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End-Users Engagement for Enacting Value of Complex Projects: an Ecological Perspective

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ABSTRACT

Engagement is fundamental for organizations in complex projects' ecologies (e.g., space, nuclear, telecommunication) to enact value for their end-users. However, the existing knowledge on this empirical subject has two significant shortcomings. First, while the narrative about project value suffices to explain how a project enacts value for its stakeholders, it falls short of unfolding the enacted value of a complex project for its end-users, from a broader economic and societal perspective. Second, while literature effectively explains project stakeholder engagement practices, the role played by other elements of a complex project' ecology in shaping the engagement practices with end-users remains largely underexplored. This paper aims to explain how organizations in complex projects' ecologies engage with their end-users to enact the value of complex projects. Leveraging a qualitative and inductive approach, we conducted 31 open interviews with managers of organizations in the European space project ecology, and their end-users. Drawing on a grounded theory approach, we identified four classes of engagement practices. 1) "Personal for value espoused", adopted by space managers to espouse the value of complex space projects to end-user managers. 2) "Personal for value expected", adopted by space managers to be engaged by end-user managers and

understand their value expectation. 3) "Personal for value enacted", reinforcing personal relationships and enacting the value of complex space projects over time. 4) “Non-personal” engagement practices, adopted by organizations in the complex project ecology toward their end-users. We contribute to the literature on value and engagement by showing that: 1) value enactment occurs through personal engagement and is not only impersonal; 2) form of value (i.e., espoused, expected, and enacted) shapes the engagement of managers and organizations in the complex project ecologies toward their end-users; 3) a project ecology perspective enhances the understanding of the value of complex projects for end-users.

KEYWORDS

Engagement practices; Project value; Intermediaries; Stakeholder management, Space Economy, Innovation

1. INTRODUCTION

Every year, billions of dollars are spent on complex space projects such as developing satellite infrastructures, designing new rockets, deploying telescopes, and upgrading outer space facilities. A key question is, what is their value?

When discussing complex projects, such as space, nuclear, and other large-scale infrastructure projects, relying solely on project-level analysis cannot provide a comprehensive understanding of their value (Laursen 2018; Li et al. 2023). Complex projects have synergies and interdependences with other projects, and the whole value is greater than the sum of the single project value (Choi et al. 2020). Value is enacted for different classes of stakeholders with different interests and expectations over time (Gunduz et al. 2022; Vuorinen and Martinsuo 2019). Moreover, complex projects enable the creation of new services and even industries, encouraging the emergence of new stakeholders hardly imaginable in the project's front end (Momeni and Martinsuo 2019; Vegas-Fernández 2022). We provide a new perspective on the value enacted by complex projects, shifting the level of analysis from the project level toward the project ecology.

Complex projects' ecologies are characterized by organizations developing mainly, not only, complex projects. Research on project ecologies investigates the interrelationships between projects and their environments (Söderlund 2004), and can offer a new relevant perspective regarding the value of complex projects (as further explained in section 2.3). In our paper, we take the definition of project ecologies recently provided by Hedborg et al. (2020), "*Project ecologies are links and interdependencies between projects with multiple organizational actors in project-intensive contexts*" (p. 394). In practical terms, organizations belonging to a complex projects' ecology are organizations operating in a project-intensive context, performing over time projects with similar characteristics (e.g., capital-intensive and high-tech outputs in the space domain), that are often linked and interdependent, e.g., the knowledge or the components developed for the satellite complex project A, are reused in satellite complex project B:

We distinguish between organizations in a complex project's ecology, and their end-users, i.e., organizations using systems or services provided by organizations in the complex project's ecology, as further explained in section 3.1. For example, regarding space projects, Airbus Defence & Space and Planetek Italia are organizations in the space complex project ecology, providing satellite imagery services to ENI, an oil and gas end-user, which is not part of the space complex project ecology (Airbus 2017). Organizations in the complex projects' ecology increasingly need to engage end-users to provide services and solutions. Yet, organizations can provide these services and solutions only because they belong to a complex project's ecology that keeps unique and specific characteristics (e.g., capabilities, knowledge, resources), enabling organizations to enact complex projects' value and shape engagement practices (Hedborg and Gustavsson Karrbom 2020; Le et al. 2021).

Engagement practices can play a pivotal role for organizations in complex projects' ecologies to espouse and enact the value of their complex projects toward the end-users (Gunduz et al. 2022; Lee et al. 2023; Li et al. 2019). At the same time, end-users can leverage engagement practices to understand if a complex project's ecology can cope with their expected value by developing a specific complex project. Greenwood (2007, p. 317) defines engagement as *"practices that the organization undertakes to involve stakeholders in a positive manner in organizational activities".* Engagement is a key process for enacting the value of complex projects (Hedborg et al. 2020; Moore 1993).

The literature on this empirical subject has two significant shortcomings. First, while the narrative about project value suffices to explain how a project enacts value for its stakeholders (Le et al. 2021), it falls short of unfolding the enacted value of a complex project for its end-users, from a broader economic and societal perspective. Second, while literature effectively explains project stakeholder engagement practices (Lehtinen et al. 2019), the role played by other elements of a complex project' ecology in shaping the engagement practices with end-users remains largely underexplored. Therefore, the aim of this paper is to explain how organizations in complex projects' ecologies engage with their end-users to enact the value of complex projects. In addressing our aim, we investigate the

engagement, operationalized through engagement practices used by organizations in the space complex project ecology to engage with end-users of satellite-based data and services.

2. BACKGROUND

2.1. Forms of Value

In management literature, value is a widely discussed topic, with researchers often simultaneously discussing both contents (what is value?) and process (how is value created?), as these two perspectives are closely intertwined (Lepak et al. 2007; Zubair and Zhang 2022). Our paper investigates both perspectives, conceptualising value as *"the sum of the economic benefits and wider social gains to be accrued from a new large-scale technology development minus the capital costs to be incurred"* (Gil and Fu, 2021, p. 3). This conceptualisation of value has three main attributes relevant to our research. First, value is multi-dimensional. It encompasses both tangible (e.g., revenues) and intangible (e.g., knowledge) dimensions (Aramali et al. 2021; Martinsuo et al. 2019). For example, satellite data adopted by an energy company to monitor pipelines may reduce the monitoring costs (tangible value) and increase company knowledge regarding the hazard exposure and cause of failures of pipelines (intangible value), or support safer maintenance interventions (intangible value). Second, value changes over time. Complex projects generate short-term value (e.g., profit for this year's balance sheet) and long-term value (e.g., fostering radical innovation on technology X). (Turner and Zolin 2012; Vegas-Fernández 2022). Third, value is subjective, varying among end-users based on their perceptions and expectations. Value is conceptualized regarding the recipient end-user (Gunduz et al. 2022; Perry 2013) as it deems something valuable when its implicit or explicit needs are met (Agrawal et al. 2022; Porter and Kramer 2011). This perspective aligns with the "names-and-faces approach" to engagement (Mcvea and Freeman, 2005). Different end-users have different needs and perceive value differently; therefore, we subscribe to the idea that value is socially constructed (Li et al. 2023; De Silva et al. 2021).

These three attributes of value are the basis for understanding the key distinction between 1) expected value, 2) espoused value, and 3) enacted value (Hart 1971; Martinsuo 2020), which we will leverage to explain how organizations in complex project ecologies engage with their end-users.

Expected value is the value a subject expects to gain from an object and is interested in exchanging something for (e.g., money, knowledge, IPRs) (Vegas-Fernández 2022). Value cannot be treated as a mere quality of an object nor as the mere mental quality of a subject (Perry 2013) but emerges in a relation between the object (e.g., satellite data) and the expected value of the subject (e.g., expected value regarding the adoption of satellite data in taking tactical and strategic decisions) (Hart 1971). End-users interested in adopting satellite data in their decision-making manifest expected value.

Espoused value is the value a subject claims is achievable through an object (Esnaashary Esfahani et al. 2020). Individuals and organizations explicitly define and communicate the espoused value (Tariq and Zhang 2021). Organizations in the space project ecology espouse their value toward their end-users. For example, a satellite service provider company claims to offer satellite data for high-performance pipeline monitoring for energy companies.

Enacted value is the value a subject may (or may not) obtain in using the object (Bowman and Ambrosini 2000; Swanson and Sakhrani 2020). End-users who, for example, improve their services, reduce their costs, or acquire new knowledge by adopting satellite data in their decision-making, enact the value of complex space projects.

2.2. Engagement as a mean for value enactment

Value and engagement are strictly connected. Since Freeman's (1984) seminal work, stakeholder engagement has been conceptualized as a mean for value enactment both in general management (Oh et al. 2023; Signori 2017; Storbacka et al. 2016) and in project studies (Di Maddaloni and Davis 2017; Lehtinen and Aaltonen 2020). This section illustrates what engagement means in complex projects and how it is operationalized by organizations in the complex projects' ecologies.

Engagement describes the involvement of stakeholders in organizational activities and decision-making processes (Sachs and Kujala 2021). It includes purposeful actions, either strategic or tactical, undertaken by an organization to address the interests and expectations related to stakeholders' relationships (Missonier and Loufrani-Fedida 2014; Sachs and Kujala 2022). Engagement is proactive, including planning and managing stakeholder engagement duties, roles, and activities (Eskerod et al. 2015). It is often presented under the umbrella of the agency theory as the way of explaining the interests, expectations, aims, connections, and actions of stakeholders in the organization's activities (Maak 2007). Different frameworks have been proposed in this sense, such as the power-interest (Eissa et al. 2021; Johnson et al. 2008) and salience-position matrices (Aaltonen et al. 2016; Gunduz et al. 2022), used to evaluate stakeholders' salience or to develop suitable engagement practices respectively. Indeed, engagement practices are designed, adapted, and transformed based on the characteristics of the target stakeholders (Choi et al. 2020; Lee et al. 2023; Missonier and Loufrani-Fedida 2014).

