MEASURING SOCIAL VALUE IN EUROPEAN SCIENCE AND TECHNOLOGY PARKS: A STAKEHOLDER-CENTRIC METHODOLOGY FOR ASSESSING ITS IMPACT IN SOCIETY

Doctoral Dissertation

Victor Blazquez Arenas

Bilbao, September 2023

Doctoral Programme in Business and territorial competitiveness, innovation, and sustainability

MEASURING SOCIAL VALUE IN EUROPEAN SCIENCE AND TECHNOLOGY PARKS: A STAKEHOLDER-CENTRIC METHODOLOGY FOR ASSESSING ITS IMPACT IN SOCIETY

Doctoral Dissertation

Phd Candidate:

Victor Blazquez Arenas

Supervisors:

Dr. Ricardo Aguado Muñoz

Dr. Jose Luis Retolaza Avalos

Bilbao, September 21st, 2023

Deusto Business School
Universidad de Deusto

Doctoral Programme in Business and territorial competitiveness, innovation, and sustainability

MEASURING SOCIAL VALUE IN EUROPEAN SCIENCE AND TECHNOLOGY PARKS: A STAKEHOLDER-CENTRIC METHODOLOGY FOR ASSESSING ITS IMPACT IN SOCIETY

Dissertation submitted in part fulfilment of the requirements for the degree of Doctor of Philosophy in Business and territorial competitiveness, innovation, and sustainability of University of Deusto (European PhD Degree).

Phd Candidate:

Victor Blazquez Arenas

Supervisors:

Dr. Ricardo Aguado Muñoz

Dr. Jose Luis Retolaza Avalos

PhD Candidate,	Supervisors,	
Victor Blazquez Arenas	Ricardo Aguado Muñoz	Jose Luis Retolaza Avalos
Victor Blazquez Arenas Firmato digitalmente da Victor Blazquez Arenas Data: 2023.09.21 09:54:46 +02'00'	Ricardo Aguado Muñoz Firmado digitalmente por Ricardo Aguado Muñoz Nombre de reconocimiento (DN): cn=Ricardo Aguado Muñoz, o, ou=DNI 30663364V, email=ricardo.aguado@deusto.es, c=ES Fecha: 2023.09.21 10:02:31 +02'00'	Jose Luis De Retolaza Ávalos Firmado digitalmente por Jose Luis De Retolaza Ávalos Nombre de reconocimiento (DN): cn=Jose Luis De Retolaza Ávalos, o, ou=DNI: 14959834J, email=joseluis.retolaza@deusto.es, c=ES Fecha: 2023.09.21 17:59:28 +02'00'

Bilbao, September 21st, 2023

Deusto Business School
Universidad de Deusto

Ricardo Aguado Muñoz and Jose Luis Retolaza Avalos, Associate Professors at Deusto Business School in Bilbao,

CERTIFY:

That the present dissertation *Measuring Social Value in European Science and Technology Parks: A Stakeholder-Centric methodology for assessing its impact in society* has been carried out under their direction, at Deusto Business School of the University of Deusto, by Victor Blazquez Arenas and constitutes his doctoral thesis.

For the record, in compliance with current legislation, authorities the presentation of the thesis to the Academic Committee of the University of Deusto, by signing this certificate,

Bilbao, September 21st, 2023

Ricardo Aguado Muñoz
Firmado digitalmente por Ricardo Aguado Muñoz
Nombre de reconocimiento (DN): cn=Ricardo Aguado Muñoz, o, ou=DNI 30663364V, email=ricardo.aguado@deusto.es, c=ES
Fecha: 2023.09.21 10:03:54 +02'00'

Dr. Ricardo Aguado Muñoz

Jose Luis De Retolaza Ávalos
Firmado digitalmente por Jose Luis De Retolaza Ávalos
Nombre de reconocimiento (DN): cn=Jose Luis De Retolaza Ávalos, o, ou=DNI: 14959834J, email=joseluis.retolaza@deusto.es, c=ES
Fecha: 2023.09.21 17:59:57 +02'00'

Dr. Jose Luis Retolaza Avalos

Abstract

In recent years, Science and Technology Parks (STPs) have gained recognition for their pivotal role in fostering innovation and regional development. However, a noticeable research gap exists in assessing the social value (SV) generated by STPs for their reference communities. This study aims to bridge this gap by developing and testing a comprehensive methodology for analysing the generation and distribution of SV by STPs to key stakeholders. By doing so, it contributes significantly to the field of STP research and practice.

The primary objective of this research is to introduce a fresh perspective on STPs, emphasising the quantification of SV produced by the constituent companies and organisations within the STP community. This approach, distinct from the traditional economic evaluation, adds a community-cantered dimension, shedding light on the role of STPs in generating SV and enhancing the well-being of the whole community of stakeholders of each park.

The proposed methodology considers a diverse range of stakeholders, enabling the quantification (monetisation) of SV generated by the STP community for each group. It is grounded in Social Accounting principles and the Polyhedral Model of SV analysis. This research aligns with the New Business Narrative debate, focusing on stakeholder theory, and refines methodologies for quantifying value generation and distribution, specifically within STPs.

This innovative methodology allows for comprehensive analysis using secondary data, minimising intrusiveness while maintaining result reliability. It shifts from using primary information to an approach based on secondary data related to companies and a

minimal use primary data. It provides a reliable estimate of SV generated by the STP community and its distribution, as well as SV per employee and company. These insights are crucial for evaluating STP performance.

The study follows a humanistic management approach, emphasising the centrality of individuals and communities in evaluating value generated by organisations.

Furthermore, this research contributes to the broader field of STPs' generation of social value by introducing a novel methodology applicable to large corporate groups, such as sectors or clusters. In addition, the collaborating with the International Association of Science Parks and Areas of Innovation (IASP) has enhanced the practicality and usefulness of this approach for STPs in Europe.

In conclusion, this study pioneers an innovative methodology for SV analysis within STPs, focusing on the distribution of that SV among stakeholders.

Aknowledgements

My doctoral thesis has reached fulfilment through the unwavering support and invaluable assistance of numerous individuals. No words can adequately convey the depth of my gratitude, a simple word that carries profound meaning. To each and every one of you, I extend my heartfelt thanks.

I am profoundly grateful to my family, who have stood by my side throughout this journey, offering boundless support and unwavering motivation. Their love and affection have been a constant source of strength.

My heartfelt appreciation goes out to my supervisors, Ricardo Aguado and Jose Luis Retolaza, for not only guiding me but also igniting the fire within me to face this formidable challenge. Their patience, encouragement, and genuine care, along with the sense of belonging I felt at HUME Research Team, have been priceless.

I extend my sincere thanks to the program director, Iñaki Peña, whose unwavering support and invaluable advice have been instrumental in my successful completion of this endeavour.

To Ivan Ureta, my gratitude knows no bounds. He not only encouraged me to embark on this journey of personal and professional growth but also provided unwavering support, enriching discussions, and a continuous source of inspiration. I am also deeply appreciative of Luca Crivelli and Domenico Ferrari for their steadfast support and for creating the ideal professional environment for me to undertake this doctoral journey.

My gratitude extends to the International Association of Science Parks and Areas of Innovation for believing in and supporting this research project through a fruitful collaboration. A special thank you goes to Laura Monasterio for her personal dedication in assisting me with this work. I also acknowledge the indispensable contributions of all the Science and Technology Parks that participated in various stages of the project; without their involvement, this research would not have succeeded as it did.

I also wish to express my heartfelt thanks to Alfredo Biffi, whose unwavering support sustained me throughout these years and who generously hosted me during my international visit to University of Insubria.

Finally, I want to express my gratitude to all the individuals who have been a part of my life during these years of thesis work. Your friendship and unwavering spirits have been instrumental in ensuring that my efforts have not been in vain.

Goodness is the only investment that never fails.

Henry David Thoreau

Bilbao, September 21st, 2023

Contents

List of Tables

List of Graphs

List of Diagrams

List of Figures

List of Acronyms

AECA	Asociación Española de Contabilidad y Administración de Empresa [*Association of Accounting and Management in Spain*]
CEO	Chief Executive Officer
CSR	Corporate Social Responsibility
EBITDA	Earnings before Interest, Taxes, Depreciation, and Amortisation
GEAccounting	Global Economic Accounting
IAAER	International Association for Accounting Education & Research
IASP	International Association of Science Parks and Areas of Innovation
LEs	Large Enterprises
NACE	Nomenclature of Economic Activities
NBN	New Business Narrative
R&D	Research and Development
RIS	Regional Innovation Systems
SA	Stakeholder or Social Accounting
SDGs	Sustainable Development Goals
SMEs	Small and Medium-sized Enterprises
STP	Science and Technology Park
SV	Social Value
SV-SIAE	Social Value - Social Impact of Economic Activity
VAT	Value Added Tax
VIF	Variance Inflation Factor

1. Introduction

In recent years, there has been a growing recognition that Science and Technology Parks (STPs) play an important role in driving innovation and promoting regional development (Martínez-Cañas & Ruíz-Palomino, 2011; Poonjan et al., 2020), but a noticeable research gap remains in the assessment of the social value (SV) generated by STPs for their reference community (Lecluyse et al., 2019). This research seeks to address this gap by developing and testing a comprehensive methodology for analysing the generation and distribution of SV by STPs to key stakeholders (Blazquez et al., 2020), thereby making a substantive contribution to the field of STP research and practice.

The overarching objective of this research is to introduce a novel perspective to the study of STPs, with a particular focus on quantifying the SV generated by the companies and organisations that comprise the STP community. The assessment of the impact of these entities has long been of interest to both academic researchers and practitioners (Lecluyse et al., 2019), and the proposed methodology will offer valuable insights to park managers and policymakers alike, enabling more informed decision-making and greater effectiveness in STP management and governance.

Traditionally, STPs have been evaluated based on their ability to generate economic growth through the creation of new businesses and jobs (Lecluyse et al., 2019; Blazquez et al. (2020). As defined by the International Association of Science Parks and Areas of Innovation (IASP, 2023): STPs are managed by specialised professionals whose primary objective is to foster a culture of innovation and enhance the competitiveness of associated businesses and knowledge-based institutions, thereby contributing to the overall prosperity of their community. Aligned with this definition, the present research aims to incorporate a more community-centred dimension of analysis, which emphasises the value generate and distributed to the STP's stakeholders. This approach provides a novel perspective on the phenomenon under study, shedding new light on the role of STPs in generating SV and contributing to the well-being of the community.

This study proposes a methodological adaptation for analysing SV within the context of STPs. The proposed approach considers a diverse range of stakeholders, including employees, customers, suppliers, public administration, and financial entities, with the possibility of quantifying (monetising) the SV generated by the STP community for each stakeholder group (Blazquez et al., 2020; Parmar et al., 2010). Through accurate testing and validation within the STP context, this methodological adaptation is implemented in this study to provide a more comprehensive assessment of the SV created by STPs.

The analysis tool developed in this research is based on the principles of Social Accounting (SA), which are also known as, and on the Polyhedral Model of SV analysis (Aguado & Eizaguirre, 2020; Freeman, et al., 2020; Retolaza et al., 2016). Consistent with these approaches, the concept of SV within the scope of this study refers to *"[...] the utility provided by the set of social assets generated by an organisation for the stakeholders or interest groups related to the organisation [...]"*, as defined by Lazcano et al. (2019, p.149). In turn, the term SV monetisation pertains to the *"[...] process that estimated in monetary units the utility of the whole social assets (those that provide well-being or discomfort to some groups in society) generated by an organisation [...]"*, as stated by Lazcano et al. (2019, p.148).

In this field our work contributes to the ongoing New Business Narrative debate (Freeman, Retolaza, et al., 2020), which is grounded in stakeholder theory, by proposing and refining methodologies and techniques for quantifying (monetise) the value generated and distributed to various stakeholders of an organisation, specifically in this case within the context of STPs (Blazquez et al., 2020; Retolaza et al., 2022).

The proposed methodology allows for the simultaneous analysis of entire communities of organisations inside STPs using secondary data, without the need for direct interaction with each organisation being examined. This makes the methodology minimally invasive towards the community of companies that makes up the STP, while maintaining the reliability of the results obtained. With this approach, the study shifts away from a predominant use of primary information and close collaboration with the entity being analysed, to an approach based on secondary data related to the companies and a minimum of primary data provided by the park manager. Ultimately, through the application of the proposed methodology to the specific case, a reliable estimate of the SV generated by the STP community and its distribution among key stakeholders can be obtained. Furthermore, the SV generated per worker and per company within the STP can be monetised. These additional pieces of information are crucial for thoroughly evaluating the performance of a STP. (Blazquez et al., 2020)

The entire research is grounded in a humanistic management approach, prioritizing the evaluation of value generated by organisations in a way that emphasises the centrality of individuals (people-centred) and communities (stakeholder-oriented). (Aguado & Eizaguirre, 2020)

The research conducted in this study is noteworthy for its development of a novel tool for analysing STPs, which can also be applied to similar settings of large groups of corporations such as sector or clusters. This innovative approach incorporates the previously understudied perspective of SV analysis, making it a pioneering work in this field. Collaborating with IASP for field analysis allowed for the introduction of this approach to the STP community in Europe, demonstrating its practicality and usefulness for strategic management and governance considerations on STPs.

Additionally, this study contributes to the areas of SV analysis research and STP research. Those contributions are made through the novel methodology to measure SV (using secondary data) and through the analysis approach providing a new tool for the academic and practitioner community.

In conclusion, this study presents a new and innovative methodology for the analysis of STPs, focusing on the perspective of SV analysis. Through a humanistic management approach, the research aims to bring back the centrality of the person and the community in the analysis of the value generated by organisations. The following subchapters, a detailed background and context of the study is provided, with an emphasis on the research problem and research questions that are guiding the investigation. The relevance and objectives of the study is also be discussed, along with a brief overview of the methodology and structure of the doctoral dissertation.

1.1 Contextualisation and conceptual framework

The term Science and Technology Park (STP) encompasses a variety of organisational structures, each with their own unique definition. For the purposes of this study, is adopted the definition provided by the International Association of Science Parks and Areas of Innovation (IASP), which is widely accepted within academic circles (Albahari et al., 2022; Henriques et al., 2018). According to the IASP *"a science park is an organisation managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. […]"* (IASP, 2023). This definition is inclusive of various terminologies often used interchangeably, such as "science park", "technology park", "technopole", and others (Hobbs et al., 2017; IASP, 2023).

The concept of STPs as a catalyst for regional development has gained widespread recognition on a global scale (Martínez-Cañas & Ruíz-Palomino, 2011; Poonjan et al., 2020). The positive impact of STPs on the development of their surrounding areas is well-established (Henriques et al., 2018). However, despite decades of application and research on the concept, there is an increasing demand for new studies that examine the role of STPs in society, from both academic and practical perspectives (Albahari et al., 2019, 2022; Mora-Valentín et al., 2018).

