabilities and resources while demonstrating the tangible value of their innovations. Conversely, challenges arise when organisations face technical, financial, and communicative barriers, limiting their ability to harness the full potential of their project ecologies. Identifying the proper beneficiaries and adapting to cultural changes further compound these difficulties. Our paper contributes to reconciling sustainable innovation and project benefit realisation. We offer a new empirical-grounded perspective to pivot from the “sustainability of projects” toward the “sustainability by projects”, showing the drivers and challenges for project benefits realisation.

Our study has four main limitations. First, using a single case study methodology, particularly regarding the ESA Business Applications Programme, may be affected by contextual bias, as unique factors, such as the project development mechanisms, and regulatory environment. Additionally, while qualitative insights can be rich, there is a risk of overemphasising anecdotal evidence, potentially skewing conclusions. Notably, such research aims not to yield universally generalisable results but to provide a nuanced perspective contributing to reconciling project benefits and sustainable innovation literature streams. Future studies should explore additional cases within the European context and other geographical areas to enhance the robustness of findings. Second, we develop our study in the space economy empirical setting, which is high-tech and asset-intensive. The drivers and challenges presented may not correctly describe those in different ecologies (construction ecology). Third, the managers interviewed belong to European organisations, and our study lacks the perspective of other geographical areas. Further studies could investigate the adoption of engagement practices in other regions, such as Asia and the Americas, discussing culture’s influence on engagement. Finally, we focus on the private and civil space industry, which lacks the defence industry’s perspective and plays an essential role in the new space economy.

We highlighted the crucial role of personal engagement because benefits are perceived differently by the different actors. Projects as interventions may encourage organisations to consider nature as a stakeholder (Goel *et al.*, 2020; Sabini and Alderman, 2021). Recognising that this debate is ongoing but given the pressing need to address grand challenges and environmental issues, future research could investigate the role of nature as a stakeholder in the context of benefits realisation. Our exploratory research highlighted the drivers and challenges to benefits realisations; future research could analyse, develop and validate methodologies and practices to assess the benefits of projects as interventions, especially unplanned ones.

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Corresponding author

Alessandro Paravano can be contacted at: alessandro.paravano@polimi.it