Stakeholder literature has documented various engagement practices (Freeman et al. 2017), which can be broadly clustered into two groups: "one-way engagement", from an organization to its stakeholders, which includes information evenings and seminars, press releases, surveys, media outreaches, public hearings, notifications, leaflets, bulletins, articles, and websites (El-Gohary et al. 2006; Eskerod et al. 2015; Lehtinen et al. 2019). "Two-way engagement" with stakeholders includes activities such as visits, conferences, personal meetings, workshops, focus and working groups, phone conversations, and roundtable talks (El-Gohary et al. 2006; Eskerod et al. 2015; Lehtinen et al. 2019). The focus of extant literature is mainly on the engagement practices among the stakeholders in complex projects' ecologies (Lehtinen and Aaltonen 2020), such as informing, consulting, dialoguing with, and making joint decisions with stakeholders (Greenwood 2007; Hedborg and Gustavsson Karrbom 2020; Lehtimaki and Kujala 2017).

2.3. Complex projects' ecologies

In this section, we present the three key elements of project ecologies, as they are discussed in the literature, that are fundamental to understanding our research setting and the relevance of taking a project ecology perspective to understand the value of complex projects, and the engagement practices adopted by organizations in the complex projects' ecologies toward their end-users.

First, project ecology encompasses the study of the project and its environment (Söderlund 2004), offering a contextual view to study complex projects (Grabher and Ibert 2011). Project ecology simultaneously includes at least five structural elements whose aggregation is defined by the isomorphism principle (Hannan and Freeman 1977). They are 1) individual members (e.g., project manager of space project X, project manager of space project Y); 2) project ecology subunits (e.g., space project X team, space project Y team); 3) individual organizations (e.g., space project X, space project Y); 4) populations of organizations (e.g., space project X contractors, suppliers, stakeholders; space project Y contractors, suppliers, stakeholders); and 5) communities of populations (e.g., space projects contractors, suppliers, stakeholders).

Second, project ecologies are "*the relational space which affords the personal, organizational and institutional resources for performing projects*" (Grabher and Ibert 2011, p. 176). Relationships and knowledge sharing play a key role in enacting the value of complex projects (Hedborg et al. 2020). Indeed, as highlighted by Grabher et al. (2009), knowledge created in a complex project can be reused in successive projects, feeding into a cumulative process of learning (Grabher 2004) that may open up access to a broader audience of end-users (Bahadorestani et al. 2020). Three main properties, describing the "architecture of learning" of project ecologies (Grabher 2004; Grabher et al. 2009), are relevant to understanding the engagement practices of organizations in complex projects' ecologies toward their end-users. 1) "Communality", that is, exchanging experience about knowing how organizations and individuals can enact value, favoring the identification of possible actors able to perform a given activity. 2) "Sociality", that is, the possibility of acquiring know-whom, like in a village where everyone knows who is doing what, the strong interdependencies between the actors in

the ecology make it easier to know which organization or individual can perform a given activity. 3) "Connectivity", that is, the possibility to upgrade the know-how" (Grabher 2004). In other words, the strong interdependencies and relationships in a complex project's ecology are necessary conditions to develop a complex project (e.g., satellite-based water leakages monitoring system), as the single parts (e.g., satellites, organizations analyzing the data) are useless without the system (e.g., complex space project's ecology).

Third, project ecologies are heterarchical and dynamic, i.e., any structural element can govern or be governed by other ones (Grabher 2002). In projects' ecologies, rather than "orchestrate", individuals and organizations "improvisate" by deliberately changing their habit patterns (Grabher 2004), fostering adaptability, which is the organizational capability of coping with unforeseen challenges (Grabher 2002). Heterarchy distinguishes ecologies from ecosystems and platforms, which are hierarchical structures; the ecosystem's existence is predicated on operationalizing the focal firm's value proposition (Adner 2017; Gunduz et al. 2022), and platforms are characterized by the value proposition of the platform orchestrator toward the platform's "sides" (e.g., supply and demand sides) (Gawer and Cusumano 2014). Improvisation and adaptability in projects' ecologies are particularly relevant for engagement, as the practices adopted by a single organization in the project's ecology may benefit other organizations who may take the lead in the next phase (Bahadorestani et al. 2020). For instance, a research institute belonging to the space project ecology may collaborate with an end-user in the energy sector, effectively demonstrating the value of satellite data for pipeline monitoring. Upon comprehending the espoused value of satellite data, the end-user may opt to invest in a related project. Therefore, end-users may be a temporary part of the project ecology (e.g. by committing resources to the project development) and, after its completion, become permanent actors of the ecology (Hedborg et al. 2020). Alternatively, end-users can exploit the outputs of the project, developed in the complex project's ecology (e.g., buying satellite-based data and services), without becoming part of the ecology (Hedborg and Gustavsson Karrbom 2020).

3. METHODOLOGY

3.1. The empirical setting: the European space project ecology

The empirical setting of our research is the European complex space projects' ecology. The space domain offers an ideal landscape to study the engagement practices adopted by organizations in the complex projects' ecologies toward their end-users. The complex space projects' ecology is characterized by heterogeneous but interdependent complex space projects that create value for end-users and favor the development of new businesses and even industries (Paravano et al. 2023). For instance, the Global Navigation System (GPS) space infrastructure enables businesses flourishing based on satellite data, such as UBER, Deliveroo, and DHL. Satellite data can be used to monitor infrastructural assets, detect pipeline leakages, assess biodiversity, support epidemiology modeling, and estimate climate change-related and environmental risks, enabling new services in many sectors (e.g., insurance, agriculture, energy). In space project's ecology, space projects are highly technological and capital-intensive (Ansar and Flyvbjerg 2022) with limited flexibility due to the relatively short operational life of a space infrastructure (in most circumstances, the operational life of a satellite is around 13 years) hardly extendable (Park et al. 2020). Space projects entail the development of satellites dedicated to Earth observation, communication, and navigation, along with pioneering endeavors in space science, human spaceflight, and advancements in space technology.

The European space projects' ecology includes institutions and companies that design, develop and operate the space infrastructure, and plan, deliver, and operate space projects as a core mission (ESPI 2019). Institutions consist of supranational space agencies such as the European Space Agency and the European Union Agency for the Space Programme, and national space agencies such as the Centre national d'études spatiales in France, the Italian Space Agency in Italy, and the Deutsches Zentrum für Luft- und Raumfahrt in Germany. Space agencies coordinate and fund various space projects at different regional levels. Research Institutions, universities, and research centers across

255 Europe are engaged in space-related research. They contribute to advancing space science,
256 developing new technologies, and training future space scientists and engineers (Vidmar 2021). The
257 European space projects' ecology encompasses various companies, including large enterprises,
258 SMEs, and innovative start-ups, all actively engaged in space project development.

259 In the European space projects' ecology, institutional (e.g., Copernicus Relays, universities),
260 private (e.g., consultancy companies), and individual (e.g., professionals) intermediaries play a key
261 role in supporting the diffusion of new digital technologies by combining their knowledge and the
262 knowledge from the space ecology (Vidmar 2021). Intermediaries also provide space projects'
263 ecology knowledge, i.e., knowledge of "who and where" (Clarysse et al. 2014) to the organizations
264 in the ecology. Furthermore, intermediaries support end-users in understanding which organizations
265 belong to the space projects' ecology, where they are located, and how to engage them. For example,
266 the Copernicus Relays are institutional intermediaries with the policy mandate to facilitate the
267 involvement of new organizations in the European space project ecology. They have technology-
268 specific and sector-specific knowledge and skills and context-specific knowledge to foster the
269 adoption and diffusion of open innovation practices (Copernicus Relays 2020). Individuals (e.g.,
270 engineers, managers, lawyers, researchers, consultants), and project teams play a key role in
271 supporting the development of space projects. In terms of geographical scope, organizations in the
272 European space projects' ecology operate at the continental scale since 1) the need for asset and
273 resource integration is a key element of the ecology that can be obtained only at the multinational
274 level, 2) space infrastructure is easily scalable in terms of services (for example, the same satellite
275 captures data from Italy, France, Norway, Germany and data providers can therefore offer the same
276 service to end-users dislocated in different countries; OECD 2022).

277 Understanding how and why the organizations in the European space projects' ecology engage
278 their end-users to enact value of space projects (e.g., organizations belonging to other industries, such
279 as energy or food, that use or may use, space data or services in their business processes), is essential

for the future of the European space projects' ecology. Figure 1 exemplifies the organizations in the European space projects' ecology and their end-users.

[Figure 1]

Figure 1: The Space Projects' Ecology

3.2. Research design

Since there is a limited understanding of the engagement practices adopted by organizations in complex projects' ecologies toward their end-users, we adopted a Grounded theory approach (Corbin and Strauss 1990). By adopting a Grounded theory approach, we were able to capture the complexity and nuances of engagement practices inductively. Moreover, a Grounded theory approach enabled us to analyze data from multiple organizations to compare and contrast different sources to identify patterns and themes (Corbin and Strauss 2015). Ultimately, we developed a theoretical framework based on the collected primary and secondary data. The unit of analysis of this study is the engagement practices adopted by the organizations in the European space complex projects' ecology toward their end-users.

From an epistemological perspective, we position our research in the critical constructivism domain (Kincheloe 2005; Mir and Watson 2001). This positioning is in line with the recent body of knowledge of value in complex projects (Martinsuo 2020) that consists of asking individuals and observing the manifestation of value in practice while acknowledging the inaccuracies of human perception (Hart 1971; Saunders et al. 2009).

3.3. Data collection

According to the Grounded theory approach (Corbin and Strauss 1990), we iteratively collected and analyzed data regarding the practices adopted by organizations in the European space project ecology to engage their end-users.