In this context, several studies have focused on the analysis of the context in which STPs are situated (Albahari et al., 2013; Etzkowitz & Zhou, 2017; Gomes et al., 2022), while others have examined the community of organisations that inhabit STPs (Diez-Vial & Fernández-Olmos, 2017; Gwebu et al., 2019; Löfsten & Lindelöf, 2002; Ubeda et al., 2019). Additionally, some studies have explored and analysed the management entity of STPs (Amaral et al., 2022; Latorre et al., 2017; Ng et al., 2019, 2020, 2021).

Despite the extensive and multi-disciplinary approach that characterizes the literature on STPs, a significant number of questions and uncertainties remain, as indicated by various literature reviews (Albahari et al., 2022; Henriques et al., 2018; Hobbs et al., 2017; Mora-Valentín et al., 2018). Several emerging topics of interest have been identified in the academic discourse about STPs, including matters related to STP management and governance (Correia et al., 2021; Latorre et al., 2017; Skowron-Grabowska, 2020), STP organisation and structure (Al-Kfairy et al., 2020; Ng et al., 2019, 2020), and the social contribution of STPs to society (Blazquez et al., 2020). One area of ongoing inquiry concerns the measurement of the social contributions arising from STPs towards stakeholders who are engaged with the companies established within them, both at the level of the STP ecosystem as a whole (Amaral et al., 2022; Bigliardi et al., 2006; Ribeiro et al., 2016, 2021) and for the individual organisations operating within it (Albahari et al., 2022; Gwebu et al., 2019; Vasquez-Urriago et al., 2016a, 2016b).

Stakeholder management and involvement within the STP ecosystem is becoming an increasingly important topic of consideration, encompassing both the park's management entity (Cadorin et al., 2017, 2021; Nieth & Benneworth, 2020) and the community of organisations within it (Polat, 2022; Urbinati et al., 2020). At the same time, the question of mutual influence between STPs and their reference territorial context remains a topic of ongoing discussion (Poonjan et al., 2020; Poonjan & Tanner, 2020). Notably, studies such as Albahari et al. (2013), which examined national science park systems, and Gomes et al. (2022), which analysed performance in regional innovation systems (RIS), have contributed to the ongoing discourse. Those studies, along with the knowledge generated, provide valuable insights for STP managers and policymakers alike, enabling them to better understand this complex ecosystem and the ways in which STPs can create value for society.

However, as mentioned previously, the existing research on STPs highlights several gaps that warrant further investigation. Notably, there is a lack of studies examining the measurement of the social contribution of STPs (Lecluyse et al., 2019), and the consideration of stakeholders in the analysis of STPs (Germain et al., 2022). In response to these gaps, the present study aims to measure and analyse the social impact of STPs in terms of the value generated and distributed to the main stakeholders. Addressing these gaps is crucial for the advancement of the knowledge on STPs and for improving their social and economic impact on society.

To achieve this objective, as previously mentioned, concepts from the field of Social Accounting (SA) or Stakeholder Accounting (SA) are drawn upon. Specifically, the Polyhedral Model is utilised for analysing social value (Aguado & Eizaguirre, 2020; Freeman, Retolaza, et al., 2020; Retolaza, San-Jose, & Ruíz-Roqueñi, 2016a; Retolaza et al., 2016). Our approach aligns with the New Business Narrative (NBN) based on stakeholder theory, aiming to develop methodologies and techniques to quantify the value generated and distributed to the diverse stakeholders of an organisation, including STPs (Blazquez et al., 2020; Retolaza et al., 2022). The approach aligns with the New Business Narrative (NBN) based on stakeholder theory (Freeman, Retolaza, et al., 2020), with the aim of developing methodologies and techniques to quantify the value generated and distributed to the diverse stakeholders of an organisation, including STPs (Blazquez et al., 2020; Retolaza et al., 2022).

The Polyhedral Model, which functions as an accounting information system, enables us to map and quantify the SV generated by the companies within STPs for each stakeholder group (Retolaza, San-Jose, & Aguado, 2016; Retolaza et.al, 2016a, 2016b; Retolaza et al., 2016). Consistently, the definitions of SV and SV monetisation to which reference is made are those proposed by Lazcano et al. (2019). According to these authors, SV represents the utility that an organisation generates for its stakeholders through the social assets at its disposal. Monetisation, on the other hand, consists in the process of estimating the value generated by these assets in monetary terms, taking into account both those that contribute to well-being and those that generate discomfort. Finally, the model is built upon the fundamental methodological principles of added value analysis, as established by the Association of Accounting and Management in Spain (AECA) (Gonzalo & Perez, 2017), which is affiliated with the International Association for Accounting Education & Research (IAAER). This approach provides a comprehensive framework for the analysis and evaluation of the value generated by an organisation, which is crucial for understanding the social and economic impact of STPs.

So far, numerous studies have demonstrated the practical application of this methodology in various fields (Aguado & Retolaza, 2020; Retolaza & San-Jose, 2018). For instance, the methodology has been tested in the monetisation of social value generated by cultural activities (San-Jose et al., 2022; San-Jose & Retolaza, 2022), as well as in university contexts (Ayuso et al., 2020), individual companies (San-Jose et al., 2017), cooperatives (Etxezarreta et al., 2018; Ruiz-Roqueni, 2020), non-profit organisations, and cooperative groups (Lazkano & San José, 2020) among other institutions (Lazkano & Beraza, 2019; J.-L. Retolaza et al., 2015, 2016). Despite the growing interest in SV analysis, its application to STPs remains limited. This is supported by the scarcity of evidence in the literature, with only a few studies conducted by Fulgencio (2017) and Torres-Pruñonosa et al. (2020) focusing on this specific context.

In this regard, a seminal experiment was conducted in 2020, where an adaptation of the Polyhedral Model was proposed, tested, and validated for monetising the SV generated by STPs (Blazquez et al., 2020)[1]. The adapted methodology facilitates the calculation of SV generated by the community of organisations within the STP, mainly using secondary data. This enables the identification of the aggregate value and distribution of SV to the primary stakeholders (Blazquez et al., 2020). The key stakeholders considered in this analysis were employees, suppliers, customers, shareholders, financial entities and public administration (Blazquez et al., 2020; Parmar et al., 2010). The adapted methodology presented here concentrates on the monetisation of SV, which can be reconstructed using secondary accounting data available through the ORBIS Platform (Companies Financial Database - Bureau Van Dijk - A Moody's Analytics Company). This methodology was developed to minimise the intrusiveness of primary data collection from individual organisations and to create analytical criteria that can be standardised, generalised, and customised to suit specific national contexts. It should be noted that this approach is particularly useful as it enables the use of a large amount of data that can be easily accessed and processed, thereby increasing the scope and accuracy of the analysis while also reducing costs and time required for data collection. In this regard, to test the adaptability of the adapted methodology at the national level, a pilot experiment was conducted on four STPs located in Sweden and Spain. This initial test successfully demonstrated the potential of the methodology as a simple-to-use tool for analysing the SV of multiple organisations simultaneously, using

[1] *As part of the thesis research project, further insights are provided in Chapter 3.1.*

primarily secondary data (Blazquez et al., 2020). Ultimately, the experiment provided a new perspective on measuring the social impact of STPs and the individual organisations that populate them.

In conclusion, STPs have become an important instrument for regional development by promoting innovation and competitiveness. However, despite the extensive research on the topic, there are still gaps in the literature that need to be addressed (Lecluyse et al., 2019), such as the measurement of the social contribution of STPs, and the consideration of stakeholders in the analysis of STPs. The present study aims to fill these gaps by using concepts from the field of Social Accounting and Stakeholder Theory to measure and analyse the social impact of STPs. By doing so, this effort aims to contribute to the advancement of knowledge on STPs and to stimulate increased interest in research regarding their social and economic impact on society.

In the following chapter, the focus will be on introducing the research problem and research questions. It will highlight the key issues and challenges that the study aims to address, along with the specific research questions that will guide the investigation. The research problem will be discussed in the context of the existing literature, providing an overview of previous research that has been conducted in the field. Furthermore, the relevance and objectives of the study will also be discussed in this chapter, highlighting its potential contributions to the field and its implications for practice. The specific objectives of the study will be outlined, providing a clear understanding of what the study aims to achieve and how it will contribute to the field of research.

Overall, the following chapter will set the stage for the rest of the study by providing a clear introduction to the research problem, research questions, significance, and objectives.

1.2 Framing the study: research problem, questions, relevance, and objectives

STPs have always garnered significant research interest, with diverse perspectives such as innovation management, territorial development, and competitiveness analysis, among others. Their various purposes range from performance evaluation to policy evaluation. It is important for both practitioners and academics to study these entities. Continuously striving to discover better tools, methodologies, and techniques for analysing STPs from different angles, both groups aim to enhance their understanding and analysis of these complex and constantly evolving ecosystems. The present research aims to contribute to this research problem, positioning itself at the forefront of the quest for better comprehension and analysis of STPs. The goal is to propose an innovative approach to analyse STPs, emphasising the generation of SV for stakeholders. This involves presenting a novel methodology that expands the range of available tools for both academics and practitioners. By adopting this new perspective, a contribution is made to the ongoing effort of better understanding and improving these particular and dynamic ecosystems.

STPs are highly complex ecosystems due to the involvement of multiple actors. These actors include, among others, the park management entity, the companies or organisations established within the park (including start-ups, small and medium-sized enterprises (SMEs), large enterprises (LEs), multinationals, research centres, etc.), and the public institutions that support them (such as agencies promoting innovation and research, local or national bodies, etc.), among others. Each of these parties represents a unique perspective of analysis, as evidenced by the existing literature. Furthermore, these actors also assume the role of STP stakeholders, each with their own unique interests and objectives, further adding complexity to the ecosystem and the interrelationships among them (Fulgencio, 2017).

Considering these various factors, it becomes evident that there are numerous types and characteristics of STPs, each representing a unique case embedded in a specific context. STPs can vary significantly in several aspects, such as their management structure and governance. Governance can take on different forms, including public, private, or mixed controlling of the STP, each with varying degrees of control over the park's strategy and operations. In terms of management and organisation, there can be differing levels of autonomy from the park's governance, as well as the presence of dedicated management teams and their size. These are just a few examples of the diverse factors that can affect the operations of an STP. Other factors that distinguish STPs include the number and composition of the companies located within them, as well as the size of the park itself. In terms of company numbers, some STPs are home to only a few dozen entities, while others host hundreds. Spatially, STPs may range from a single building to a sprawling complex where companies have the option to construct their own facilities. Additionally, the structure of the STP's business community can vary significantly from one park to another. Two other critical aspects that significantly impact the innovation capacity of the company community hosted in STPs are the range of services provided and the potential connection with universities and research institutes. STPs vary considerably in terms of the services they offer, ranging from simple office space rentals to providing incubation, acceleration, and support activities for tenant firms. As a result, the services available to tenants differ significantly, as does the level of engagement with universities, which can range from informal to formalized partnerships. Finally, two additional factors that significantly shape the structure and development of an STP are its historical background and the territorial context in which it is situated. The STP's age, determined by the period in which it was established, can influence its current strategic orientation, organisational culture, and level of maturity. On the other hand, the location of the STP, such as whether it is centrally or peripherally located, or integrated into a regional innovation system, can impact its accessibility, visibility, and networking opportunities. These contextual factors must be taken into account when analysing and characterising an STP, along with the previously mentioned elements (Albahari et al., 2019).

Consequently, it remains a challenge to identify a tool capable of producing unambiguous metrics that are applicable to all contexts, making one-to-one comparisons between parks exceedingly difficult. This is due to the fact that the analysis and, specifically, the interpretation of the results cannot be carried out independently of the context in which an STP is located. In this context, developing monitoring tools that can provide reliable metrics to measure performance and assess impact becomes all the more critical, given the complexities of interpreting and comparing results in different contexts (Lecluyse et al., 2019).

Despite the complexity that can arise from managing an STP and the challenges that come with it, park managers are consistently under pressure from stakeholders, especially if the park operates under public or mixed governance. These stakeholders typically demand regular feedback and information on the park's performance and trends, as well as its economic and social impact on the local area. Therefore, there is an increasing need for analysis metrics that can be used internally to continuously improve the management of STPs, and externally to inform and negotiate with specific partners and stakeholders. Developing monitoring tools to improve management and performance in various aspects is therefore essential (Fulgencio, 2017).

On the other hand, policy makers and local entities are increasingly being called upon to provide information, assessments, or analyses on the status, performance, and impact of STPs on their respective territories. Therefore, both for their internal reflections and to respond to their stakeholders, they require new analytical tools. Specifically, for example policy makers need information to evaluate the effects of various policies aimed at promoting innovation, entrepreneurship, or supporting SMEs. Meanwhile, local authorities require information to evaluate the potential investments in STPs, for instance. It is important to note that STPs play a significant role in stimulating innovation, as well as enhancing the competitiveness of both companies and their respective territories. Consequently, the interest in these ecosystems is crucial for policy makers and local authorities, viewed from the perspective of a regional innovation system (RSI), adhering to the principle of the Triple Helix of territorial development (Ng et al., 2020).

Thus, this kind of information and analysis are valuable to both internal actors, such as STP managers and governance boards, and external actors, such as policy makers and local institutions. Such information is useful not only for routine activities but also for strategic decision-making, as it allows them to broaden their knowledge and make more informed choices (Ng et al., 2021).

Keeping in mind the importance of these complex ecosystems, the academia supports these players by contributing to the discourse on enhancing understanding and providing potential analysis tools and interpretative frameworks to aid in the analysis and interpretation of results. In the academic field, the phenomenon of STPs is a subject of interdisciplinary analysis. As demonstrated earlier, various perspectives and lenses are employed in observing the object of study, enabling a comprehensive and systemic understanding of STPs as a “third entity” (Poonjan and Tanner, 2020; Polat, 2022).

The aim of this study is to analyse the phenomenon of STPs by adopting a perspective that focuses on the SV generated and distributed by these parks. To achieve this goal, an established methodology recognized in other fields of application will be adopted and adapted to this specific context. Through the development of this methodology, we provide information on the value created for a selected group of stakeholders, typically the main and classical ones of an organisation. This approach enables the quantification and monetisation of value, which is particularly important and frequently expected by these stakeholders, as mentioned previously. Consequently, a common economic language is established, allowing for effective communication among stakeholders. Our analysis extends beyond the SV generated by a given individual company to include the individual employee, with a proposed indicator of the SV generated by each worker within the STP.

Given the research problem of the need for new tools to analyse STPs and generate performance-related information (Lecluyse et al., 2019; Fulgencio, 2017), the present study is guided by the following research question: *How can a measurement tool based on secondary data be developed to assess the SV generated by STPs in a way that is both convenient for the key potential users and also reliable in terms of quality of analysis?* To address this question, the study will aim to explore the following sub-research questions:

1. *How can essential data be accessed and integrated into the adapted model to ensure accurate analysis and evaluation of STPs?*
2. *How can the adapted model be standardised to effectively utilize secondary data while remaining adaptable to specific national contexts?*

3. *How can the adapted model be designed and configured to function as a monitoring tool for STPs?*
4. *How can the use of non-specific data maintain a high degree of accuracy in the analysis of STP performance using the adapted model?*
5. *How can the adapted model be validated with potential users to ensure its usefulness and effectiveness as an analytical tool for STPs?*

In conclusion, the development of a tool capable of measuring the SV generated by STPs and addressing the challenges associated with its application is crucial (Lecluyse et al., 2019; Fulgencio, 2017). The proposed sub-research questions aim to overcome the constraints related to data accessibility, standardisation, adaptability, accuracy, and validation. Addressing these sub-questions will contribute to the creation of a methodology that is useful for both internal management and external communication purposes. Ultimately, this methodology will provide valuable insights for STP managers and stakeholders, supporting evidence-based decision-making and facilitating the identification of areas for improvement.

Coherently the objectives of this research work are as follows. Firstly, the aim is to develop, test, validate and optimize an adapted methodology for the analysis of STPs in terms of the SV generated and distributed to key stakeholders, while having a clear understanding of the traditional methodology, the analysis context, and the object of study. Secondly, in order to achieve the most reliable results possible, the appropriate sources of information on which to base the application of the adapted model will be identified, analysed and validated, thus adapting the model to the constraints of data accessibility. Thirdly, the methodology will be designed and structured in a way that is sufficiently standardised and easily adaptable to different national contexts for its utilization in different contexts. Fourthly, the methodology will be studied and conceived to apply as a monitoring tool for the analysis of historical data, both for the analysis of the STP over a certain period of time and for the analysis of individual established companies/organisations. Fifthly, the accuracy of the analysis will be discussed, evaluated, and validated given the constraints of quality of input data (non-specific and from secondary sources) after testing the applicability of the model. Finally, the utility of the methodology for potential users, in this case, park managers, will be discussed and validated after testing the applicability of the model and obtaining results. Thus, by accurately fulfilling the stated objectives, the main research question of this thesis can be effectively addressed, thereby providing valuable insights towards resolving the initial research problem. Indeed, the methodology was successfully developed and tested in the field, effectively achieving its objectives and providing answers to both the main research question and its corresponding sub-questions.

The methodology developed in this study, as part of this doctoral thesis, was applied in the field to validate and test its effectiveness (Blazquez et al., 2020), leading to the creation of two-level database of preliminary results. Ultimately, two datasets were created: one with data on the analysis of SV generated by 799 organisations located in 14 distinct STPs across Europe, and another with information pertaining to the structural, organisational, and management aspects of the STPs. This database opened up a number of opportunities for further investigation. The first research avenue involved the analysis of the distribution of SV among stakeholders, which required the initial identification and definition of a model. The second research direction focused on the analysis and exploration of the variables that have the greatest impact on value generation. Both research paths represent important objectives of this research.

Thanks to the fieldwork and collaboration with key stakeholders of the system, namely the STPs, the pilot test of the methodology generated interest from IASP, demonstrating the significance of this study in the field. The formal involvement of IASP in the research project brought the debate on SV analysis to the forefront among practitioners, creating an initial community of STPs interested in the topic. This community served as a valuable testing ground for the methodology on a full scale, ultimately providing answers to the relevant research sub-questions. These included the usefulness of the methodology for potential users, adaptability to different national contexts (tested in six countries), and applicability to STPs with varying characteristics such as age, size, and governance. The success of the methodology in addressing these sub-questions was a significant achievement, highlighting its potential to inform and enhance the work of STPs in various contexts (Blazquez et al., 2020).

In conclusion, this exploratory experiment proved to be a unique endeavour. At the end of the process, it was possible to ascertain the applicability of the tool and the usefulness of the results for the stakeholders involved in the STP, both for internal and external purposes. A small yet significant contribution was made to the academic and practical debate, also addressing certain gaps in the existing literature, as previously highlighted and will be discussed further.

Through this research, an additional instrument has been provided for the analysis and understanding of STPs. What has been conveyed to the relevant community is a discussion on new perspectives of analysis, with particular consideration given to the SV analysis. Awareness seems to have disseminated, and through the achieved results and the commitment of STP managers, the discussion has expanded to include stakeholders and actors within their respective regional contexts. The research conducted with direct involvement of the actors has facilitated an immediate and progressive transfer of knowledge, both for the directly involved actors and indirectly interested parties.

To achieve these outcomes and the objectives of this study, a rigorous methodological process has been followed, which will be briefly outlined in the subsequent sub-chapter, along with the presentation of the thesis structure.

1.3 Methodological framework and thesis structure

The development of the research was guided by an approach consisting of four key phases. The initial phase served as a critical starting point, centred around the development and testing of the proposed methodology. In the subsequent phase, the focus shifted towards expanding the scope of testing, encompassing an application and analysis on a European scale. The third phase offered a valuable opportunity to conduct exploratory statistical analysis, focusing on the results of the European application. Finally, the concluding phase of the research focused on the examination and discussion of the findings obtained throughout the study, allowing for an in-depth exploration of the emerging insights. This chapter provides a concise overview of the four pivotal stages of the research process. For detailed methodological insights, please refer to *Chapter 3*, which offers a comprehensive understanding of the adopted methodology and the key investigation stages. A detailed explanation and analysis of the methodological framework and its four phases can be found in Blazquez et al. (2020).

In the first phase of this study, it was necessary to gain a comprehensive understanding of the SV analysis methodology and the specific context of STPs. Subsequently, a methodology tailored specifically to the STP context was developed. This methodology was subjected to a rigorous testing and validation process through a pilot study involving four STPs across two countries. The outcomes obtained from this pilot test served as a robust foundation for publishing the methodology, thereby establishing a benchmark for future studies and applications.

In the second phase of the study, the decision was made to expand the testing of the model to a European level, with active involvement from the IASP. A call for participation was initiated, inviting all European IASP members to voluntarily take part in the study.

Following a careful analysis and selection process based on the criterion of analysability, the model was implemented at the chosen STPs to achieve the desired outcomes. Throughout this process, contextual information on the participating STPs was gathered through questionnaires and interviews, providing a comprehensive framework for the interpretation and analysis of the results. Furthermore, the obtained results were individually discussed and validated with the STP managers, followed by a collective comparison and discussion of the findings involving the participating STP executives.

During the third phase, exploratory statistical analyses were conducted on the European-level application results of the model. A key approach employed was the utilisation of a hierarchical cluster analysis on the sample of analysed organisations, aimed at identifying meaningful patterns and relationships in the distribution of SV to stakeholders. Simultaneously, efforts were made to develop a multilevel model for analysing the obtained results, enabling an exploratory study on the variables that significantly contribute to the generation of SV within organisations operating in the STPs.

In the final phase of the study, a comprehensive reflection was carried out on the developed methodology, the results obtained from the field application, and the findings derived from the conducted exploratory statistical analyses. This critical phase facilitated the identification of new opportunities for analysis and investigation, laying the foundation for future studies and research in the field of SV within STPs.

Through these four distinct phases, the research successfully achieved its objectives, significantly enriching our understanding and knowledge of SV within the context of STPs. The process followed and the results obtained are documented in the following doctoral dissertation, which is structured into four main sections. These chapters provide a comprehensive overview of the research conducted on SV within STPs, shedding light on the methodology, findings, and implications of the study.

The first section (refer to *Chapter 2*) provides a comprehensive presentation of the theoretical framework of the study, delving into and contextualising the two main areas that converge in this research. On one hand, the study explores STPs as the application context, while on the other hand, it analyses the techniques of SV analysis. A discussion of the state of the art is presented, shedding light on noteworthy research gaps and limitations identified in the literature, both within the realm of STPs and in the application of SV analysis techniques. Additionally, the potential derived from the application of these methods within the STP context is emphasised.

The second section (refer to *Chapter 3*), dedicated to the research methodology, provides an extensive and exhaustive presentation of the study's approach and design, offering detailed insights into each of the aforementioned phases. The paragraph delves into the data collection methods, sources utilized, and analysis techniques employed throughout the various implementation phases of this experimental study. Furthermore, the validity and reliability of the adopted methodological framework are discussed, followed by an exploration of the methodological limitations inherent in the present work.

The third section (refer to *Chapter 4*) presents a detailed exposition of the research results, accompanied by a critical discussion. The first part introduces and explains the SV analysis model, specifically adapted to the context of STPs. Subsequently, the study's findings at the European level are presented, derived from the application of the methodology to the fourteen participating STPs. Moreover, the results of the exploratory statistical analysis conducted on the data obtained from the SV analysis of a sample comprising 799 organisations involved in the research are presented and thoroughly examined. In this results section, in-depth discussions of the results will be conducted progressively, along with the provision of interpretations and analyses of their implications. Special attention is given to the research conducted in the context of STPs and the application of SV analysis. Additionally, the role of the STP governance and management system in the generation and distribution of SV is explored and critically examined.

Finally, the last section (refer to *Chapter 5*) is dedicated to presenting the conclusions of the study, encompassing the key findings and their significance. The contribution of this research to the field of STPs and SV analysis is carefully outlined and discussed. The section concludes with a critical assessment of the limitations of the present work and a thoughtful exploration of potential avenues for future research.

2. Research Conceptual Background

This chapter aims to establish a theoretical and conceptual foundation for the current research. It provides a comprehensive understanding of the contextual framework, emphasising the research's significance and the underlying conceptual basis. By presenting a clear and coherent conceptual framework, this chapter enables readers to fully grasp the importance and coherence of the research.

Consistently, the purpose is to provide an in-depth overview of the context, the theoretical models used and the positioning of the research within the specific field of study, in order to provide a solid basis for the overall understanding of the topic and the entire thesis work.

The first section (refer to *Chapter 2.2*) begins with an introduction and discussion of the concept and context of STPs. It explores the academic and practical debates surrounding these complex ecosystems and identifies the current state of the art in STP analysis. Emphasis is placed on aspects such as their structure, management, functioning, and their role within regional innovation systems.

The subsequent second section (refer to *Chapter 2.2*) delves into the theoretical framework employed for the analysis of STPs, with particular focus on the perspective of measuring and monetising the generated and distributed SV. The Stakeholder Accounting concept and the Polyhedral Model are explored as tools for analysing SV.

Finally, the third section (refer to *Chapter 2.3*) discusses the positioning of the research within the existing academic debate. It identifies and deliberates on open issues in the field of STPs, examines gaps and limitations in the scientific literature, and highlights the research areas that require further investigation. In doing so, it underscores the contributions that this research aims to make.

2.1 Contextual framework: Science and Technology Parks

The object of study in this research is Science and Technology Parks (STPs). In the introduction, the acronym STP was previously presented to encompass and categorize the various terminologies commonly employed to describe these ecosystems, including “science park”, “technology park”, “technopole”, “research park”, and similar terms. (Hobbs et al., 2017) By utilizing this acronym, in conjunction with the definition coined by the International Association of Science Parks and Areas of Innovation (IASP) and generally recognized in scholarly communities (Albahari et al., 2022; Henriques et al., 2018), we specifically refer to the entity known as STP, which represents *“[…] an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a […] STP […] stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.”* (IASP, 2023) (Hobbs et al., 2017; Meseguer-Martinez et al., 2020)

For the research purposes, it is not necessary to distinguish between the different types of entities (from a terminological perspective). Conceptually, these entities share a common basis and root, which is well represented in the definition coined by the international umbrella association (IASP). Therefore, the issues addressed in this study are common to all types of entities; whether they are classified as “science parks”, “research parks”, or other designations (Meseguer-Martinez et al., 2020). However, as will be discussed, the distinct characteristics of each STP and its contextual environment can significantly impact its operational dynamics and overall performance (Ng et al., 2019). Consequently, it is imperative to consider these factors when conducting an analysis of the findings.

STPs are widely recognised as drivers of innovation and technological development (Martínez-Cañas & Ruíz-Palomino, 2011; Poonjan & Tanner, 2020). The primary objective of these entities is to foster innovation within businesses (Corrocher et al., 2019; Hommen et al., 2006). Essentially, the concept revolves around providing a physical space where companies at different stages of development can establish themselves and pursue their entrepreneurial activities (Diez-Vial & Fernández-Olmos, 2017). This environment, or context, is typically designed to facilitate research and development activities (Lamperti et al., 2017; Vasquez-Urriago et al., 2016b). Within these settings, entrepreneurs and businesses often find the knowledge, resources, and networking opportunities necessary for the advancement of their activities (Gwebu et al., 2019; Löfsten & Lindelöf, 2005). Access to such resources can be crucial for business innovation and growth. (Diez-Vial & Fernández-Olmos, 2017)

STPs serve as catalysts for creating an ecosystem that promotes interaction among companies, research institutions, government entities, and investors (Etzkowitz & Zhou, 2017; Skowron-Grabowska, 2020). This interaction facilitates knowledge sharing, access to funding, collaboration on joint research projects, and entry into potential markets (Corrocher et al., 2019). Moreover, STPs create a stimulating environment that nurtures a culture of innovation and entrepreneurship. Research and development activities within these parks often focus on strategic sectors, aligning with regional and national development policies. (Gomes et al., 2022)

In summary, STPs play a key role in the innovation ecosystem, providing a conducive environment for the interaction of businesses, research, and financial resources. Their role in promoting innovation and technological development is of paramount importance for economic and social progress. (Etzkowitz & Zhou, 2017)

2.1.1 Exploring the characteristics of Science and Technology Parks

The characteristics of a STP are influenced by several key factors (Lecluyse & Knockaert, 2021; Meseguer-Martinez et al., 2020). Firstly, the territorial context, considering the dynamics at the local, regional, and national levels, plays a significant role in shaping the configuration and characteristics of the park (Gomes et al., 2022; Theeranattapong et al., 2020). Secondly, the type of initiative behind its establishment, whether it is public, private, or a mixed public-private partnership, also contributes to its distinct features (Leite et al., 2022; Lund et al., 2020). An essential aspect is the active involvement of various stakeholders in both the establishment and operation of the park (Polat, 2022; Urbinati et al., 2020). Institutions, companies, universities, and associations each play specific roles within the STP, contributing to its dynamic nature and overall development.

The presence of innovation policies in the STP's location, at regional or national level, significantly influences its characteristics. These policies can impact the park's structure, orientation, and, consequently, the types of businesses attracted to and hosted within the STP (Almeida et al., 2020; Yan et al., 2018). Therefore, indirectly they can influence the services provided to these businesses and shape the relationships that the STP maintains with its community of hosted enterprises (Albahari et al., 2022; Skowron-Grabowska, 2020). The governance and management system of the STP play a crucial role in defining its characteristics. This encompasses the adoption of stakeholder management strategies, which may vary based on the park's specific needs and objectives (Germain et al., 2022). Furthermore, the autonomy of the management team in making strategic decisions and shaping internal policies is a determining factor in the park's functioning (Amaral et al., 2022).