306 We adopted two consecutive sampling strategies, one for the organization's sampling and one for
307 the managers working in such organizations. We selected organizations through purposive sampling
308 (Coyne 1997). We based the selection on the deep knowledge of the empirical setting of two authors,
309 therefore A) we selected organizations in the European space projects' ecology that had engaged their
310 end-users in recent years. B) we selected European end-users that the organizations in the European
311 space projects' ecology had engaged in recent years. Interviewing end-users allowed us to explain
312 their perception of the engagement practices adopted by the organizations in the European space
313 projects' ecology. Managers were selected through purposive sampling (Palinkas 2014; Patton 2014)
314 according to their job content and direct involvement in engagement activities between the
315 organization in the complex project ecology and their end-user. We conducted 31 interviews,
316 including A) 14 managers of the organizations in the European space projects' ecology, with an
317 average of 22 years of experience (the interviews lasted an average of 55 minutes), and B) 17
318 managers of the end-users, with an average of 15 years of experience (the interviews lasted on average
319 58 minutes). The sampling stopped when we reached theoretical saturation (Saunders et al. 2015).
320 Table 2 in the Appendix details the profiles of the interviewees. All the conversations occurred online,
321 and all the interviewees and organizations were granted anonymity.
322 Leveraging the deep knowledge about the empirical context of two of the three authors, we
323 conducted open interviews with space managers departing from the question, "*How did you engage*
324 *end-users?*". We started the interview with end-user managers asking, "*How did the organizations in*
325 *the space project ecology engage you*?". We used the respondent's frame of reference rather than our
326 pre-structured frame (Bryman, Alan; Bell 2011; Easterby-Smith, Mark; Thorpe, Richard; Jackson
327 2015). As guidance, to touch on relevant topics, we used notes taken from Greenwood (2007),
328 Chinyio and Akintoye (2008), Yang et al. (2011), and Lehtinen et al. (2019a, 2020), detailed in
329 Appendix Table 3. We received authorization to record 28 out of 31 and took extensive notes for all
330 the interviews. We leveraged secondary data to validate and triangulate the interviews (Jick 1979).
331 For instance, if the interviewee mentioned a certain space project (e.g., satellite Sentinel 2), we

collected relevant data about such a project. Table 4 in the Appendix summarizes the types of secondary data sources triangulated for each interview.

3.4. Data analysis

The data analysis was based on immersion in the data and repeated sorting, coding, and comparison (Corbin and Strauss 2015), supported by Atlas.ti. We began with open coding, examining individual words, phrases, and sentences, and creating codes and categories. For example, "*scouting a personal herald*" (Int 20). We systematically compared and contrasted the codes individuated, generating increasingly complex and inclusive categories. The first author also wrote analytic and reflective memos to document and enrich the analytic process, make implicit thoughts explicit, and expand the data corpus. Analytic memos consisted of questions, musings, and speculations about the data and emerging theory. For example, "*Int 6, belonging to an insurance company, was engaged by a space manager interested in understanding their needs rather than selling products"*. Then, we performed axial coding by combining data and categories in new ways, "making connections between a category and its subcategories" (Corbin and Strauss, 1990, p. 97). We assigned in vivo labels to these categories. In the Findings, the underlined sentences correspond to the axial codes in Figure 3 in the Appendix.

Finally, we ensured selective coding. It was an integrative and systematic process to select the core categories, e.g., "Empowering value interpretation". We followed the Strauss and Corbin (1994) criteria for core status: 1) category's centrality (i.e., how the category is central for the theory development), 2) frequency of category occurrence in the data, 3) inclusiveness (i.e., include all the relevant categories, especially if they are in contrast), 4) clarity of the category implication for a more general theory, 5) theoretical power (i.e., the power in explain why the phenomenon occurs), and 6) its allowance for maximum variation of dimensions, properties, conditions and consequences.

We compared the core categories with the other categories by searching for confirming examples, e.g., *"End-user managers value the support of managers of organizations in the project ecology in*

understanding the value of space technologies", and disconfirming examples, e.g., *"End-user managers do not understand why managers of organizations in the project ecology engage them"*. We sorted, compared, and contrasted all the codes and categories until saturation, which means there were no new codes, and all the data were accounted for in the core categories of the grounded theory paradigm model (Morrow and Smith 1995). Given the large amount of data collected, we followed the advice of Corbin and Strauss (2015) to guarantee a rigorous approach and robust findings. We regularly discussed the research process to ensure robustness and accountability in data collection and analysis. We documented the evolution of the codes, categories, and theory and all the research activities, such as pre-entry conceptualizations, field entry, interviews, transcription, initial coding, coding and analytic activities, and the development of the conceptual model. Figure A in the Appendix represents the coding suggested by Saldaña (2013, p. 219).

We also carefully reviewed the 327 in-vivo codes that formed the basis of our analysis. We sought disconfirming evidence to avoid confirmation bias. We analyzed discrepancies through discrepant case analysis. Lastly, the framework was validated with a lengthy interview with a leading expert with more than 20 years of experience in the business.

4. FINDINGS

Figure 2 presents the grounded theory framework explaining how organizations in the space projects' ecology engage their end-users to enact value. We identified four classes (detailed in the next sections) of engagement practices: 1) personal for value espoused (outbound), 2) personal for value expected (inbound), 3) personal for value enacted (iterative), and 4) non-personal.

[Figure 2]

Figure 2: Conceptual framework of engagement between organizations in space projects' ecologies and their end-users

Our data shows that individuals, i.e., managers, play a pivotal role in the engagement between organizations in the space project ecology and their end-users. Individuals embrace the engagement practices in line with the organization's engagement principles (i.e., guidelines and instruments) and, over time, improve the engagement principles by implementing feedback resulting from the engagement.

Personal engagement, i.e., the engagement between managers of organizations in the space project ecology (i.e., space managers) and their end-users (i.e., end-user managers), plays a key role in supporting organizations in the complex project ecology and their end-users to enact the value of space projects, because "*It's all about people*" (Int 8). Managers are boundary spanners of their organizations. We observed a cycle of engagement in which space and end-user managers keep engaging over time, even across projects, which aligns with the project ecology perspective.

Taking the space manager's perspective, the engagement develops in two directions. 1) Along the Outbound direction, space managers engage end-user managers to espouse their value proposition and empower them to understand it (section 4.1). 2) Along the Inbound direction, space managers embrace engagement practices such as meetings, workshops, and inquiries to be engaged by the end-user managers to understand their value expectations (section 4.2).

We also found an inner cycle of personal engagement in which engagement practices adopted by space managers aim to enact the value of complex projects for end-user managers in an iteratively personal relationship (section 4.3). Engagement develops over time, over projects, meetings, calls, coffee breaks, and product co-development workshops between space and end-user managers. Over time, the managers get to know each other professionally and personally, and start enacting the value of such relationships. Personal dimensions of engagement, such as trust and personal reputation, are the key to nourishing the relationship and enhancing its value. As a result, individuals become "heralds" of the relationship within their organizations, give feedback to the organization to improve the impersonal engagement practices, and enact the value of the space project ecology.

Organizations in the complex project ecology adopt non-personal practices (section 4.4) to engage (e.g., websites, tutorials) and be engaged (e.g., digital platforms, open innovation calls) by their end-users. Here, we consider non-personal engagement as the class of engagement practices independent of personal relationships between individuals, where the term "personal relationship" denotes a physical, cognitive, and emotional connection between individuals (Kahn 1990). The main characteristic of non-personal engagement practices is that the organization manages them, and that the engaged manager perceives to be reached out by an organization, not an individual. Here, the classification driver is not the nature of the practice (e.g., newsletter vs. meeting), but the nature of the agent that establishes the relationship (e.g., from organization to manager vs. from manager to manager) (Mcvea and Freeman 2005). For example, the newsletter does not imply a personal relationship between the sender and the receiver, even if the newsletter may engage the receiver and emotionally connect with the newsletter's content (not the individual sending the newsletter). Non-personal engagement results in the first step of the engagement and is primarily driven by organizations in the complex project ecology that expect value from the engagement with their end-users, as said by Int 16: "*We engage other organizations because we expect to gain value from the relationship*".

Overall, we identified subsets of specific engagement practices applied to implement different engagement classes, as detailed in Table 1 and highlighted in bold in the following sections.

[Table 1]

Table 1: Engagement practices of organizations in the space project ecology toward their end-users

4.1. Personal engagement practices for value espoused (Outbound)

Space managers adopt engagement practices to espouse the value of space projects to end-user managers. Our findings show that end-user managers struggle to understand the value of satellite data and, more in general, to understand the value coming from the space projects, "*Sincerely, I don't understand the value of satellite data, how could I use them to provide insurance service?*" (Int 28).

435 Space managers leverage engagement to support end-users in 1) clarifying their needs, 2) bridging
436 the competencies gap, by 3) favouring open discussion.

437 Our findings show that end-user managers do not clearly understand their needs. To this end, space
438 managers help end-user managers clarify their needs and the potential value of satellite data in solving
439 them. Space managers leverage exploratory **calls** and **meetings** to explore end-users needs: "*From*
440 *the formal and informal dialogues with end-users, we understood that it was necessary to move from*
441 *providing processed images to providing easy-to-read information for the end-user, anticipating*
442 *responses to needs that they had not identified*" (Int 19). Furthermore, space managers develop
443 **guided free trials** to support end-users in the identification of the complementarities and
444 commonalities between the solutions and their possible needs, *"When you try to use satellites to solve*
445 *your need (e.g., monitor the infrastructure) and there is someone experienced in helping you*
446 *understand the potential, you can understand the true value of satellite. You leave the meeting*
447 *wondering, why didn't we do it before?"* (Int15).

448 Space managers engage end-user managers to bridge the competencies gap. They leverage **guided**
449 **free trials**, and **meetings** with end-user managers to show the value of their satellite-based products
450 and services, and offer end-user managers learning tools. "*We sit together in front of a computer, and*
451 *we guide end-user managers in navigating our solutions. They touch with their hands the value that*
452 *satellite data can bring to them and their organization*" (Int2).