These various factors contribute to the diversity observed among different STPs. Gaining a comprehensive understanding of a particular park necessitates an in-depth analysis of the context in which it operates. This includes considering territorial factors, the actors involved, innovation policies, and the governance framework (Albahari et al., 2013; Almeida et al., 2020). This overview highlights the importance of conducting a contextualised study to thoroughly assess and understand the diverse aspects of these innovation ecosystems.

The diverse configurations of STPs and their distinctive ecosystems are influenced by the interplay of the aforementioned factors. Notwithstanding the broad spectrum of configurations, it is possible to outline some key differences across various categories of characteristics. These encompass the physical infrastructure of the STP, the composition of the established business community, the range of services provided, the governance and management framework, and the nature of stakeholder relations (Guadix et al., 2016; Liberati et al., 2016; Meseguer-Martinez et al., 2020). These aspects have been extensively explored in the literature.

The physical infrastructure of STPs can exhibit considerable variation (Albahari et al., 2013; Etzkowitz & Zhou, 2017). Spatially, they can range from a single building to several hectares of land, accommodating either individual development spaces or a multi-building campus (Albahari et al., 2018; Bruneel et al., 2012). The rental options within STPs can vary from individual workstations to office spaces, entire buildings, or even undeveloped land. As a result, the scale of the STP's establishment can range from hosting a few companies to accommodating several hundred entities. The spatial configuration of an STP thus has a direct impact on the types of businesses that could choose to establish themselves within its premises. Undoubtedly, it would align with the specific strategy pursued by the STP.

STPs could offer a wide range of services to support the businesses hosted within them (Meseguer-Martinez et al., 2020). These services could include basic organisational and logistical support such as reception services, mail handling, infrastructure maintenance, cleaning, and security - all derived from being situated within a shared space in the STP (Chandra & Chao, 2016; Liberati et al., 2016). Additionally, STPs could provide shared spaces such as meeting rooms, dining facilities, leisure facilities, and laboratories (Robinson & Stubberud, 2014). Moreover, STPs could offer specialised services such as legal and patent consulting, accounting and financial management, and assistance in seeking funding opportunities (Albahari et al., 2018; Liberati et al., 2016; Robinson & Stubberud, 2014; Schmidt & Balestrin, 2015). They could also provide training courses to enhance the skills of the hosted businesses (Bruneel et al., 2012; Hommen et al., 2006). Networking activities could be actively promoted to facilitate connections and collaboration among the companies within the park and with external organisations (Hommen et al., 2006). Strategic and managerial support could be available to help businesses define and implement their growth strategies (Bruneel et al., 2012; Liberati et al., 2016; Robinson & Stubberud, 2014). Furthermore, STPs could provide support for research and development (R&D) activities of the hosted companies, offering resources, specialised equipment, and services (Chandra & Chao, 2016; Fukugawa, 2006; Schmidt & Balestrin, 2015). They could also foster technology transfer activities, facilitating the dissemination of knowledge and technologies developed within the park to the market and other interested organisations (Etzkowitz & Zhou, 2017; Kim & Jung, 2010; Liberati et al., 2016; Somsuk & Laosirihongthong, 2014; Steruska et al., 2019). It is important to note that the range of services offered by STPs may vary based on the specific offerings of the park, the needs of the hosted businesses, and the territorial context in which they operate.

The composition of the business community within a STP can vary significantly (Lamperti et al., 2017; Vasquez-Urriago et al., 2016b). Typically, the organisations that establish themselves in an STP can belong to different types, including startups, small and medium-sized enterprises, large corporations, and research centres (Correia et al., 2021). The predominance of a specific type of organisation depends on the strategic orientation of the STP (Ubeda et al., 2019). In addition to strategic orientation, there are other factors that can influence the composition of the population of organisations within an STP. For example, the definition of a specific focus for the park and the presence of access criteria can shape the types of businesses that choose to settle in (Ng et al., 2022). Some STPs may have a sectoral focus, concentrating on a specific industry such as biotechnology or information technology (Corsaro & Cantù, 2015; Staszków et al., 2017; Xie et al., 2018). Others may be focused on a particular type of business, such as incubating and accelerating new enterprises (Diez-Vial & Montoro-Sanchez, 2017). This focus can influence the composition of the community of businesses established, attracting organisations operating in specific sectors or falling within the supported business type.

The variation in the composition of the business community within STPs reflects the diversity and flexibility of these ecosystems (Gwebu et al., 2019). This diversity can foster synergies and collaborations among businesses, providing opportunities for knowledge exchange and networking. Additionally, the presence of a heterogeneous community can stimulate innovation and cultivate a dynamic environment within the park (Corsaro & Cantù, 2015). In summary, the composition of the business community within

STPs can be influenced by the strategic orientation of the park, the definition of a specific focus, and the presence of access criteria. These characteristics contribute to the creation of diverse and stimulating ecosystems, promoting interaction and collaboration among businesses within the park.

The governance and management system of a STP would play a crucial role in shaping its operations and outcomes (Amaral et al., 2022). Three main types of governance could be observed: public, mixed (public-private partnership), and private (Lund et al., 2020). The type of governance adopted would significantly influence the level of autonomy that could be granted to the park's management, both in terms of strategic decision-making and day-to-day operations. In a publicly governed STP, the management would typically operate within a framework defined by public authorities. This framework would set the guidelines and regulations for the park's functioning, often involving close collaboration with government agencies or public entities responsible for economic development. The management team's autonomy could be more constrained, with decisions subject to approval from relevant authorities. In a mixed governance model, where public and private entities could collaborate, the management would enjoy a certain degree of autonomy in decision-making and operational management. This model would allow for more flexibility and adaptability, as the involvement of private entities would bring a business-oriented perspective to the park's management. The collaboration between public and private stakeholders could lead to innovative strategies and a dynamic operational environment. In privately governed STPs, the management would have a higher level of autonomy in decision-making and operations. Private entities would take the lead in managing the park, often guided by profit-oriented considerations. The management team would have the flexibility to develop and implement strategies tailored to the specific needs of the park and its tenants. (Al-Kfairy et al., 2020; Hobbs et al., 2017, Lecluyse & Knockaert, 2020)

The size of the park, the range of services provided, and the governance model would also influence the staffing requirements for the management team (Albahari et al., 2018). Larger STPs with a wide array of services would require a larger management staff to handle various aspects of park operations, including tenant management, facility maintenance, financial management, and strategic planning. In contrast, smaller parks with fewer services would have a leaner management team focused on core functions.

Overall, the governance and management system of an STP would significantly shape its functioning and outcomes (Entringer & Da Silva, 2020). The choice of governance model and the level of management autonomy would have implications for strategic decision-making, operational efficiency, and the ability to respond to the evolving needs of the park and its tenants.

The relationships between STPs and stakeholders could vary significantly, depending on the type of governance within the STP. In some cases, specific stakeholders could be more or less involved in the strategic or operational management of the park. One crucial stakeholder is universities, with which STPs could have varying degrees of formalised relationships. Collaborations between STPs and universities could range from informal partnerships to formalized agreements involving joint research projects, technology transfer initiatives, and academic-industry collaborations (Kosmol & Kotra, 2013). Another important stakeholder group is research centres, with which STPs could establish significant relationships. In certain cases, these research institutes could be directly located within the parks and could be either public or private entities. Collaborations between STPs and those entities could involve joint research activities, knowledge sharing, and the creation of a research-driven innovation ecosystem (Löfsten & Lindelöf, 2002).

Regardless of the governance model, it would be essential to maintain strong relationships with institutional stakeholders at the local, regional, and national levels. These stakeholders would include government agencies, economic development organisations, and other relevant institutions. Collaboration and coordination with these stakeholders would be crucial for creating a supportive environment for innovation and economic development. One of the primary stakeholders within an STP is the companies that are established in the park. The strength of the relationship with these companies could vary, and it could range from providing basic services and infrastructure support to more strategic partnerships and active involvement in the management of the park. Additionally, some STPs could have associations or networks that facilitate the engagement and collaboration among the companies, allowing them to collectively contribute to the park's development and success (Mora-Valentín et al., 2018).

In summary, the relationships between STPs and stakeholders could be diverse and multifaceted. They would involve universities, research centres, institutional stakeholders, and the companies established within the park. The nature and intensity of these relationships would depend on various factors, including the governance model, the strategic objectives of the park, and the specific needs and interests of the stakeholders involved. As highlighted, STPs can present a wide range of configurations, which are largely influenced by the regional context in which they are situated and the prevailing regional innovation system. Consequently, gaining a comprehensive understanding of their distinctive characteristics necessitates an examination of their historical evolution. The academic and practical discourse surrounding on the functioning of these complex and distinctive ecosystems is vibrant, stimulating numerous interesting opportunities for investigation (Lecluyse et al., 2019).

2.1.2 Exploring the academic debate on Science and Technology Parks

The realm of STPs offers a rich and multifaceted terrain for scholarly exploration (Albahari et al., 2022; Hobbs et al., 2017; Lecluyse et al., 2019; Theeranattapong et al., 2020). These highly complex entities present ample opportunities for in-depth study, as the research avenues traverse various elements that define them. Researchers meticulously explore every aspect of STPs, carefully analysing their configurations, operational dynamics, and interactions within the surrounding context (Lecluyse et al., 2019). The academic discourse on STPs encompasses a wide range of topics, providing a comprehensive understanding of these unique ecosystems from their inception to their functioning and their intricate relationships with the broader socio-economic landscape (Amaral et al., 2022; Poonjan & Tanner, 2020). This chapter aims to delve into the academic debate surrounding STPs, shedding light on the diverse perspectives and insights that have emerged from scholarly research in this field.

The academic discourse on STPs is developing on several fronts, addressing several issues crucial to understanding their complexity and impact. First and foremost, the debates delve into the regional context in which STPs are situated and the intricate relationship between these parks and their surrounding territorial environments (Albahari et al., 2013; Gomes et al., 2022). This analysis involves examining the dynamics of interaction, mutual influence, and synergies between STPs and the regional context, considering the development policies and innovation ecosystems that are present (Etzkowitz & Zhou, 2017; Yan et al., 2018). At a more definite level, the attention shifts to the internal dynamics of STPs, focusing on the governance, management and organisation of parks (Al-Kfairy et al., 2020; Correia et al., 2021; Latorre et al., 2017). Discussions revolve around the various governance models, including stakeholder participation, as well as the strategic and operational management strategies employed within STPs (Cadorin et al., 2021; Germain et al., 2022). Additionally, researchers explore the dynamics of the communities of organisations established within STPs, examining the composition, relationships, and interactions between businesses, academic institutions, research centres, and other key actors (Amaral et al., 2022; Gwebu et al., 2019).

In addition to these specific aspects, there are overarching themes that permeate the academic debate on STPs. These themes include the analysis of stakeholder relations at different levels, encompassing the interactions between governance, management, and the business community within the STPs (Nieth & Benneworth, 2020; Polat, 2022). Furthermore, significant attention is devoted to assessing the performance of STPs and the impacts they generate, evaluating their effectiveness both at the park-wide level and on individual enterprises (Bigliardi et al., 2006; Diez-Vial & Fernández-Olmos, 2017; Gomes et al., 2022; Ubeda et al., 2019). These cross-cutting themes provide valuable insights into the role and effectiveness of STPs as catalysts for innovation and territorial development.

The academic debate on STPs is evolving and encompasses a broad range of topics that delve into the intricacies of these complex entities. The discussions unfold across five distinct levels, each addressing key aspects that define the nature and impact of STPs. These levels include the regional context, governance, management, stakeholder relations, and performance analysis. Scholars contribute to developing an in-depth understanding of these ecosystems and their impact on economic development and innovation (Albahari et al., 2022).

At the regional level, the academic discourse delves into the interplay between STPs and their surrounding territorial environment (Poonjan & Tanner, 2020). This inquiry encompasses a comprehensive examination of how the regional context shapes various aspects of STPs, including their configuration, operational dynamics, interactions, and performance (Poonjan et al., 2020). Furthermore, scholars investigate the reciprocal relationship between STPs and regional development, evaluating their contribution to enhancing competitiveness, fostering entrepreneurial dynamics, and driving socio-economic progress (Gomes et al., 2022; Soenarso et al., 2013). Of particular significance is the role of STPs within the broader National or Regional Innovation System (RIS), wherein they actively engage with the *State*, the *Education* and *Research System*, and the business sector, reflecting the principles of the triple and/or quadruple helix model (Mineiro et al., 2023). While the intricate dynamics between STPs and the territory remain multifaceted, it is widely acknowledged that STPs have a positive impact, notably through job creation and their role in promoting socio-economic development (Lecluyse et al., 2019; Moyano-Fuentes et al., 2019). An aspect that gains increasing importance is the analysis of the societal contribution made by these entities within the contexts in which they are embedded.

The governance of STPs constitutes a critical area of investigation in the academic discourse (Lecluyse et al., 2019). Scholars devote considerable attention to examining the different governance models employed in STPs, which can be broadly classified into three categories: public, mixed (public-private), and private (Lund et al., 2020). The ownership structure of the parks is also examined, along with the extent of stakeholder involvement in the governance process (Cadorin et al., 2021; Chou, 2007; Liberati et al., 2016; (Warwick Enterprise Limited & IASP, 2017). These variations in governance models have significant implications for the configuration of the management structure, the level of autonomy in strategic and operational decision-making, and ultimately, the performance of the STP (Sampaio Filho & Nascimento-Santos, 2017). Moreover, scholars investigate the degree of governance involvement in park management activities, shedding light on the factors that shape effective governance practices and their impact on the overall functioning of the STP. One aspect that sustains ongoing interest lies in exploring how governance can exert an impact on the performance of the STP, thereby influencing its operational effectiveness and efficiency.

The organisation and management of STPs constitute a focal point of academic inquiry, attracting significant attention from scholars (Ribeiro et al., 2021; Zhang, 2004). Researchers meticulously analyse the complex interrelationship between park management and governance, investigating the dynamics between operational and strategic activities, decision-making power, and the allocation of responsibilities (Skowron-Grabowska, 2020; Sudiana & Hendayani, 2020). The managerial structure encompasses various dimensions, including the involvement of stakeholders, the composition of the business community within the STP (which encompasses diverse types of organisations), and the engagement of institutional and local stakeholders (Ng et al., 2021). Moreover, the size of the management staff is carefully considered, considering the strategic objectives and specific characteristics of the park, as well as the range of services provided to the tenant companies (Albahari et al., 2018; Gower et al., 1996). Scholars also explore the dynamism and entrepreneurial mindset of the management team (Jimenez-Zarco et al., 2013). It is widely acknowledged that the managerial structure significantly influences the performance of the STP, with particular emphasis on the pivotal role of the Chief Executive Officer (CEO) in shaping outcomes through their expertise and skills (Mora-Valentín et al., 2018; Ribeiro et al., 2016; Skowron-Grabowska, 2020). Additionally, the need for tools and frameworks to enhance park management, such as advanced information systems, remains an ongoing topic of discussion, driven by the objective of fostering informed decision-making processes.

Stakeholder relations represent a pivotal and extensively examined area of research within the academic discourse on STPs (Germain et al., 2022). The significance of engaging key stakeholders, including universities, research centres, and technology transfer agencies, is widely recognised (Cadorin et al., 2021; Löfsten et al., 2020). Scholars delve into various aspects of stakeholder involvement, such as collaborative projects, open innovation strategies, and other forms of engagement (Urbinati et al., 2020). Moreover, the inclusion of local stakeholders is emphasised to ensure the seamless integration of the STP within the broader regional context and to consider the interests of the local community and businesses (Nieth & Benneworth, 2020). Discussions revolve around stakeholder management and involvement strategies at the STP level, as well as the practices adopted by individual tenant organisations, with a particular emphasis on stakeholders who hold a key role within the STP (Polat, 2022). Discussions also revolve around the appropriate level of engagement from various stakeholders, whose involvement may vary from active to passive, depending on the specific circumstances. This includes for example trade or business associations in the case of sector-specific or business-type focused parks, as well as innovation agencies when parks are subject to settlement criteria associated with government funding. Recognizing the criticality of stakeholder management in the functioning of STPs and its significant influence on overall performance, as well as the comprehension of key stakeholders and the establishment of effective relationships continue to be fundamental areas of scholarly exploration (Lecluyse et al., 2019). Moreover, exploring the measurement of stakeholder impact is gaining attention, although the development of appropriate analytical tools for such assessments is an ongoing endeavour.

Performance analysis constitutes a critical dimension of the academic debate on STPs. Scholars examine the metrics and key performance indicators (KPIs) employed to evaluate the overall performance of STPs and the effectiveness of their management (Albahari et al., 2013; Amaral et al., 2022; Bigliardi et al., 2006; Sudiana & Hendayani, 2020). These assessments have broader implications for evaluating local, regional, and national policies related to territorial development, innovation stimulation, and technology transfer (Gwebu et al., 2019; Lyra & Almeida, 2018). Performance analysis also considers how STPs influence the performance of their tenant companies, measuring both park-level performance and the individual performance of the companies within the park (Diez-Vial & Fernández-Olmos, 2017; Martínez-Cañas et al., 2011). Comprehensive performance analysis at multiple levels is essential for operational and, more importantly, strategic decision-making processes.

In conclusion, the academic discourse on STPs encompasses a wide range of dimensions and aspects, providing a comprehensive understanding of these innovation ecosystems and their influence on social and economic development. Through exploring the regional context, governance and management structures, stakeholder relations, and performance analysis, scholars contribute to advancing knowledge and informing decision-making processes in the field of STPs.

The debate addressed at the academic level is also reflected in practice, as revealed by the interactions with park managers and IASP representatives within the framework of this project. This confirms that the issues discussed in the academic sphere are also a topic of great interest to practitioners, and therefore well reflect the current context and needs in this field.

2.2. Theoretical framework: Stakeholder Accounting and New Business Narrative

To establish a comprehensive theoretical framework for this research, the exploration will begin by delving into the scholarly discourse concerning the concepts of economic and social value, as well as their respective perceptions and measurements.

In general, the economic value generated by companies is intuitively recognised, and they are commonly perceived as natural enablers of such value (Groth et al., 1996). However, the identification and appreciation of the social value they create are less immediate (Retolaza et al., 2016). Throughout history, the social function of companies has been overlooked and relegated to a secondary position (Anunciação et al., 2011). Frequently, social value or social function has been associated with the concept of the "invisible hand" (Smith, 1776), leading to the prevailing accounting system primarily focusing on measuring a company's economic activities (Freeman, Retolaza, et al., 2020; Retolaza et al., 2016). Indeed, the dominant perspective often revolves around shareholders, leading to the development of financial-based value indicators. Conducting a more profound analysis of the social value produced by companies facilitates the assumption of a broader perspective, encompassing the benefits to society as a whole and the engagement with stakeholders (Parmar et al., 2022; Retolaza et al., 2022).

The development of accounting models that can effectively integrate both economic and social value, adopting a stakeholder-oriented perspective, becomes imperative (Freeman, Retolaza, et al., 2020; Parmar et al., 2022; Retolaza et al., 2022). In this context, it is essential to expand the concept of value (Mitnick, 2000; Retolaza & San-Jose, 2011; Retolaza et al., 2016; Wood, 1991). On one hand, it should encompass the capacity to capture the economic value generated and distributed among diverse stakeholders, including shareholders. On the other hand, it should account for the broader impact of the company's activities on these stakeholders, transcending purely economic considerations (Retolaza et al., 2014; San-Jose & Retolaza, 2012). This more comprehensive and inclusive notion of value, in this context, is commonly referred to as "social value" or alternatively as "extended value", "blended value", or sometimes "social income" (Retolaza et al., 2016).

Furthermore, the concept of social value is not novel; indeed, numerous classic and well-established publications have explored this subject. Esteemed authors such as Smith (1776), Marx (1844), and, more recently, Coase (1960), have all delved into this topic. At regular intervals, the discussion returns, offering diverse perspectives, and the underlying motivation behind the new interest in this subject is often associated with the emergence of various crises (economic, environmental, etc.) (Parmar et al., 2022; Retolaza et al., 2016). What distinguishes the current situation from the past is the growing importance attached to the active involvement of companies in this matter (Freeman, Retolaza, et al., 2020; Retolaza et al., 2022). The necessity of thoughtfully incorporating this aspect into their business activities is becoming ever more essential (Costas, 2017; GEAccounting, 2022).

Another highly relevant aspect pertains to the prevailing inclination among companies, or at least the aspiration, to shift their primary focus away from mere profit maximisation (Freeman, Retolaza, et al., 2020; Retolaza et al., 2022). Instead, they are gravitating towards a more purpose-driven concept closely aligned with the organisation's mission (Harrison et al., 2020; Mayer, 2021; Serafeim, 2020). Undeniably, while contemplating the purpose of the organisation, the notion of "multi-stakeholders" and the impacts that the organisation generates concerning these stakeholders must not be overlooked. Indeed, companies are also motivated to consider their mission in relation to stakeholders and aim to establish an equitable distribution of value for all the parties involved or affected by their actions (Retolaza et al., 2022).

In this context, it becomes evident that there is a need to move beyond the current one-dimensional accounting information model, which is primarily oriented to the shareholders, and move towards a more comprehensive multidimensional approach (Freeman, Retolaza, et al., 2020; Hörisch et al., 2014, 2020; Mitchell et al., 2015). This expanded model should consider a wider range of stakeholders and include the collection of non-financial information. To ensure better understanding and comparability, it should also incorporate a system for converting this information into monetary units, thus enhancing its overall value and relevance (Retolaza et al., 2022).

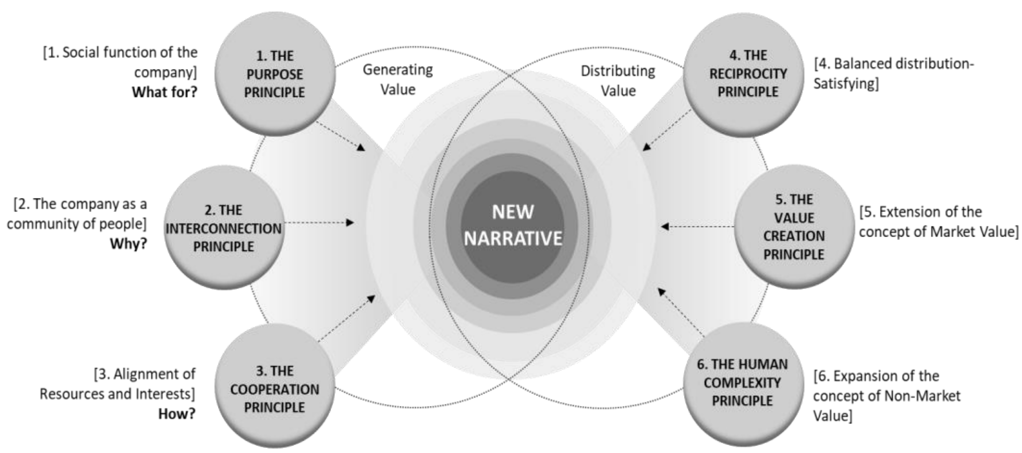
From this perspective, adopting such an approach would enable organisations to communicate their value creation or depletion for society in a more accessible manner, reaching out to both the general public and stakeholders (Parmar et al., 2022). Additionally, it would provide information into the distribution of this value among various stakeholders (Freeman, Retolaza, et al., 2020; GEAccounting, 2022; Retolaza et al., 2022). As a result, stakeholders would gain a comprehensive understanding of the organisation’s performance from multiple angles. Internally, this approach would grant organisations a broader view of their impacts, facilitating more effective decision-making and better alignment with their purpose-oriented strategic objectives (Hörisch et al., 2014; Mitchell et al., 2015). The comprehensive measurement and communication of an organisation’s performance and impacts would enhance awareness both within and outside the organisation, shedding light on its activities and effects (Hörisch et al., 2020; Parmar et al., 2022). Hence, this approach could be regarded not only as an effective communication tool but also as a valuable management instrument (Harrison et al., 2020; Parmar et al., 2022; Retolaza et al., 2022).

Within this evolving framework, and based on the previously mentioned premises, a New Business Narrative [NBN] is gradually taking shape (Freeman, Retolaza, et al., 2020; Retolaza et al., 2022). This emerging discourse revolves around five pivotal concepts: First and foremost, it advocates for giving priority to the organisation's purpose and financial gains, recognizing the significance of aligning financial success with broader societal goals. Secondly, it emphasises the generation of value for all stakeholders, including shareholders, highlighting the importance of considering diverse interests and perspectives. Furthermore, this new perspective views businesses as integral parts of society and markets, acknowledging their interconnectedness and responsibilities beyond profit-seeking. Moreover, it highlights the human aspect of individuals within the business context, encompassing their economic interests while also acknowledging their broader social and ethical dimensions. Lastly, this evolving narrative seeks to integrate business practices and ethics into a more comprehensive and cohesive model, where ethical considerations are not merely an afterthought but an integral aspect of decision-making processes (Freeman, Martin, et al., 2020; Freeman, Retolaza, et al., 2020; Retolaza et al., 2022) Overall, this reimagined business narrative aims to create a more purpose-driven, inclusive, and socially responsible approach to business management that embraces the complexities of the modern world.

Considering these five fundamental concepts aligned with Stakeholder Theory, it is possible to derive the six guiding principles of this new narrative (Freeman, Retolaza, et al., 2020; Retolaza et al., 2022; San-Jose et al., 2017). Indeed, stakeholder theory allows to consider organisations as a set of interconnected individuals who also interact with a wider community (network) or have specific contractual relationships with other actors in the system in which they operate [2nd Principle: interconnection]. These individuals and entities collaborate to accomplish the organisation's objectives, generating value for both the directly involved actors and those impacted indirectly [1st Principle: Purpose]. The cooperation among these actors aims to optimise and augment the overall value created [3rd Principle: cooperation], with the goal of an equitable redistribution based on each party's contribution [4th Principle: reciprocity]. The value generated goes beyond the market value obtained through purely economic activities and encompasses other dimensions such as non-market and emotional value [5th Principle: value creation]. Given that individuals are multifaceted human beings with diverse motivations and interests, the perception of value can significantly vary [6th Principle: human complexity]. Finally, as depicted in the summary *Diagram 1* below, those six principles are organised in such a way that the first three pertain to value generation, while the remaining three are concerned with the distribution of the generated value.

Diagram 1: The 6 Principles of the New Business Narrative

Diagram 1: The 6 Principles of the New Business Narrative



Source: Own elaboration based on Freeman, Retolaza et al. (2020)

Based on the above-mentioned diagram, the concepts underlying these principles can be briefly summarised as follows. The purpose principle is fundamentally rooted in the concept of the organisation's social function. In this context, companies are established to address unmet needs or, more broadly, to enhance and augment value for the community. As a result, the company's existence and its fundamental purpose find justification. The unifying purpose of the organisation enables the alignment of resources and interests among the diverse stakeholders involved, all working towards the accomplishment of the company's goals (Freeman, 1999; Freeman, Retolaza, et al., 2020; Strand & Freeman, 2015). Following, the interconnection principle views the enterprise as a network of stakeholders sharing resources, skills, and knowledge in order to create added value (Freeman et al., 2007; Mathur et al., 2008). These interconnections can take the form of communities of people (Melé, 2012), networks of explicit or implicit contractual relationships of various forms (Coase, 1937), or simply as broader network ties (Bolton & Dewatripont, 1994). In any case, it is evident that the individuals or entities involved share common interests in various ways and to different degrees (Freeman, Retolaza, et al., 2020). Furthermore, the principle of cooperation suggests that companies, when collaborating, generate more value than individuals acting alone. Internal cooperation can confer a competitive advantage by aligning interests and resources to enhance overall value (Freeman, Retolaza, et al., 2020). Moreover, external cooperation, rather than mere competition, optimises outcomes within the broader ecosystem of value creation where companies and organisations operate (Schneider & Sachs, 2017). Consistently, the fourth principle revolves around reciprocity, assuming an equitable distribution of the generated value based on each stakeholder's contribution. This implies that through cooperative efforts, the organisation generates diverse forms of value for the various stakeholders involved. Unlike the conventional shareholder-centric approach aimed at profit maximisation, this principle emphasises a balanced distribution among stakeholders to fulfil their respective interests, prioritising satisfaction over maximisation (Brown, 2004; Freeman, Retolaza, et al., 2020; Retolaza et al., 2022).