453 To espouse the value of complex projects, space managers tend to open to personal relationships
454 with end-user managers based on transparent conversations and personal reputation, "*In our industry,*
455 *communicating does not mean building a webpage that end-users can consult. It is a smokescreen. I*
456 *prefer to write on the website, "Please, contact me for info by email", and receive the message. An*
457 *open dialogue starts*" (Int 21). Counterintuitively, rather than engage end-user managers to show their
458 portfolio of products and services, acting as providers of satellite data, space managers implement
459 engagement practices to explore end-user managers' needs, acting as boundary spanners. *"The real*
460 *difficulty is that end-user managers often do not know their needs. An insurer did not consider it*

important to monitor the roofs of houses because too expensive. I presented her with a case showing competitors' use of satellite data. There the conversation opened" (Int 7).

4.2. Personal engagement practices for value expected (Inbound)

Space managers adopt engagement practices to be engaged by end-user managers and understand the end-users expected value. Space managers leverage **messages**, phone **calls,** and **meetings** to share their needs with end-user managers and look for solutions. Space managers adopt these practices to gain the end-user managers' experience and cope with the context's uncertainty.

To gain the end-user managers experience, space managers pointed out that they have to be able to listen and implement end-user managers' suggestions. Space managers invite **intermediaries** with multidisciplinary experience and necessary competencies to bridge their value espoused and the end-user managers' expected value. Intermediaries act as "translators", facilitating the dialogue between space and end-user managers and helping space managers understand the value expected by the end-user managers by learning the end-users' language. *"I make satellites. I understand that other sectors can get stimuli to improve my product, but I struggle to speak their language. For this, I involve consultants or people external to the company who act as intermediaries and help me to 'translate' their language into my language"* (Int 9).

Space managers leverage **meetings and calls** with end-user managers to cope with the context uncertainty, by assessing the gap between their value espoused and the value expected by end-user managers. "*I prefer to be called to understand if their [ed. End-user] expectation coincides with reality. It's important because the value they expect often does not coincide with what I espoused"* (Int 19), and building new personal relationships as "*You have to know new people. The context is changing. You have to be open and make people find you*" (Int 24).

4.3. Personal engagement practices for value enacted (Iterative)

Value enactment occurs mainly at the individual level through continuous engagement and personal relationships between space and end-user managers. *"In the end, what leads to participate in a project is a mutual trust matured over time in a personal relationship. In our high-risky sector, it would be otherwise impossible"* (Int 21). Space managers recognize the importance of personal engagement for value enactment, based on a valuable and genuine personal relationship, with people who become personal heralds of the complex project value.

Space managers engage end-user managers to create a genuine personal relationship. Promoting trust through **events and workshops** is a necessary condition but not sufficient for value enactment. Leveraging the relationship, end-user managers are committed to enacting the expected value from space products and services (e.g., satellite data for insightful information on pipelines). On the other hand, space managers can shape their value espoused to meet the end-users expected value, thus enacting the value espoused. Value enactment is nourished through **formal** and **informal relational events** (e.g., personal meetings) between space and end-user managers. In the early stages of the engagement, meeting in an informal environment helps space and end-user managers to know each other professionally and personally, recognizing mutual interests and trust. *"Often everything is born in front of a coffee machine; informally, it is easier to know your interlocutor and get in touch"* (Int 1).

Space managers exploit the value of the relationship over time by nourishing a continuous collaboration as "*It's not one shot. You need time. You have to continuously collaborate with the other manager*" (Int 22). Collaboration requires managers to be open and to enable new relationships between end-user managers and their personal network in the ecology to enact the value of complex projects. Indeed, "*It's all about people, and you have to be open-minded. For example, an urban manager called me to develop a satellite-based indicator to monitor air quality, the environment, and the impact of one on the other. […] I know the manager well, and we are good friends. I put his tech*

guy in touch with one of our techs, and they talked, and they understood each other, and we solved their problem. Ultimately, they were happy because the problem was solved". (Int 2)

Space and end-user managers, over time, become personal heralds of the value of complex projects, enacting it in their organizations. To this end, **informal meetings** enable managers to identify the right person: "*It's all about people. You have to spot the right person who can understand you and show you the way*" (Int 20). Often, space managers struggle to speak the end-user managers' language and vice-versa. Again, the presence of **intermediaries** is essential to overcome this barrier: "*It is a "language" problem. It is necessary to participate in events where facilitators, or translators, help the organization external to our industry to speak and understand each other. For example, the initiatives some universities promote with this purpose are very useful*" (Int 23). Space and end-user managers consider mediated workshops and networking events the most effective practice intermediaries implement. "*Attending workshops facilitated by the intermediaries simplify the interaction with organizations and managers external to the ecology, making the engagement more effective*" (Int. 5). Intermediaries also play a key role in scouting the right contact person within the organization to engage.

4.4. Non-personal engagement practices

Organizations in the space project ecology adopt several non-personal engagement practices to enable personal engagement. Non-personal engagement practices aim to increase organization permeability and promote transparent communication.

To increase their permeability, organizations in the space project ecology implement **open innovation calls** to be engaged by their end-users and to make their end-users aware of the opportunities coming from space projects. *"The industry is rapidly evolving; we decided to make several calls for start-ups and calls for ideas to acquire new stimuli and find someone who could create value from using our data"* (Int 21). End-users report that open calls are effective if organizations in the complex project ecology treat them fairly and transparently share needs and

536 solutions during the entire open call period. "*The call is a great opportunity, but for the collaboration*
537 *to materialize, the space stakeholder must open up and give us all the information to meet their*
538 *expectations"* (Int 12).

539 Organizations in the space project ecology leverage **intermediaries,** i.e., organizations such as
540 consultancy companies, incubators, and universities, to fill the literacy gaps between their end-users
541 and them. "*My company is in a very up position of the value chain; it is necessary to engage*
542 *intermediaries between the end-users (e.g., insurance, energy) and us; otherwise, it would not be*
543 *possible to understand their needs*" (Int 26). To cope with the literacy issue and reduce the distance
544 between the value espoused by organizations in the space project ecology and the value expected by
545 their end-users, organizations in the space project ecology train their managers to understand non-
546 space domains, and hire end-user managers. "*We hire managers from other industries and train our*
547 *people to no longer be just technical experts"* (Int 3).

548 Moreover, our results show that organizations in the space project ecology use **digital platforms**
549 as the main engagement tool through which end-users can get the right contacts to ask for
550 explanations, "*We are developing a platform, a digital marketplace. End-users may register to the*
551 *portal, receive all the useful information, and know our value proposition. Contacting us via the*
552 *platform is also possible to start a conversation. It is open to all"* (Int 4). Digital platforms help end-
553 users understand the value espoused by space organizations and assess if it aligns with their value
554 expectation. On the other side, end-users highlighted the usefulness of digital platforms for exploring
555 the value espoused by space organizations, yet this is useful only at the preliminary stages of the
556 engagement, which will be built through personal relationships: "*They* [ed. space organizations] *are*
557 *promoting the usage of digital platforms that are useful for preliminary engagement and exploring*
558 *their solutions. Building a personal relationship is the first step*" (Int 12).

559 Organizations in the space project ecology promote transparent communication with their end-
560 users. Organizations in the space project ecology use **newsletters** and **websites** to espouse their value
561 proposition. *"The first means to make themselves* [ed. the organization] *known is the website; we show*

562 *them who we are and our value proposition"* (Int 26). Organizations in the space project ecology also
563 use **seminars** and **tutorials** as dissemination practices to espouse their value and the value of their
564 projects. In practical terms, they give the instruments to their end-users to understand the value
565 coming from the adoption of satellite data in their businesses, "*We believe that there is, first of all, a*
566 *literacy problem. That's why we started a series of free seminars for the end-users of our ecology. We*
567 *explained simply what a satellite can do*" (Int 8).
568
569

570 # 5. DISCUSSION

571 ## 5.1. Leveraging personal engagement for complex projects value enactment

572 As presented in sections 4.1, 4.2, and 4.3, value enactment occurs through engagement at the
573 individual level, not just at the organizational level. In the literature, most studies investigate
574 engagement and value from the organization's perspective (project or firm) (Bondy and Charles 2020;
575 Miles 2017). This organization-centric perspective results in the under-representation of the role of
576 individuals (Di Maddaloni and Davis 2017; Lu et al. 2021). Engagement is a matter of human
577 behavior in enacting value. Our findings in sections 4.1 and 4.2 align with Mcvea and Freeman's
578 (2005) *"names and face approach"*, according to which an exclusive analytical focus on the level of
579 groups or organizations as stakeholders might fall short when individuals are not taken into account
580 (Lee et al. 2023; Sachs and Kujala 2022). Indeed, our findings show the relevance of personal
581 engagement for space managers to clarify the end-user needs and bridge the competencies gap,
582 resulting in engagement practices such as meetings and guided free trials to espouse the value of
583 complex space projects (section 4.1). Our findings show that personal engagement plays a key role
584 in developing an understanding of the expected value of end-users, favoring space managers in
585 gaining the end-user experience and coping with context uncertainty (section 4.2). This personal focus
586 emphasizes the need to move away from the simplifications offered by role-based identification of
587 standard stakeholder groups (Harrison and Wicks 2013) to point toward identifying stakeholders as

588 individuals belonging to organizations with their specific identities and interests (Bundy et al. 2018;
589 Vegas-Fernández 2022). Managers in the organizations of complex projects' ecologies need to
590 implement engagement practices such as leveraging intermediaries (Aspeteg and Bergek 2020) to
591 engage end-users and bridge the value espoused and expected (Zerjav 2021).