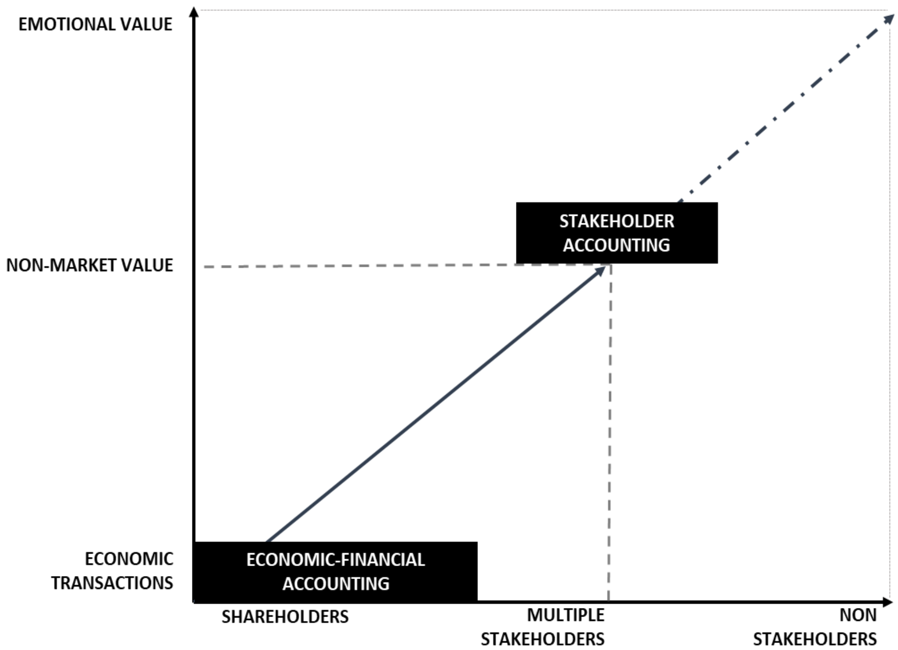
In a coherent manner, adhering to the five foundational concepts of this narrative, the principle of value creation leads towards an expanded notion of value. Generally, it is widely recognised, even within theoretical models, that the primary objective of companies is to create value (Freeman & Liedtka, 1997; Freeman et al., 2007). However, simply equating value with mere profit, i.e., the difference between income and expenses, or limiting it solely to the value-added generated by the organisation's activities, falls short. These approaches fail to capture the broader value generated, for instance, for employees or suppliers, as they primarily focus on the market dimension of the company's activities. Instead, value should be seen as the sum of credits and debits transferred between an entity and its stakeholders, or more precisely, between the different stakeholders of the entity through its intermediation (Freeman, Retolaza, et al., 2020). These transfers encompass not only monetary exchanges but also non-market transfers, which can be identified in all types of organisations and are crucial in social entities. Additionally, emotional value transfers should be taken into account (Retolaza & San-Jose, 2022). Hence, in this comprehensive creation and distribution of value, three types of value must be considered: market value, non-market value, and emotional value (Retolaza et al., 2016). Finally, the sixth principle, the human complexity principle, highlights the unique nature of human beings' perception of value and the diverse motivational factors that drive them. Beyond monetary incentives, emotional and non-market value aspects can significantly enhance satisfaction and value for individuals involved. To achieve this, companies must invest in thoroughly comprehending the value perceptions of their stakeholders and identifying their specific interests. This knowledge enables a more effective alignment of stakeholder interests with the organisation's purpose and objectives, thereby fostering the creation of greater value for each stakeholder. Moreover, it is crucial to acknowledge that individuals have varying motivations and values. While monetary incentives may be relevant to some, others may prioritise emotional value or opportunities to serve others. The company must be capable of meeting these diverse needs to maximise stakeholder engagement and satisfaction (Freeman, Retolaza, et al., 2020; Mitchell et al., 2015; San-Jose et al., 2017).

According to these principles, the NBN necessitates a paradigm shift in accounting practices. It goes beyond the traditional focus solely on profit and incorporates a comprehensive evaluation of all transfers generated by organisations (Freeman, Retolaza, et al., 2020; Retolaza et al., 2022). As previously highlighted, this expanded perspective encompasses not only market-based transactions but also emotional and non-market transfers, commonly referred to as negative and positive externalities. To effectively implement the NBN, methodologies and techniques are required to quantify and monetise the generated and distributed value (GEAccounting, 2022; Retolaza et al., 2015, 2016). While the current accounting system provides valuable information regarding market value, it falls short in capturing non-market and emotional value. Furthermore, it lacks insights into the equitable distribution of value among stakeholders. The NBN demands a holistic approach in accounting information, aiming to identify the holistic and all-encompassing value created by the organisation for its stakeholders and society (Freeman, Retolaza, et al., 2020; Harrison et al., 2020; Retolaza et al., 2016, 2022).

This new approach is called Stakeholder Accounting (SA), also known as Social Accounting, and represents an expansion of the accounting information system, moving it towards a multidimensional stakeholder-centred perspective. This approach is closely aligned with the extended concept of value, as it aims to reconstruct the comprehensive social value generated by the organisation (Retolaza et al., 2016). As depicted in the following *Diagram 2*, stakeholder accounting aims to exceed the boundaries of traditional economic and financial accounting by recognising a broader spectrum of stakeholders and embracing the complex nature of value creation and distribution. The SA approach ensures a more inclusive representation of the organisation's impact on its stakeholders and society, fostering a better understanding of its role beyond mere financial performance. This approach encompasses an extension of stakeholders for whom the value generated is calculated, starting from shareholders and extending to encompass the organisation's stakeholders up to the maximum extent, including non-stakeholders. Simultaneously, it expands the calculated and reconstructed value, encompassing three levels: market value, non-market value, and even emotional value. Stakeholder accounting allows for a more nuanced understanding of the multifaceted dimensions of value generated by the organisation and its broader contributions to various stakeholders, ultimately contributing to a more holistic assessment of its overall impact (Freeman, Retolaza, et al., 2020; Retolaza et al., 2016, 2022).

Diagram 2: Stakeholder Accounting - Accounting Information System Expansion

Diagram 2: Stakeholder Accounting - Accounting Information System Expansion



Source: Own elaboration based on Retolaza et al. (2022)

In the context of reconstructing the value generated by a company, it is essential to define different levels of value, starting with the overarching concept of social value. In this regard, we refer to the definitions provided by the Global Economic Accounting (GEAccounting) association, which has been actively engaged in Stakeholder Accounting for over a decade and it is considered a reference in the field (Freeman, Retolaza, et al., 2020). According to GEAccounting, social value is defined as the degree of utility provided by the set of social goods generated by an organisation for the various stakeholder groups related to the organisation (GEAccounting, 2022). Specifically, the market social value represents the value generated and distributed by the company through its commercial activities, encompassing elements such as net wages, social security contributions, personal taxes, and Value Added Tax (VAT). These components are clearly documented in the company's accounting records, offering a transparent view of value creation through market-driven actions (GEAccounting, 2022). On the other hand, non-market value denotes value distributed to various stakeholders outside market transactions, and consequently, it is not recorded in the company's financial reports. Typically, this value is assessed qualitatively, and social accounting endeavours to integrate it into the comprehensive analysis of social value (GEAccounting, 2022). Finally, emotional value pertains to the sentimental value that the company provides to its stakeholders. This value acts as a corrective factor that can amplify or diminish the overall social value generated by the company, by up to 50%, based on public perception of its actions in comparison to other entities. Incorporating emotional value into the overall assessment of social value allows for a more comprehensive reflection of the emotional impact the organisation has on society (GEAccounting, 2022).

Consistently, within the framework of Stakeholder Accounting, a comprehensive model for analysing SV has been developed, known as the Polyhedral Model (Retolaza, San-Jose, & Ruíz-Roqueñi, 2016b, 2016a; Retolaza et al., 2015, 2016). This model allows to quantify in monetary units the value generated on three levels: market, non-market and emotional value. Moreover, it facilitates the reconstruction of value distribution among the organisation's stakeholders (for further details, refer to the following *Chapter 2.2.2*) (Retolaza et al., 2016). The main stakeholders considered encompass employees, customers, suppliers, financiers, public administration, users, and the community (Freeman, 1984; Jones & Wicks, 1999; Maguregui et al., 2019; Retolaza & San-Jose, 2011; Tantalo & Priem, 2016). The key strength of this methodology lies in its capacity to measure, quantify, and monetise the social value generated, standardising it to a common unit of measurement across all levels. This makes social value observable, understandable and comparable (Freeman, Retolaza, et al., 2020; J.-L. Retolaza et al., 2022).

The Polyhedral Model serves as a valuable tool for effective internal and external communication (Harrison et al., 2020; Hörisch et al., 2020), providing a comprehensive perspective on the generated and distributed value (Retolaza et al., 2016). By conducting this analysis, management gains a deeper understanding of the organisation's influence on both society and the territory (Blazquez et al., 2020). Aligned with the principles of the NBN, this approach enhances comprehension of the organisation's social impact, facilitating the formulation of strategies to optimize value for stakeholders and ensure equitable distribution (Freeman, Martin, et al., 2020; Parmar et al., 2022; Retolaza et al., 2022). Ultimately, the overarching goal is to optimize value for society.

Stakeholder Accounting emerges as a pivotal tool for evaluating corporate performance and value distribution among diverse stakeholders. This approach, built upon an extended notion of value, facilitates the incorporation of other pertinent aspects tied to social responsibility and sustainability. These encompass alignment with the Sustainable Development Goals (SDGs), adoption of circular economy practices, emphasis on the local economy, and promotion of gender equality (Retolaza et al., 2022). By adopting this model, a precise and comprehensive assessment of the value contribution, encompassing positive and negative aspects, stemming from the company's social and sustainable endeavours is attainable.

This novel accounting approach has been collaboratively developed with various companies (Retolaza et al., 2016; Retolaza & San-Jose, 2018) and has undergone multiple experiments to measure non-market value (Retolaza & San-Jose, 2021) as well as emotional value (Retolaza & San-Jose, 2022; Ruiz-Roqueni, 2020). Numerous case studies have been published in the scientific field (Aguado et al., 2015; Ayuso et al., 2020, 2022; Etxezarreta et al., 2018; Lazkano & San José, 2020; Retolaza et al., 2015; Retolaza et al., 2015; San-Jose et al., 2017) providing evidence of the effectiveness of this approach. Nevertheless, this method remains a work in progress and, benefiting from real-world experience, it continues to evolve, refining both its overall concept and the quantification tool. An area that requires further investigation is the incorporation of value generated or impacted by non-stakeholders (Retolaza, San-Jose, & Aguado, 2016; J.-L. Retolaza et al., 2022).

In conclusion, adopting the NBN alongside the Stakeholder Accounting approach brings forth a transformative accounting model, enriching the evaluation of an organisation's value generation and distribution. By embracing the comprehensive and multidimensional nature of value, organisations can align their activities more effectively with the needs and interests of stakeholders, promoting sustainable and socially responsible practices.

2.2.1 Exploring the Polyhedral Model for Social Value Analysis

The Stakeholder or Social Accounting, as previously discussed, aspires to capture the real social impact of a company beyond the interests of its shareholders, and it should be able to do so with economic criteria that are also homogeneous and comparable among themselves, just like conventional accounting (GEAccounting, 2022). Accordingly, the Polyhedral Model, originated within this conceptual framework, was developed as a tool to codify (monetise) the generation and distribution of social value (Retolaza et al., 2016). This pivotal tool remains under continuous refinement and adaptation as its implementation expands across various companies and organisations (Retolaza et al., 2022). The accumulated experience plays a vital role in enhancing the model of measuring and quantifying SV (objectification), particularly concerning non-market and emotional value domains (Freeman, Retolaza, et al., 2020).

In contemporary times, corporations and institutions are progressively acknowledging their social responsibility (social function) and showing a sensitive inclination towards methodologies aimed at quantifying and evaluating the extent and quality of the SV they produce (Barraket & Yousefpour, 2013; Jensen, 2001; Murphy & Ackermann, 2014; Vanclay & Esteves, 2011). Empirical observations across diverse domains underscore the model's efficacy and reliability, albeit with a mindful acknowledgement of potential areas for enhancement (Retolaza & San-Jose, 2018). Thus, this engenders a novel realm of ongoing exploration and inquiry (Retolaza et al., 2022).

Practically, the Polyhedral Model for the analysis of SV is being developed primarily based on six fundamental principles. These principles form the foundation on which the model is built, enabling a comprehensive and accurate assessment of the SV generated by various organisations. First and foremost, the principle of universality is a distinctive feature of this approach. The model is designed to be adaptable to all types of organisations, regardless of their sector of operation. This flexibility allows the model to be applied to a wide range of business and nonprofit entities, facilitating a meaningful and comparable evaluation (GEAccounting, 2022; Retolaza, San-Jose, & Ruíz-Roqueñi, 2016b). Systematicity constitutes another crucial pillar of the model. The assessment of SV occurs uniformly and continuously over time, ensuring consistency and cohesion in the analyses. This regularity yields reliable data and enables the monitoring of an organisation's social performance evolution (Freeman, Retolaza, et al., 2020; GEAccounting, 2022). A third essential principle is cross-sectoral applicability, which allows for comparisons between organisations operating in different sectors. This comparative perspective helps identify best practices and areas for improvement by benchmarking against similar or dissimilar entities (GEAccounting, 2022). Integrity is a central concept in the Polyhedral Model. It encompasses both values generated through market transactions and that which goes beyond the traditional economic market. This broadened approach to SV assessment captures impacts that may not always be quantifiable in monetary terms but are nonetheless critical in evaluating an organisation's societal relevance (GEAccounting, 2022). The multistakeholder perspective represents another key aspect of the model. By emphasising the analysis of an organisation's entire stakeholder network, the model recognizes the importance of considering the diverse perspectives of involved actors and assessing social impact from multiple angles (GEAccounting, 2022). Finally, reliability constitutes the sixth principle on which the Polyhedral Model is based. To ensure consistency and accuracy in assessments, the model adopts standardised formulas agreed upon by a community of user entities. This collaborative approach enhances the credibility of evaluations and facilitates comparability of results across different organisations (GEAccounting, 2022; Retolaza, San-Jose, & Aguado, 2016; Retolaza, San-Jose, & Ruíz-Roqueñi, 2016a, 2016b; Retolaza et al., 2016, 2022).

In summary, the Polyhedral Model for the analysis of SV emerges as a robust and inclusive methodological framework, based on key principles that enable a comprehensive and reliable evaluation of organisations' social contributions. Its application promises to provide a clear and accurate picture of the SV generated, encouraging greater social responsibility from organisations and fostering sustainable and conscious development.

As mentioned earlier, the model stands out for its holistic and dynamic nature, and these attributes are evident in the four fundamental assumptions that underlie its methodological application (Retolaza et al., 2016). Firstly, the model employs action research as a methodological process. A mixed working team, consisting of active participants within the organisation under investigation, engages in progressive improvement cycles, typically on an annual basis. This collaborative approach allows for continuous refinement and enhancement of the model, ensuring its relevance and effectiveness (Barraket & Yousefpour, 2013; Reason & Bradbury, 2006). Secondly, the Polyhedral Model embraces the principles of stakeholder theory. It recognises each organisation as a network of stakeholders who contribute resources and share associated risks. Together, they work towards generating value, which is subsequently distributed among the stakeholders as a whole. Social value, therefore, signifies the value created for these diverse stakeholders (Argandoña, 2012; Freeman, 1984; Parmar et al., 2010; Retolaza & San-Jose, 2011). The third assumption is a phenomenological outlook, emphasising the importance of quantifying value variables based on the perceptions of stakeholders. This approach acknowledges the subjectivity of value and considers the diverse viewpoints and experiences of those involved. By accounting for different perspectives, the model enriches its assessment, capturing the true essence of SV (Retolaza et al., 2015; Retolaza, San-Jose, & Ruíz-Roqueñi, 2016b; Retolaza et al., 2015, 2016). Finally, the Polyhedral Model incorporates fuzzy logic, allowing for flexibility in value assessment. Instead of relying on exact numerical scores, the model employs fuzzy data, representing values as centroid guidelines within a set. This recognition of uncertainty and imprecision enhances the accuracy and adaptability of the model, acknowledging the multifaceted nature of SV (Retolaza et al., 2016).

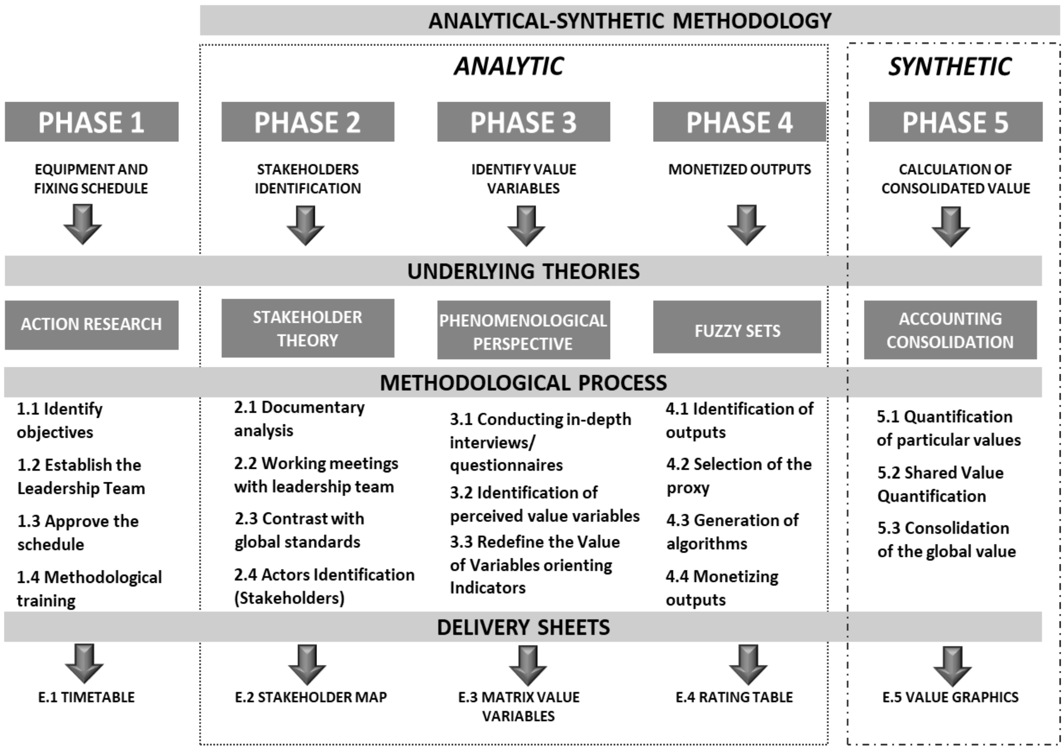
By integrating these four core assumptions, the Polyhedral Model emerges as a powerful methodology, enabling organisations to comprehensively assess their SV and make informed decisions. Its emphasis on stakeholder engagement and inclusivity fosters a holistic understanding of an organisation's contributions to society. The model's continuous improvement cycles and flexible approach ensure its relevance and effectiveness in a rapidly changing social landscape. In conclusion, the Polyhedral Model stands as a cutting-edge methodology, guided by key principles, that allows organisations to navigate the complex terrain of SV assessment.

The process, based on the six key principles and the four foundational assumptions, generally unfolds in a five-phase procedure (see the *Diagram 3* below) (GEAccounting, 2022; Retolaza et al., 2016). It is important to specify that each application of the model is a distinct and specific case; hence, the procedure might vary in specific instances while maintaining the logical sequence presented here.

In brief, phase one, or the preparatory phase, involves defining the working group and outlining its plan. In phase two, the analytical aspect of the procedure begins, entailing the identification of the organisation's stakeholders. Moving on to phase three, the focus shifts to identifying the value variables. In phase four, attention turns to the monetisation of outputs or activities that generate value. Lastly, in phase five, the synthesis phase, the calculation of consolidated value is undertaken.

Diagram 3: Pholyedral Model - Procedure

Diagram 3: Pholyedral Model - Procedure



Source: Own elaboration based on Retolaza et al. (2016)

A synthesis of the procedure is presented below, which is extensively elucidated in GEAccounting association documents, some of which are tailored for the practitioner world, or in seminal scholarly publications such as Retolaza et al. (2016, 2015). Therefore, the following information is based on the previously mentioned documents (GEAccounting, 2022; Retolaza, San-Jose, & Ruíz-Roqueñi, 2016a, 2016b; Retolaza et al., 2015, 2016).

In the first phase, rooted in the concept of action research, the participatory nature of applying this analysis model becomes apparent. In its application it is crucial to collaborate directly with the analysed organisation. Therefore, the work team comprises a mix of researchers and organisation members. Essential steps in the procedure's application include defining objectives, establishing leadership within the team, developing and approving the work plan, and providing methodological training to organisation's team members. Organisation-involved individuals become central and active players in the methodology's application and thus require appropriate training. Given the methodology's nature, the ultimate aim of this process is for the organisation itself to increasingly adopt autonomy in implementing the analysis, enabling recurrent processes similar to traditional accounting. Ultimately, the quality and engagement of the research team with the organisation will significantly determine the success of the analysis and systematization process. Moreover, the timeline not only introduces the process but also serves as a reference framework to prevent indefinite prolongation.

The second phase initiates the analytical process by focusing on stakeholder identification. The primary objective is to map out the ecosystem of actors associated with the organisation and its activities, both directly and indirectly. In essence, the aim is to identify the interest groups to which the organisation presumably provides value. This value is contextualised in terms of its recipients, representing the perceived value across diverse stakeholder groups within the organisation. This phase closely aligns with the principles of stakeholder theory. In line with the preceding phase, collaborative work meetings with the project team are also initiated at this stage.

Upon achieving the stakeholder map, the third phase unfolds, centred on identifying value variables through a phenomenological perspective. In this context, value variables encompass a broad spectrum of aspects through which an organisation generates value for third parties. These variables are directly identified by the specific interest group as part of the process. To summarize, once stakeholders are identified, direct engagement with them commences. Through interviews and/or questionnaires, perceived value variables are discerned. These variables are then refined to derive indicators for their subsequent quantification. This participatory approach with stakeholders yields a matrix of value variables.

With the stakeholder map reconstructed and value variables pinpointed, the fourth phase comes into play, focusing on value quantification. At this stage, fuzzy logic is deployed to establish proxies for monetisation – essentially assigning a monetary value to the variable or action generating value for stakeholders. This phase entails identifying the outcomes of various actions, selecting fitting proxies, and/or devising dedicated calculation algorithms. The conclusion involves the monetisation of these outcomes, culminating in an evaluation and valuation of variables.

To consolidate the achieved insights, the fifth phase involves calculating the aggregate value. Here, specific and relevant values are quantified for individual stakeholders, further determining shared value. This process leads to the overall value calculation, eliminating any redundant values. The calculated value is presented and visually represented for the intended audience. Lastly, a continuous feedback and improvement process is integrated, serving both the organisation itself across successive analysis cycles (annual social accounting), and other organisations that can leverage the outcomes and insights garnered from the process. This is particularly advantageous for entities within the same industry sector seeking to optimise their practices.

At the conclusion of the comprehensive application process, which may span from six to twelve months depending on the organisation's commitment and circumstances, the three levels of value are addressed (Retolaza et al., 2016). As previously highlighted in alignment with stakeholder accounting, this process enables the reconstruction of market value, non-market value, and emotional value generated and distributed to stakeholders.

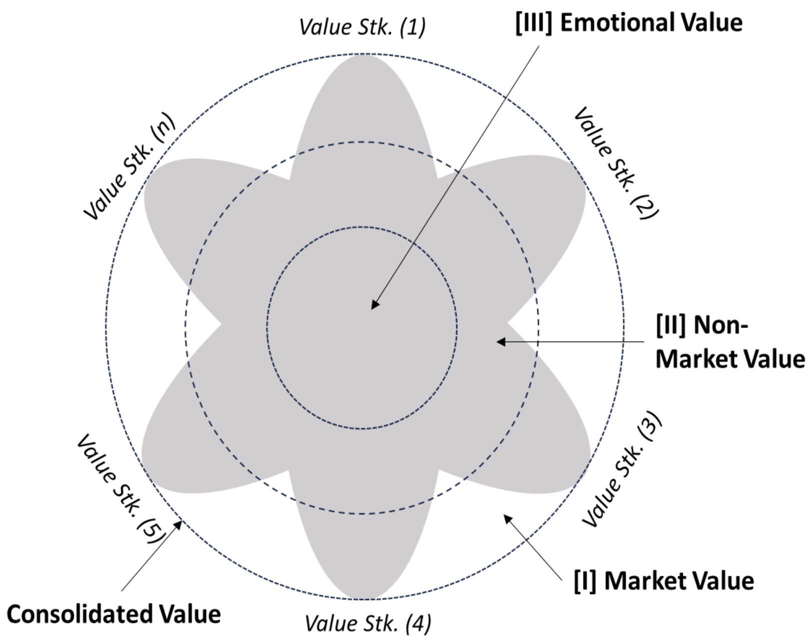
In its stakeholder-centric essence, the Polyhedral Model is often metaphorically depicted as a flower (refer to the *Diagram 4* below) (Freeman, Retolaza, et al., 2020; GEAccounting, 2022; Retolaza et al., 2016). In this representation, distinct stakeholders are symbolized by the petals, while at the flower's core, their overlapping points symbolize shared value. However, it is important to note that this portrayal is a simplification; frequently, values intersect at various levels.

Upon examining the flower metaphor, the three levels of value become evident: the market value, which is the most intuitively observable and distinguishable among stakeholders, corresponds to the edges of the petals. As one moves towards the centre of the flower, the non-market value becomes less easily observable and distinguishable. Finally, at the very heart of the flower lies the emotional value, which represents the most challenging aspect to identify and differentiate.

This metaphor also applies to the process of reconstructing SV. It commences with the most straightforward aspect, rooted in objective data and values, which is the market-based element. Progressing toward the more abstract realm (such as emotional value), it necessitates a more intricate process involving proxies to quantify and monetise.

Diagram 4: Polyhedral Model for Social Value Analysis

Diagram 4: Polyhedral Model for Social Value Analysis



Source: Own elaboration based on Retolaza et al. (2022)

This representation serves not only as a means of introducing the model but also as a communicative tool for summarizing analysis outcomes, both in popular dissemination and academic-scientific context (Ayuso et al., 2020). As previously explained, a complete application of the model entails reconstructing the value generated and allocated to individual organisational stakeholders – those pinpointed on the stakeholder map and chosen for examination. In the framework of stakeholder accounting, facilitated by the Polyhedral Model, the goal is to potentially reconstruct value for all stakeholders. In a pragmatic and realistic context, stakeholders are analysed following a hierarchy of analytical interest established by the organisation, aligned with the resources the organisation can allocate to this endeavour. In essence, if a stakeholder is indirectly and only marginally impacted by the organisation's operations, they might be excluded from the analysis. As previously discussed, efforts are also proceeding to optimize the analysis to encompass value, whether positive or negative, even for so-called non-stakeholders. Certainly, as a result, the current utilization of the model is influenced by practical considerations. As the procedure gains more standardisation, particularly through refining proxies, the process is expected to become easier to implement. This will facilitate an extended inclusion of analysable stakeholders in the future (Retolaza et al., 2016, 2022).

In the implementation of the Polyhedral Model, numerous stakeholders can be holistically analysed, thereby reconstructing the SV generated by the organisation for them. Typically, in its application, the analysed stakeholders include always: employees, customers, suppliers, public administration, financial entities, and shareholders (GEAccounting, 2022; Retolaza et al., 2016).

In a more concise application of the Polyhedral Model for these same stakeholders, the market-based social value is calculated, also referred to as the Social Impact of Economic Activity (SIEA) (Retolaza et al., 2016). The GEAccounting association provides a definition of this value distributed to each of these key stakeholders, along with total value generate for society (see the following *Table 1*).

Table 1: Social Value For Stakeholders - Key Definitions

Table 1: Social Value For Stakeholders - Key Definitions

Concept	Definition
Value Distributed to Customers	Value received by customers through the purchase price. In a market-based company, the value perceived by customers equates to turnover.
Value Distributed to Workers	Value obtained by workers both directly (own employees) and indirectly (employees of supplier companies). Refers to the net salaries without duplicating social security and income tax.
Value Distributed to Suppliers	Considers the pull effect of purchases made to suppliers, proportionate to the billing ratio compared to all suppliers. Only the value added by the supplier is considered, specifically distributed to workers, public administrations, and investors. First-level suppliers are the focus.
Value Distributed to Public Administration	Revenues generated for public administrations either directly (added value) or indirectly (through suppliers). Mainly via social security contributions, various taxes and fees, corporate tax, and VAT. Includes: Social Security, Income Tax, various taxes, and corporate tax.
Value Distributed to Financial Entities	Total financial expenses. Given the expenses subtract from the added value, the total expense is considered. This encompasses 100% of financial expenses.
Value Distributed to Shereholders	Revenues generated for investors either directly (profits) or indirectly (percentage of supplier profits). Represents all the value generated to its investors, both after financial expenses and taxes, and indirectly to the investors of its suppliers. Total profits are considered, whether distributed or retained.
Value Distributed to Society	Identified with integrated social value, calculated by consolidating the value generated for each stakeholder (based on the polyhedral model). It's also the sum of the market and non-market social value. Synonymous with integral social value.

Source: Own elaboration based on GEAccounting (2022)

Certainly, these are general definitions. For each specific case, depending on how stakeholder mapping and clustering are conducted, the elements considered for reconstructing the value for these stakeholders might change, and these stakeholders themselves might also be further subdivided.

It is important to keep in mind that the Polyhedral Model, with its inherent nature and six fundamental principles, holds the potential for application in any type of organisation, regardless of its nature or corporate purpose (Retolaza et al., 2016). While this methodology is relatively recent, with just over a decade of development, it is worth noting that a variety of applications are now emerging across different organisational types and domains (Retolaza et al., 2022).

To provide some examples, applications have been observed in the cultural sphere, such as museums (San-Jose et al., 2022; San-Jose & Retolaza, 2022), and in the sports domain, like professional basketball teams (Mendizabal et al., 2022; Mendizabal & García, 2021). The methodology has been employed in university and educational settings (Ayuso et al., 2020, 2022; Barba-Sánchez, Milán, et al., 2021) and within individual business enterprises (San-Jose et al., 2017). Its scope extends to cooperative contexts (Etxezarreta et al., 2018; Ruiz-Roqueni, 2020), cooperative groups, and nonprofit organisations (Barba-Sánchez, Salinero, et al., 2021; Lazcano et al., 2019; Lazkano & San José, 2020), as well as various other organisational types (Lazkano & Beraza, 2019; Retolaza, San-Jose, & Aguado, 2016; Retolaza, San-Jose, & Ruíz-Roqueñi, 2016a, 2016b; Retolaza et al., 2016). Furthermore, applications delve into specific themes such as gender equity (Gartzia & Retolaza, 2019), innovation (Echevarria, 2020), circular economy, assessing the impact of public procurement (Bernal et al., 2019), and territorial impact and proximity purchasing (Retolaza et al., 2015).