592 We found that engagement occurs among individuals who are boundary spanners of their
593 organizations and promotes the relationship between the organizations over time, creating a genuine
594 relationship, exploiting its value, and becoming heralds (section 4.3). This phenomenon is discussed
595 in the boundary spanners literature (Sandal Stjerne et al. 2018), according to which boundary spanners
596 are key individuals working at the organizational interface, engaging in information processing and
597 external representation (Cao et al. 2021). Individuals as boundary spanners are fundamental in both
598 directions of engagement (from space manager to end-user manager and vice versa) and play a key
599 role in sharing the organization's espoused or expected value with the counterpart. In this regard, we
600 complement Aaltonen et al. (2010) and Eskerod et al. (2015), who studied how organizations in the
601 project ecology react to end-users engagement by showing that organizations in the project ecology
602 adopt engagement practices to be engaged by their end-users. This idea is consistent with the key
603 insights of the "open innovation" literature (Chesbrough et al. 2018; De Silva et al. 2021), according
604 to which organizations have to open their boundaries, exercise their innovation capabilities and get
605 more aligned with the value expectation of their end-users to make innovation happen (Gunduz et al.
606 2022; Obradović et al. 2021). In this regard, our findings in section 4.4 complement Lehtinen et al.
607 (2019), who call for "permeability" (p. 47) of the system's organizational boundaries to allow timely
608 engagement, showing that, in complex projects' ecologies, non-personal engagement practices
609 increase permeability and promote transparent communication between organizations in the complex
610 project's ecology and their end-users.
611

5.2. Value-led engagement practices: a complementary view to the extant literature

Our findings show that the value (i.e., espoused, expected, and enacted) shapes the engagement practices of organizations in the complex projects' ecologies toward their end-users, not vice-versa. In the literature, the narrative of value and engagement is mostly in one direction, from engagement to value (Choi et al. 2020; Khan et al. 2021; Lehtinen and Aaltonen 2020). There is little evidence of literature discussing the opposite direction, i.e., how different forms of value lead to planning and delivering end-user engagement. The distinction is relevant, particularly when considering the recent debate among the scientific community on outlining the characteristics of the value in projects to move beyond the triple bottom line (Bahadorestani et al. 2020; Laursen 2018; Martinsuo 2020). We show that different engagement practices are adopted for each form of value (i.e., espoused, expected, and enacted) as shown in Table 1.

Our findings show that space managers adopt guided trials and meetings to espouse the value of their organizations to end-user managers (section 4.1). These practices go more in-depth than the traditional stakeholder communication and information practices (Vuorinen and Martinsuo 2019); here, the personal level favors end-user managers to become aware and understand the value of space projects' ecology. This complements Vegas-Fernández (2022), who claims the need for a personal relationship between individuals to reduce stakeholders' marginalization; in our case, engagement and value espoused is toward end-users, who are not necessary stakeholders of the complex project but for whom the complex project may enact value.

Space managers adopt engagement practices such as meetings to be engaged and understand the expected value of end-user managers (section 4.2). Literature looks little at this phenomenon, which is often seen as a practice to reduce risks of stakeholder management (Aaltonen et al. 2010; Vegas-Fernández 2022) rather than a process for value enactment. Here, a key role is played by intermediaries invited to these meetings who act as translators (De Silva et al. 2021), bridging the language and cultural barriers between the space and end-user managers, those forcing the commonalities and connectivity properties of project ecologies (Grabher 2004). Finally, we showed

638 that relational events, prototyping, and workshops are engagement practices that favor the personal
639 relationship between space and end-user managers, enacting the value of space projects and
640 organizations in the space project ecology for their end-users (section 4.3). Here, we contribute with
641 practical insights to the emerging body of knowledge on project value (Aramali et al. 2022; Lee et al.
642 2023; Martinsuo 2020). We claim that value takes place within individuals' minds by presenting a
643 fresh outlook on how value management is approached in complex projects, and challenging the
644 existing notion of value management constrained within the organization's boundaries (Gaur and
645 Tawalare 2022; Vuorinen and Martinsuo 2019).
646
647 **5.3. Unraveling the value of complex projects through the ecology perspective**
648 Literature about project value takes the single project in isolation as a unit of analysis (Vuorinen
649 and Martinsuo 2019; Zubair and Zhang 2022). This is perfectly adequate for relatively simple
650 projects, such as building a school, because 1) the project objective is very clear and specific, i.e.,
651 construct a functional and habitable learning space, 2) evaluating the achievement of this objective is
652 relatively easy and based on well-defined metrics, such as completion time, budget adherence, and
653 meeting the client's requirements, 3) there is limited complexity, building a school follows a
654 structured process, with well-established design and construction practices (Aramali et al. 2021).
655 However, things radically change when we consider complex projects (Gao et al. 2018) and their
656 environment, that is, their ecology (Hedborg and Gustavsson Karrbom 2020). Managers of
657 organizations in complex projects' ecologies wonder which end-user they can engage to enact the
658 value of the complex project they are involved in (Gaur and Tawalare 2022). For example, as shown
659 in our empirical setting, the greater accessibility to satellite data and the easy use of digital
660 technologies (e.g., AI, Machine learning, big data) for data processing and exploitation, are forcing
661 organizations in the space project ecology to engage with end-users to enact the value of their complex
662 projects (section 4.1). While the narrative about project value suffices to explain how a project enacts
663 value for its stakeholders (Le et al. 2021), it falls short of unfolding the enacted value of a complex

project for its intended end-users, from a broader economic and societal perspective. Our findings show that the complex projects value enactment occurs at the project ecology level, meaning that organizations (e.g., space companies and intermediaries) and individuals (e.g., managers) jointly enact the value of space complex projects toward their end-users. Our results confirm that the value of complex space projects can be fully understood only by taking a broader perspective, i.e., the complex projects' ecology that includes additional levels of analysis (Zerjav 2021). Although the complex projects' ecology is heterarchical by nature (Grabher 2004), our findings emphasize the presence of a hierarchical process, from non-personal engagement practices (section 4.4), between organizations and individuals, to personal engagement practices, among individuals, which can be explained as a virtuous, reinforcing, and personal engagement cycle (sections 4.1-4.3) for value enactment. This is because engagement practices aim to align the value espoused by the organizations in the complex projects' ecology organizations to the value expectation of their end-users, enacting it (Esnaashary Esfahani et al. 2020; Hart 1971). Furthermore, in the case of complex space projects, tasks are knowledge-intensive and high in novelty (Tariq and Zhang 2021), project outcomes are largely unknown (or unknowable) in advance (Agrawal et al. 2022), and value should be transformed, not simply transferred among the parties (Zerjav 2021). To this end, we show the key role of intermediaries in supporting the "learning architectures" (Grabher 2004) of complex projects' ecologies (Aspeteg and Bergek 2020; De Silva et al. 2018). Intermediaries act as 1) translators, reinforcing the commonality properties of the ecology by supporting the exchange of experience between the space and the end-users managers in integrating satellite data and services in the business process, 2) explorers, fostering the acquiring properties of the ecology by leveraging the "knowing whom" develops satellite data and services for specific end-users, and finally as 3) integrators, supporting the know-how upgrade (i.e., how to use satellite data for specific end-users needs).

6. CONCLUSIONS

This paper aims to explain how organizations in complex projects' ecologies engage with their end-users to enact the value of complex projects. We show that 1) value enactment occurs through engagement at the individual level and not only at organizational level, linking for the first time the stakeholder engagement discourse with the boundary spanning in the context of complex projects' ecologies, 2) the form of value (i.e., espoused, expected, and enacted) shapes the engagement practices of organizations in the complex project's ecologies toward their end-users, and not only vice-versa, 3) a project ecology perspective is relevant to understand the value of complex projects from a broader perspective. Furthermore, we offer a fine-grained description and explanation of engagement practices, including new ones (e.g., intermediaries), and show that practices such as "utilizing heralds" are adopted by organizations in the complex projects' ecologies to engage their end-users, enacting the value of complex projects.

Taking the perspective of organizations in the European space projects' ecology, we provide a framework (Figure 2) gathering engagement practices in four main classes. 1) "Personal engagement for value espoused", adopted by space managers to espouse the value of complex space projects to end-user managers. For example, space managers use phone calls and emails to engage end-user managers. 2) "Personal engagement for value expected", engagement practices adopted by space managers to be engaged end-user managers and understand their value expectation. For example, space managers participate in conferences to personally meet and be engaged by end-user managers. 3) "Personal engagement for value enacted", engagement practices that reinforce the personal relationship and enact the value of complex space projects over time. For example, personal relational events during which discussing formally and informally and prototyping satellite data and services for their end-users. 4) "Non-personal" engagement practices adopted by organizations in the complex projects' ecology toward end-user organizations. For example, organizations in the space projects' ecology use open calls toward their end-users and leverage websites to engage end-user managers who impersonally browse the website for information.

Managers of organizations in complex projects' ecologies characterized by asset-intensive and high technological complex projects, such as quantum, artificial intelligence, and hydrogen, that need to engage with their end-users may leverage our framework (Figure 2) and a list of engagement practices (Table 1) to navigate the uncertain and complex context of new complex projects' ecologies in which they operate or will eventually operate. Depending on the value form (i.e., espoused, expected, and enacted) they want to exploit, managers can adopt engagement practices illustrated in this paper. We show that engagement occurs mainly at the individual level. In this regard, a balance of formal and informal engagement appears fundamental, and managers can leverage it when engaging their end-users and vice-versa. Finally, organizations should favor personal engagement practices by empowering and supporting managers dealing with end-user engagement, being individuals fundamental in enacting value.

Our study has three main limitations. First, we develop our study in the complex space projects' ecology setting, which is high-tech and asset-intensive. The engagement practices presented may not properly describe the engagement between organizations and their end-users in different ecologies (construction ecology). Second, the managers interviewed belong to European organizations, 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. Third, we focus on the private and civil space industry, lacking the defense industry's perspective that nevertheless plays an important role in the space projects' ecology.

Future research should address the organizational and individual processes that lead to the value espoused, expected, and enacted within their organizations and toward their end-users. This could complement our research on engagement practices and foster our understanding of the value enactment. In our study, we look at engagement practices; future studies should investigate disengagement practices and their relationship with the value enactment and engagement practices illustrated in our paper. Our research delves into the engagement practices among the organizations

in the complex project ecology and their end-users. Future research may complement our study by examining the engagement practices among the organizations in the complex projects' ecology. This may further extend the discourse on learning architectures proper of project ecologies. Another promising line of research is investigating the role of intermediaries in the engagement process. Finally, we suggest investigating organizations' dynamics and procedures to empower and support managers in their engagement practices.

Appendix – Data collection and data analysis further material

Data Availability Statement

Some or all data, models, or code generated or used during the study are proprietary or confidential in nature and may only be provided with restrictions.

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APPENDIX – DATA COLLECTION AND DATA ANALYSIS FURTHER MATERIAL

Table 2 interviewees profiles

Table 2 presents the interviewees' profiles, detailing the industry in which they work, their job role, year of experience in the industry, and the duration of the interview.

#	Industry	Job Role	Experience	Duration
Int 1	Space	Head of Research and Innovation	22 years	64 min
Int 2	Space	Head of Digital Transformation	20 years	53 min
Int 3	Space	Senior Vice President	21 years	57 min
Int 4	Space	Head of Research Program	12 years	51 min

Int 5	Space	Senior Program Manager	18 years	56 min
Int 6	Insurance	Data Scientist	12 years	62 min
Int 7	Space	Head of R&D and Innovation Institutional Manager	22 years	61 min
Int 8	Space	Director of European Institutional Affairs	34 years	62 min
Int 9	Space	Head of EO	21 years	57 min
Int 10	Insurance	Head of Portfolio Management	14 years	47 min
Int 11	Energy/Utilities	Head of Assets Coordination	18 years	63 min
Int 12	Energy/Utilities	Innovation and Partnerships Manager	22 years	43 min
Int 13	Logistics	Head of Technical Dept.	10 years	66 min
Int 14	Insurance	Head of Space	25 years	58 min
Int 15	Energy/Utilities	Head of Venture Building and Scouting	12 years	65 min
Int 16	Logistics	Head of Marketing, Communication and Strategic Business	28 years	59 min
Int 17	Energy/Utilities	Geodynamics and Monitoring dept. Engineer	11 years	67 min
Int 18	Insurance	Leading Expert Space Insurance Underwriting	24 years	46 min
Int 19	Space	CTO	26 years	44 min
Int 20	Energy	Head of Innovation	18 years	52 min
Int 21	Space	CTO	32 years	44 min
Int 22	Energy	Head of Open Innovation	14 years	61 min
Int 23	Space	Head of Market Development	16 years	60 min
Int 24	Space	Head of commercialization	18 years	57 min
Int 25	Insurance	Head of Innovation	13 years	68 min
Int 26	Space	Head of space commercialization	22 years	61 min
Int 27	Energy	Head of Innovation	14 years	58 min
Int 28	Insurance	Head of business development	13 years	60 min
Int 29	Insurance	President	31 years	52 min
Int 30	Insurance	Senior project manager	11 years	56 min
Int 31	Space	Head of business development	19 years	49 min
Int 1 - Validation	Space	Head of Research and Innovation	22 years	32 min

765

766 Table 3 – key topics
767 presents the interview topics used as checklist during the open interviews. In detail, it shows the key
768 questions, the topics of interest and the academic literature the are based on.

#	Question	Topics	Literature
1	Who are the space organizations/end-users?	Complex space project End-users identification	Based on: Mitchell, 1997; Aaltonen, 2016.
2	How do you engage with the space organizations/end-users?	How do you communicate with them? How do you involve them? How do you develop a relationship with them?	Based on: Greenwood, 2007; Chinyio and Akintoye, 2008.
3	What practices do you use to engage?	• Founding a joint organization • Implementing visual tools • Promoting active dialogues • Leveraging specialists in communication and arbitration • Fostering common guidelines or ground rule • Organizing personal meetings • Organizing inquiries: gathering feedback	Based on: Yang et al., 2011; Lehtinen et al., 2019a, 2020.
4	What are the benefits of engaging the stakeholder?	Economic value Social value Environmental value Expected value Espoused value Enacted value	Based on: Evan & Freeman, 1993; Freeman et al., 2007; Eskerod & Ang, 2017; Signori, 2017; Martinsuo, 2019, 2020

769

Table 4 – Secondary data

Table 4 presents the number of secondary data used to triangulate the interviews. For each interview, we specify the number of project reports, company reports, presentations, detailed plans, website news, and newspaper articles.

#	Project reports	Company reports	Presentations	Detailed plans	Website news	Newspaper article
Int 1	0	1	1	0	2	3
Int 2	0	1	0	0	1	2
Int 3	0	2	2	0	3	2
Int 4	0	0	1	1	1	1
Int 5	1	0	1	0	0	4
Int 6	1	1	1	0	0	2
Int 7	0	0	2	0	1	3
Int 8	1	1	2	0	0	4
Int 9	0	2	0	0	3	5
Int 10	0	1	0	0	0	4
Int 11	0	1	0	0	0	5
Int 12	1	3	4	0	2	4
Int 13	0	2	1	0	2	2
Int 14	0	0	1	0	0	5
Int 15	0	2	1	0	0	4
Int 16	0	1	0	0	1	2
Int 17	0	0	0	0	1	6
Int 18	0	2	0	0	1	2
Int 19	2	3	1	0	0	3
Int 20	0	1	1	0	0	2
Int 21	0	0	0	0	1	1
Int 22	0	2	1	0	0	3
Int 23	0	0	0	0	1	2
Int 24	0	2	1	0	0	2
Int 25	1	1	0	0	3	2
Int 26	0	1	1	0	2	4
Int 27	0	0	1	0	1	2
Int 28	1	1	0	0	1	1
Int 29	0	0	0	0	2	2
Int 30	0	0	0	0	0	1
Int 31	1	0	0	0	1	1

List of Figures

REFERENCES

Aaltonen, K., J. Kujala, L. Havela, and G. Savage. 2016. "Stakeholder Dynamics During the Project Front-End: The Case of Nuclear Waste Repository Projects." *Project Management Journal*, 46 (6): 15–41. https://doi.org/10.1002/pmj.21549.

Aaltonen, K., J. Kujala, P. Lehtonen, and I. Ruuska. 2010. "A stakeholder network perspective on unexpected events and their management in international projects." *International Journal of Managing Projects in Business*, 3 (4): 564–588. https://doi.org/10.1108/17538371011076055.

Adner, R. 2017. "Ecosystem as Structure: An Actionable Construct for Strategy." *Journal of Management*, 43 (1): 39–58. https://doi.org/10.1177/0149206316678451.

Agrawal, A., M. Fischer, and V. Singh. 2022. "Digital Twin: From Concept to Practice." *J. Manage. Eng.*, 38 (3): 06022001. https://doi.org/10.1061/(ASCE)ME.1943-5479.0001034.

Airbus. 2017. "Press release: Eni to utilize Earth Observation satellite data and services provided by Planetek Italia and Airbus." Airbus Defence & Space.

Ansar, A., and B. Flyvbjerg. 2022. "A Platform Approach to Space Exploration." *Harvard Business Review*, (November).

Aramali, V., G. E. Gibson, M. El Asmar, and N. Cho. 2021. "Earned Value Management System State of Practice: Identifying Critical Subprocesses, Challenges, and Environment Factors of a High-Performing EVMS." *J. Manage. Eng.*, 37 (4): 04021031. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000925.

Aramali, V., H. Sanboskani, G. E. Gibson, M. El Asmar, and N. Cho. 2022. "Forward-Looking State-of-the-Art Review on Earned Value Management Systems: The Disconnect between Academia and Industry." *J. Manage. Eng.*, 38 (3): 03122001. https://doi.org/10.1061/(ASCE)ME.1943-5479.0001019.

Aspeteg, J., and A. Bergek. 2020. "The value creation of diffusion intermediaries: Brokering mechanisms and trade-offs in solar and wind power in Sweden." *Journal of Cleaner Production*, 251: 119640. Elsevier Ltd. https://doi.org/10.1016/j.jclepro.2019.119640.

Bahadorestani, A., J. T. Karlsen, and N. M. Farimani. 2020. "Novel Approach to Satisfying Stakeholders in Megaprojects: Balancing Mutual Values." *Journal of Management in Engineering*, 36 (2): 04019047. American Society of Civil Engineers (ASCE). https://doi.org/10.1061/(asce)me.1943-5479.0000734.

Bondy, K., and A. Charles. 2020. "Mitigating Stakeholder Marginalisation with the Relational Self." *Journal of Business Ethics*, 165 (1): 67–82. Springer Netherlands. https://doi.org/10.1007/s10551-018-4085-x.

Bowman, C., and V. Ambrosini. 2000. "Value Creation Versus Value Capture: Towards a Coherent Definition of Value in Strategy." *British Journal of Management*, 11 (1): 1–15. https://doi.org/10.1111/1467-8551.00147.

Bryman, Alan; Bell, E. 2011. *Business Research Methods*. Oxford University Press.

Bundy, J., R. M. Vogel, and M. A. Zachary. 2018. "Organization–stakeholder fit: A dynamic theory of cooperation, compromise, and conflict between an organization and its stakeholders." *Strategic Management Journal*, 39 (2): 476–501. Wiley Online Library.

Cao, T., G. Locatelli, N. Smith, and L. Zhang. 2021. "A shared leadership framework based on boundary spanners in megaprojects." *International Journal of Managing Projects in Business*, 14 (5): 1065–1092. https://doi.org/10.1108/IJMPB-03-2020-0090.

Chesbrough, H., C. Lettl, and T. Ritter. 2018. "Value Creation and Value Capture in Open Innovation." *Journal of Product Innovation Management*, 35 (6): 930–938. https://doi.org/10.1111/jpim.12471.

Choi, J. O., B. K. Shrestha, Y. H. Kwak, and J. S. Shane. 2020. "Innovative Technologies and Management Approaches for Facility Design Standardization and Modularization of Capital Projects." *Journal of Management in Engineering*, 36 (5). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000805.

Clarysse, B., M. Wright, J. Bruneel, and A. Mahajan. 2014. "Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems." *Research Policy*, 43 (7): 1164–1176. Elsevier B.V. https://doi.org/10.1016/j.respol.2014.04.014.

Copernicus Relays. 2020. "Copernicus Factsheet." Copernicus.

Corbin, J., and A. Strauss. 1990. “Grounded theory research: Procedures, canons, and evaluative criteria.” *Qualitative Sociology*, 13 (1): 3–21. https://doi.org/10.1007/BF00988593.
Corbin, J., and A. Strauss. 2015. *Basics of Qualitative Research: Techniques and procedures for developing Grounded Theory*. SAGE Publications Ltd.
Coyne, I. T. 1997. “Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries?” *Journal of Advanced Nursing*, 26 (3): 623–630. https://doi.org/10.1046/j.1365-2648.1997.t01-25-00999.x.
De Silva, M., J. Howells, and M. Meyer. 2018. “Innovation intermediaries and collaboration: Knowledge–based practices and internal value creation.” *Research Policy*, 47 (1): 70–87. Elsevier. https://doi.org/10.1016/j.respol.2017.09.011.
Di Maddaloni, F., and K. Davis. 2017. “The influence of local community stakeholders in megaprojects: Rethinking their inclusiveness to improve project performance.” *International Journal of Project Management*, 35 (8): 1537–1556. Elsevier Ltd and Association for Project Management and the International Project Management Association. https://doi.org/10.1016/j.ijproman.2017.08.011.
Easterby-Smith, Mark; Thorpe, Richard; Jackson, P. R. 2015. *Management and Business Research*. (K. Smy, ed.). SAGE Publications Ltd.
Eissa, R., M. S. Eid, and E. Elbeltagi. 2021. “Conceptual Profit Allocation Framework for Construction Joint Ventures: Shapley Value Approach.” *J. Manage. Eng.*, 37 (3): 04021016. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000911.
El-Gohary, N. M., H. Osman, and T. E. El-Diraby. 2006. “Stakeholder management for public private partnerships.” *International Journal of Project Management*, 24 (7): 595–604. Elsevier.
Eskerod, P., M. Huemann, and G. Savage. 2015. “Project stakeholder management-past and present.” *Project Management Journal*, 46 (6): 6–14. https://doi.org/10.1002/pmj.21555.
Esnaashary Esfahani, M., C. Rausch, C. Haas, and B. T. Adey. 2020. “Prioritizing Preproject Planning Activities Using Value of Information Analysis.” *J. Manage. Eng.*, 36 (5): 04020064. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000822.
ESPI. 2019. *Evolution of the Role of Space Agencies*. European Space Policy Insititute.
Freeman, R. E., J. Kujala, S. Sachs, and C. Stutz. 2017. “Stakeholder Engagement: Practicing the Ideas of Stakeholder Theory.” *Issues in Business Ethics*, 46: 1–12. https://doi.org/10.1007/978-3-319-62785-4_1.
Gao, N., Y. Chen, W. Wang, and Y. Wang. 2018. “Addressing Project Complexity: The Role of Contractual Functions.” *Journal of Management in Engineering*, 34 (3): 04018011. https://doi.org/10.1061/(asce)me.1943-5479.0000613.
Gaur, S., and A. Tawalare. 2022. “Investigating the Role of BIM in Stakeholder Management: Evidence from a Metro-Rail Project.” *Journal of Management in Engineering*, 38 (1). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000979.
Gawer, A., and M. A. Cusumano. 2014. “Industry Platforms and Ecosystem Innovation: Platforms and Innovation.” *J Prod Innov Manag*, 31 (3): 417–433. https://doi.org/10.1111/jpim.12105.
Gil, N. A., and Y. Fu. 2021. “Megaproject Performance, Value Creation, and Value Distribution: An Organizational Governance Perspective.” *Academy of Management Discoveries*, 8 (2): 1–27. https://doi.org/10.5465/amd.2020.0029.
Grabher, G. 2002. “The project ecology of advertising: Tasks, talents and teams.” *Regional Studies*, 36 (3): 245–262. https://doi.org/10.1080/00343400220122052.
Grabher, G. 2004. “Temporary Architectures of Learning: Knowledge Governance in Project Ecologies.” *Organization Studies*, 25 (9): 1491–1514. https://doi.org/10.1177/0170840604047996.
Grabher, G., and O. Ibert. 2011. *Project Ecologies: A Contextual View on Temporary Organizations*. *The Oxford Handbook of Project Management*.

905 Grabher, G., O. Ibert, and S. Flohr. 2009. "The Neglected King: The Customer in the New Knowledge
906 Ecology of Innovation." *Economic Geography*, 84 (3): 253–280.
907 https://doi.org/10.1111/j.1944-8287.2008.tb00365.x.
908 Greenwood, M. 2007. "Stakeholder engagement: Beyond the myth of corporate responsibility."
909 *Journal of Business Ethics*, 74 (4): 315–327. https://doi.org/10.1007/s10551-007-9509-y.
910 Gunduz, M., A. A. Aly, and T. El Mekkawy. 2022. "Value Engineering Factors with an Impact on
911 Design Management Performance of Construction Projects." *J. Manage. Eng.*, 38 (3):
912 04022012. https://doi.org/10.1061/(ASCE)ME.1943-5479.0001026.
913 Hannan, M. T., and J. Freeman. 1977. "The Population Ecology of Organizations." *American Journal*
914 *of Sociology*, 82 (5): 929–964. https://doi.org/10.1086/226424.
915 Harrison, J. S., and A. C. Wicks. 2013. "Stakeholder theory, value, and firm performance." *Business*
916 *ethics quarterly*, 23 (1): 97–124. Cambridge University Press.
917 Hart, S. L. 1971. "Axiology - Theory of Values." *Philosophy and Phenomenological Research*, 32
918 (1): 29–41. https://doi.org/2105883.
919 Hedborg, S., P. E. P.-E. Eriksson, and T. K. Gustavsson. 2020. "Organisational routines in multi-
920 project contexts: Coordinating in an urban development project ecology." *International*
921 *Journal of Project Management*, 38 (7): 394–404. Elsevier Ltd.
922 https://doi.org/10.1016/j.ijproman.2020.01.003.
923 Hedborg, S., and T. Gustavsson Karrbom. 2020. "Developing a neighbourhood: exploring
924 construction projects from a project ecology perspective." *Construction Management and*
925 *Economics*, 38 (10): 964–976. https://doi.org/10.1080/01446193.2020.1805479.
926 Jick, T. D. 1979. "Mixing qualitative and quantitative methods: Triangulation in action."
927 *Administrative science quarterly*, 24 (4): 602–611. JSTOR.
928 Johnson, G., K. Scholes, and R. Whittington. 2008. *Exploring corporate strategy: Text and cases*.
929 Pearson education.
930 Kahn, W. A. 1990. "Psychological conditions of personal engagement and disengagement at work."
931 *Academy of Management Journal*, 33 (4): 692–724. https://doi.org/10.5465/256287.
932 Khan, A., M. Waris, S. Panigrahi, M. R. Sajid, and F. Rana. 2021. "Improving the Performance of
933 Public Sector Infrastructure Projects: Role of Project Governance and Stakeholder
934 Management." *J. Manage. Eng.*, 37 (2): 04020112. https://doi.org/10.1061/(ASCE)ME.1943-
935 5479.0000886.
936 Kincheloe, J. L. 2005. *Critical constructivism primer*. Peter Lang.
937 Laursen, M. 2018. "Project Networks as Constellations for Value Creation." *Project Management*
938 *Journal*, 49 (2): 56–70.
939 Le, C., M. W. Yaw, H. D. Jeong, and K. Choi. 2021. "Comprehensive Evaluation of Influential
940 Factors on Public Roadway Project Contract Time." *Journal of Management in Engineering*,
941 37 (5). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000932.
942 Lee, K.-T., J.-W. Jekal, and J.-H. Kim. 2023. "Client Briefing for Introducing Value Management to
943 Establish Daycare Center Guidelines for the Republic of Korea." *J. Manage. Eng.*, 39 (3):
944 04023011. https://doi.org/10.1061/JMENEA.MEENG-5090.
945 Lehtimaki, H., and J. Kujala. 2017. "Framing dynamically changing firm–stakeholder relationships
946 in an international dispute over a foreign investment: a discursive analysis approach."
947 *Business & Society*, 56 (3): 487–523. SAGE Publications Sage CA: Los Angeles, CA.
948 Lehtinen, J., and K. Aaltonen. 2020. "Organizing external stakeholder engagement in inter-
949 organizational projects: Opening the black box." *International Journal of Project*
950 *Management*, 38 (2): 85–98. Elsevier Ltd. https://doi.org/10.1016/j.ijproman.2019.12.001.
951 Lehtinen, J., K. Aaltonen, and R. Rajala. 2019. "Stakeholder management in complex product
952 systems: Practices and rationales for engagement and disengagement." *Industrial Marketing*
953 *Management*, 79 (November 2017): 58–70. Elsevier.
954 https://doi.org/10.1016/j.indmarman.2018.08.011.

Lepak, D. P., K. G. Smith, M. S. Taylor, D. P. Lepak, K. E. N. G. Smith, and M. S. Taylor. 2007. "INTRODUCTION TO SPECIAL TOPIC FORUM VALUE CREATION AND VALUE CAPTURE : A MULTILEVEL PERSPECTIVE." *Academy of Management Review*, 32 (1): 180–194.

Li, J., W. Xiong, C. B. Casady, B. Liu, and F. Wang. 2023. "Advancing Urban Sustainability through Public-Private Partnerships: Case Study of the Gu'An New Industry City in China." *Journal of Management in Engineering*, 39 (1). https://doi.org/10.1061/(ASCE)ME.1943-5479.0001103.

Li, Y., Y. Lu, Q. Cui, and Y. Han. 2019. "Organizational Behavior in Megaprojects: Integrative Review and Directions for Future Research." *J. Manage. Eng.*, 35 (4): 04019009. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000691.

Lu, Y., B. Liu, and Y. Li. 2021. "Collaboration Networks and Bidding Competitiveness in Megaprojects." *Journal of Management Engineering*, 37 (6). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000961.

Maak, T. 2007. "Responsible leadership, stakeholder engagement, and the emergence of social capital." *Journal of Business Ethics*, 74 (4): 329–343. Springer.

Martinsuo, M. 2020. "The management of values in project business: Adjusting beliefs to transform project practices and outcomes." *Project Management Journal*, 51 (4): 389–399. SAGE Publications Sage CA: Los Angeles, CA. https://doi.org/10.1177/8756 9728 20927890.

Martinsuo, M., L. Vuorinen, and C. Killen. 2019. "Lifecycle-oriented framing of value at the front end of infrastructure projects." *International Journal of Managing Projects in Business*, 12 (3): 617–643. https://doi.org/10.1108/IJMPB-09-2018-0172.

Mcvea, J. F., and R. E. Freeman. 2005. "A names-and-faces approach to stakeholder management how focusing on stakeholders as individuals can bring ethics and entrepreneurial strategy together." *Journal of Management Inquiry*, 14 (1): 57–69. https://doi.org/10.1177/1056492604270799.

Miles, S. 2017. "Stakeholder theory classification: A theoretical and empirical evaluation of definitions." *Journal of Business Ethics*, 142 (3): 437–459. Springer.

Mir, R., and A. Watson. 2001. "Critical realism and constructivism in strategy research: Toward a synthesis." *Strategic Management Journal*, 22 (12): 1169–1173. https://doi.org/10.1002/smj.200.

Missonier, S., and S. Loufrani-Fedida. 2014. "Stakeholder analysis and engagement in projects: From stakeholder relational perspective to stakeholder relational ontology." *International Journal of Project Management*, 32 (7): 1108–1122. IPMA and Elsevier Ltd. https://doi.org/10.1016/j.ijproman.2014.02.010.

Momeni, K., and M. Martinsuo. 2019. "Going downstream in a project-based firm: Integration of distributors in the delivery of complex systems." *International Journal of Project Management*, 37 (1): 27–42. Elsevier Ltd. https://doi.org/10.1016/j.ijproman.2018.09.007.

Moore, J. F. 1993. "Predators and prey: a new ecology of competition." *Harvard Business Review*, 71 (3): 75–86.

Morrow, S. L., and M. L. Smith. 1995. "Constructions of survival and coping by women who have survived childhood sexual abuse." *Journal of Counseling Psychology*, 42 (1): 24–33. https://doi.org/10.1037/0022-0167.42.1.24.

Obradović, T., B. Vlačić, and M. Dabić. 2021. "Open innovation in the manufacturing industry: A review and research agenda." *Technovation*, 102. https://doi.org/10.1016/j.technovation.2021.102221.

OECD. 2022. *OECD Handbook on Measuring the Space Economy, 2nd Edition*. *OECD Handbook on Measuring the Space Economy*. OECD.

Oh, H. J., S. Chang, and B. Ashuri. 2023. "Patterns of Skill Sets for Multiskilled Laborers Based on Construction Job Advertisements Using Web Scraping and Text Analytics." *J. Manage. Eng.*, 39 (3): 04023009. https://doi.org/10.1061/JMENEA.MEENG-5243.

Palinkas, L. A. 2014. “Qualitative and mixed methods in mental health services and implementation research.” *Journal of Clinical Child \& Adolescent Psychology*, 43 (6): 851–861. Taylor \& Francis.
Paravano, A., G. Locatelli, and P. Trucco. 2023. “What is value in the New Space Economy? The end-users’ perspective on satellite data and solutions.” *Acta Astronautica*, S0094576523002242. https://doi.org/10.1016/j.actaastro.2023.05.001.
Park, J. H., H. Jung, C. H. Lim, and T. Chang. 2020. “The economic impact analysis of satellite development and its application in Korea.” *Acta Astronautica*, 177: 9–14. Elsevier Ltd. https://doi.org/10.1016/j.actaastro.2020.06.031.
Patton, M. Q. 2014. *Qualitative research \& evaluation methods: Integrating theory and practice*. Sage publications.
Perry, R. B. 2013. *General Theory of Value: Its Meaning and Basic Principles Construed in Terms of Interest*. Harvard University Press.
Porter, M. E., and M. R. Kramer. 2011. “Creating shared value.” *Harvard Business Review*, 89 (1–2). Harvard Business School Publishing.
Sachs, S., and J. Kujala. 2021. “Stakeholder Engagement in Management Studies: Current and Future Debates.” *Oxford Research Encyclopedia of Business and Management*. Oxford University Press.
Sachs, S., and J. Kujala. 2022. “Stakeholder Engagement in Humanizing Business.” *Freeman, & S. Dmytriyev, Humanizing business: What humanities can say to business*, 559–572.
Saldaña, J. 2013. *The coding manual for qualitative researchers*. Los Angeles: SAGE.
Sandal Stjerne, I., J. Söderlund, and D. Minbaeva. 2018. “Crossing times: Temporal boundary-spanning practices in interorganizational projects.” https://doi.org/10.1016/j.ijproman.2018.09.004.
Saunders, B., J. Kitzinger, and C. Kitzinger. 2015. “Anonymising interview data: Challenges and compromise in practice.” *Qualitative Research*, 15 (5): 616–632. Sage Publications Sage UK: London, England.
Saunders, M., P. Lewis, and A. Thornhill. 2009. *Research methods for business students*. Pearson education.
Signori, S. 2017. “From ‘Managing for Stakeholders’ to ‘Managing with Stakeholders’: When Stakeholders Can Help Rescue a Company.” *Issues in Business Ethics*, 46: 167–192. https://doi.org/10.1007/978-3-319-62785-4_8.
De Silva, M., L. Gokhberg, D. Meissner, and M. Russo. 2021. “Addressing societal challenges through the simultaneous generation of social and business values: A conceptual framework for science-based co-creation.” *Technovation*, 104 (September 2020): 102268. Elsevier Ltd. https://doi.org/10.1016/j.technovation.2021.102268.
Söderlund, J. 2004. “On the broadening scope of the research on projects: A review and a model for analysis.” *International Journal of Project Management*, 22 (8): 655–667. https://doi.org/10.1016/j.ijproman.2004.05.011.
Storbacka, K., R. J. Brodie, T. Böhmann, P. P. Maglio, and S. Nenonen. 2016. “Actor engagement as a microfoundation for value co-creation.” *Journal of Business Research*, 69 (8): 3008–3017. Elsevier Inc. https://doi.org/10.1016/j.jbusres.2016.02.034.
Strauss, A., and J. Corbin. 1994. “Grounded theory methodology: An overview.” *Handbook of qualitative research*, 273–285. Thousand Oaks, CA, US: Sage Publications, Inc.
Swanson, R., and V. Sakhrani. 2020. “Appropriating the value of flexibility in ppp megaproject design.” *Journal of Management in Engineering*, 36 (5). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000770.
Tariq, S., and X. Zhang. 2021. “Socioeconomic, Macroeconomic, and Sociopolitical Issues in Water PPP Failures.” *J. Manage. Eng.*, 37 (5): 04021047. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000947.

Turner, R., and R. Zolin. 2012. "Forecasting success on large projects: Developing reliable scales to predict multiple perspectives by multiple stakeholders over multiple time frames." *Project Management Journal*, 43 (5): 87–99. https://doi.org/10.1002/pmj.21289.

Vegas-Fernández, F. 2022. "Project Risk Costs: Estimation Overruns Caused When Using Only Expected Value for Contingency Calculations." *J. Manage. Eng.*, 38 (5): 04022037. https://doi.org/10.1061/(ASCE)ME.1943-5479.0001064.

Vidmar, M. 2021. "Enablers, Equippers, Shapers and Movers: A typology of innovation intermediaries' interventions and the development of an emergent innovation system." *Acta Astronautica*, 179 (February 2020): 280–289. https://doi.org/10.1016/j.actaastro.2020.10.011.

Vuorinen, L., and M. Martinsuo. 2019. "Value-oriented stakeholder influence on infrastructure projects." *International Journal of Project Management*, 37 (5): 750–766. Elsevier Ltd, APM and IPMA. https://doi.org/10.1016/j.ijproman.2018.10.003.

Zerjav, V. 2021. "Why Do Business Organizations Participate in Projects? Toward a Typology of Project Value Domains." *Project Management Journal*, 52 (3): 287–297. SAGE Publications. https://doi.org/10.1177/87569728211001663.

Zubair, M. U., and X. Zhang. 2022. "Investigation and Improvements of the Existing Best-Value Selection Criteria for Elevator Maintenance Contractors." *Journal of Management in Engineering*, 38 (1). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000987.

1075 Table 1 - Engagement practices of organizations in the space project ecology toward their end-users

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		Engagement Classes			
		Personal Engagement for value espoused *(outbound)*	Personal engagement for value expected (*inbound*)	Personal Engagement for value enacted (*iterative*)	Non-personal Engagement
Engagement Practices	Conferences and networking events				X
	Formal and informal meetings	X	X		
	Guided trials	X			
	Information material				X
	Intermediaries as explorers				X
	Intermediaries as integrators			X	
	Intermediaries as translators		X		
	Messages (e.g., emails)	X	X		
	Open calls				X
	Organizing inquiries				X
	Personal sponsor			X	
	Phone calls	X	X		
	Platforms				X
	Prototyping			X	
	Relational events			X	
	Seminars and tutorials				X
	Social media				X
	Website				X
	Workshops			X	

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