Notably, these are only a subset of academically documented experiences. The association GEAccounting has registered approximately 200 applications of the methodology over a decade (Retolaza et al., 2022), with Retolaza identifying around fifty in 2018 (Retolaza & San-Jose, 2018). This signifies a recent expansion in its application, reinforcing its validity and supporting its continuous enhancement.

The rationale behind organisations embracing Stakeholder Accounting and applying the Polyhedral Model primarily lies in their desire to gain a deeper understanding of the impact of their activities and actions (Retolaza, San-Jose, & Ruíz-Roqueñi, 2016a; Retolaza et al., 2016). Specifically, it involves quantifying the generated value and how it is distributed. This contemplation, stemming from model application, enables organisations to engage in profound reflection and thus enhance their awareness of their societal role (Retolaza et al., 2022).

Embarking on this organisational analysis journey and attaining the aforementioned results yields a wealth of information that can be effectively leveraged by the organisation for strategic and operational considerations (Echanove Franco, 2020). It facilitates improved stakeholder engagement and serves as a basis for both internal and external communication purposes (Lazkano et al., 2020).

Undoubtedly, utilizing this approach for organisational communication and reputation is legitimate and can be achieved even through a single application (Lazkano & Beraza, 2019). The aspiration within the realm of stakeholder accounting is that its application becomes recurrent, similar to traditional accounting practices (Retolaza et al., 2022). The model is perceived as an informative tool that provides valuable support for strategic and managerial endeavours within the organisation. It notably stands out as an instrument for assessing the organisation's impact, encompassing its effects on society, territory, and specific projects (Blazquez et al., 2020).

Furthermore, an extension and hope encompass its incorporation into people management activities, given that employees represent pivotal stakeholders within the organisation. Lastly, this tool could also prove beneficial for initiating benchmarking initiatives (Retolaza et al., 2022). Certainly, the current challenge lies in working towards the standardisation of procedures, with a particular focus on the definition of widely validated proxies (Retolaza et al., 2016).

2.2.2 Exploring the academic debate on Social Value analysis

The realm of Social Accounting, often referred to as stakeholder accounting, is relatively new, alongside its Polyhedral Model for quantifying SV. Emerging around a decade ago, these concepts have been progressively evolving through practical experimentation (Retolaza & San-Jose, 2011; Retolaza et al., 2022).

Certainly, the current emerging approach reflects a transition from a narrow, justificatory perspective to a more holistic framework, embracing the monetisation of social value. This evolution signifies a departure from the historical standpoint, which was characterized by limited discussions and confined focus. In the past, research in this domain primarily centred on quantifying impacts, neglecting a comprehensive grasp of various value dimensions and their intended beneficiaries (stakeholders) (Barraket & Yousefpour, 2013; Murphy & Ackermann, 2014).

This broader perspective embraces the monetisation of SV as an integral aspect. It transcends the narrow confines of mere impact quantification, striving to integrate a multitude of value categories and their intricate connections to diverse stakeholders. In direct contrast to the earlier approach, which primarily relied on constrained quantifiable metrics for justification, this holistic viewpoint emerges as the pivotal catalyst for change (Retolaza et al., 2016).

Within this emergent holistic paradigm, there exists an acute awareness of the intricate interplay between organisational actions and their far-reaching societal consequences. Through the adoption of a Polyhedral Model, organisations gain the capacity to assess an expansive spectrum of value generation and its equitable distribution among stakeholders. Such an encompassing framework effectively ensures a comprehensive evaluation of an organisation's contributions to its stakeholders and the broader societal landscape (Aguado et al., 2015; Alcaniz et al., 2020).

Certainly, as corporations' social roles gain explicit recognition, the endeavour to precisely define both the quality and quantity of social value generated by these entities, both collectively and individually, assumes heightened significance (Vanclay & Esteves, 2011). This renewed emphasis underscores the imperative for a comprehensive evaluation of an organisation's holistic impact, surpassing the confines of traditional economic benchmarks (Aguado & Eizaguirre, 2020; Aguado & Retolaza, 2020).

These appeals have reverberated profoundly, prompting a shift towards a more all-encompassing appraisal of an organisation's undertakings, encompassing not only its economic endeavours but also its social contributions. The narrative is undergoing transformation, evolving from a sole focus on financial performance to one that encapsulates broader societal outcomes (Aguado et al., 2015; Argandoña, 2012; Jensen, 2001; Retolaza & San-Jose, 2011; Retolaza et al., 2015). This evolving perspective resonates with the present-day demand for corporate responsibility and transparency (Fung et al., 2007), where organisations are expected to embrace their roles as active agents in shaping the well-being of communities and the broader society (Retolaza, San-Jose, & Aguado, 2016).

Integrating social and economic value creation within a unified framework aims to offer a more comprehensive outlook on an organisation's contributions. This amalgamation stems from the realization that businesses hold the potential to serve as agents of positive change beyond conventional market outcomes. The concept of blended value advocates for a mutually beneficial relationship between financial success and social impact. This dynamic approach necessitates a shift in managerial focus, encouraging leaders to view social value as an integral aspect of their decision-making processes, just as economic value has been historically.

Within this paradigm shift, the question of how to accurately and comprehensively quantify and assess this integrated value emerges (Vanclay & Esteves, 2011). The challenge lies in constructing robust methodologies and frameworks capable of effectively encapsulating the multifaceted nature of this blended value, subsequently translating it into meaningful and actionable insights. Accomplishing this objective would not only enable organisations to gauge their success through financial metrics but also through the positive societal contributions they make. This transformation amplifies their role as contributors to societal well-being, beyond traditional profit-driven measures.

Certainly, the ongoing discourse surrounding the dual role of organisations as generators of both economic and social value has heralded a significant paradigm shift. This transformation accentuates the essentiality of acknowledging the intricate interplay between economic prosperity and societal well-being, ultimately culminating in an integrated approach for value creation. As the call for a more holistic comprehension of organisational influence continues to gather momentum, the significance of precise measurement and assessment methodologies increase. This evolving landscape fundamentally redefines the scope of corporate responsibility, necessitating a harmonious equilibrium between financial gains and societal advantages (Aguado & Eizaguirre, 2020).

Undoubtedly, in the current context, it can be unambiguously asserted that these concepts are in a phase of dynamic development and consolidation, both as a practice and as a methodology (Retolaza et al., 2016). The ultimate aspiration is for this framework to receive widespread acknowledgment as the contemporary standard for accounting practices. Pioneering initiatives like ARTE (Action Research Training Experience) have been devised with the aim of fostering knowledge exchange among a diverse array of organisations. Their purpose is fostering the advancement of stakeholder accounting and encouraging its integration within the organisational landscape (Aguado et al., 2019, 2021).

Absolutely, while currently more pronounced within the non-profit sector, the paradigm's influence is gradually permeating commercial enterprises. It is evident that the ongoing discourse, spanning both academic circles and practitioners' discussions, remains confined to a specialised domain. This niche environment is enriched by a distinguished cohort of pioneers, encompassing scholarly researchers and pragmatic implementers alike, collectively driving the discourse forward. The overarching aspiration persists in establishing a self-sustaining cycle that involves consistent application and perpetual refinement within this framework (Retolaza & San-Jose, 2021).

Aligned with the principles of the New Business Narrative, this approach strategically addresses the increasing societal and organisational interest in the social dimensions of business activities. Its purpose is to accommodate to the contemporary demand for heightened transparency in business operations, thus elevating the quality of information produced (Andrades Peña & Jorge, 2019; Fung et al., 2007). Consequently, organisations are tasked with pursuing both economic and social objectives, which must be incorporated into their strategic agendas. This mandate further extends to measuring, justifying, and evaluating these objectives. In response to this imperative, targeted approaches and techniques are being developed, with stakeholder accounting and the Polyhedral Model emerging as noteworthy examples (Freeman, Retolaza, et al., 2020).

The quantification of SV, facilitated through a process of monetisation, presents a compelling response to the pressing need for measurement and comparison. This process, while essential for evaluation, also serves a dual role in establishing a universal language that resonates not only within an organisation but also with external stakeholders. While the concept of social value may often seem abstract, its transformation into a tangible monetary value renders it readily understandable for a wider audience. Nonetheless, a significant challenge remains: achieving a level of standardisation comparable to conventional accounting practices. This journey involves the eventual objectification and weighting of SV. This evolution not only grants a more holistic view of the collective value generated by an organisation but also streamlines the integration of economic and social objectives within its overarching management framework (Retolaza et al., 2016, 2022).

This approach effectively addresses the limitations inherent in the present accounting framework. Looking forward, the aspiration is for stakeholder accounting to seamlessly integrate into standardised accounting practices. This alignment is fortified by the growing resonance of Corporate Social Responsibility (CSR) principles. These principles can either serve as complementary factors or fundamental building blocks, facilitating the eventual adoption of stakeholder accounting (Retolaza et al., 2016).

To expedite its development, empirical evidence must be reinforced through practical application. In this pursuit, experimentation across diverse domains holds considerable potential. Such experimentation not only receives a warm welcome but also substantially propels the advancement of the methodology.

Promisingly, broadening the scope of application stands as a crucial pathway. Such expansion has the potential to stimulate the formulation and formalization of proxies tailored for the monetisation of SV. These proxies, particularly those addressing non-market and emotional dimensions, could substantially contribute to the creation of standards, fostering enhanced comparability across diverse contexts.

Yet, a predominant challenge persists: the nuanced interpretation of results, often necessitating context-specific analysis. As empirical evidence accumulates across various organisational types and sectors, overarching analytical frameworks can gradually emerge. This evolutionary process has the potential to establish benchmarks, refine indicators, and pave the way toward achieving alignment with conventional accounting standards. This trajectory, in essence, charts a course for a meaningful convergence between these two systems (Retolaza et al., 2022).

In short, it is imperative not to lose sight of the primary objective: the application and reconstruction of social value offer a profound insight into stakeholders' perspectives, serving as a bedrock for responsible and informed decision-making. This, in turn, fosters a constructive social impact and ensures the continuity of sustainable growth (R. E. Freeman et al., 2021; Parmar et al., 2022). This ultimate aspiration reinforces the notion that stakeholder accounting transcends being a mere theoretical construct; it metamorphoses into a pragmatic tool, empowering organisations to actively contribute to societal advancement while securing their lasting prosperity.

2.3 Research positioning: Academic debate, gaps and limitations in literature

This research seeks to make dual contributions: to the ongoing discourse on STPs and to the domain of social value analysis, spanning both academic and practical dimensions. With its primary goal of developing a stakeholder-centric tool for analysing social value within STPs, this study offers insights that enrich both realms.

Regarding Stakeholder Accounting and the application of the Polyhedral Model, this research introduces a fresh application domain – namely, STPs. Simultaneously, it extends the understanding of the model's adaptability and versatility, enhancing its practical utility.

Specifically concerning the model adaptation, intriguing dimensions have been explored. These encompass formulating a methodology predominantly reliant on secondary data, enabling the simultaneous analysis of numerous organisations, and devising a tool adaptable across diverse national contexts. Within this process, maintaining stringent analytical quality standards has remained pivotal. This commitment ensures a robust estimation and accurate reconstruction of social value within STPs, distributed among key stakeholders. A pivotal experiment, rigorously validated on multiple levels (see *Chapter 3.2*), convincingly attests to the feasibility of contextual standardisation (Retolaza et al., 2022). It further emphasises the model's reliable adherence to its foundational principles, consistently yielding precise results (GEAccounting, 2022).

Within the sphere of this applied experiment and the reconstruction of social value within the community of STP enterprises, additional evidence surfaces: the model's relevance extends to various organisational archetypes. Yet, the intricate task of result interpretation endures as an ongoing consideration. It is clear that outcomes cannot be comprehensively understood without considering the distinctive attributes of each specific scenario (Retolaza et al., 2022). Overall, this undertaking underscores a modest, yet insightful, contribution to the model's evolution. Through empirical insights and constructive suggestions, a pathway for ongoing refinement emerges (Retolaza et al., 2016).

Indirectly, this contribution resonates with the ethos of the New Business Narrative. It drives the advancement of methodologies and techniques for effectively quantifying value generation and equitable distribution among diverse stakeholders of an organisation (Freeman, Retolaza, et al., 2020; Hörisch et al., 2020).

Regarding its application, this study makes a dual contribution to existing research gaps. On one hand, it introduces a novel realm of application, specifically the STPs. On the other, it provides tangible empirical evidence of the model's functionality. This evidence not only addresses the number of cases investigated but also, more importantly, encompasses the wide-ranging sectors and diverse organisations involved in the analysis. This underlines the validation of cross-sector applicability, albeit within the limitations of the specific cases (employing secondary data for company analysis) (GEAccounting, 2022; Retolaza et al., 2016).

Furthermore, the utilisation of secondary data and the model's application across various countries have necessitated adaptations to accommodate context-specific proxies and to tackle intricacies tied to secondary data utilization, such as data accessibility. Hence, it can be asserted that a modest, yet valuable contribution has been made to the ongoing discourse on standardisation. This contribution delivers not only empirical evidence and practical implementations but also valuable insights for future advancements (Retolaza et al., 2022).

In a broader sense, these applications undertaken in the study have also facilitated the dissemination of awareness regarding the significance of social value analysis and the potential applications of the methodology. This engagement in turn supports the establishment of a self-sustaining cycle, characterised by consistent applications and ongoing enhancements within this framework (Retolaza & San-Jose, 2021).

In the realm of application, specifically within STPs, the contributions to ongoing debates are multifaceted. At the forefront, a fresh perspective on social value analysis within the STP domain is introduced. A robust analytical methodology centred on monetisation is employed, effectively contributing to the discourse ignited by Fulgencio (2017) and Torres-Pruñonosa et al. (2020) in their seminal works. This vital input addresses the research gap underscored by Lecluyse et al. (2019), where a lack of studies quantifying the social contribution of STPs is evident.

In this context, a tool is presented that facilitates the measurement of the social contribution of such entities, offering a benchmark and an objective assessment of their societal and territorial impacts (Albahari et al., 2013; Gomes et al., 2022). This serves a dual purpose, encompassing both academic and practical aspects. It offers a tangible and actionable tool for STP management, allowing them to assess the effects of their efforts. This empowerment enables the integration of such analyses into the parks' strategic decision-making and operational management activities (Cadorin et al., 2021; Germain et al., 2022).

Furthermore, a contribution resonates in the discourse on evaluating park performances and understanding STP governance structures (Amaral et al., 2022). This line of inquiry is delved into, offering a nuanced comprehension (Bigliardi et al., 2006; Diez-Vial & Fernández-Olmos, 2017; Gomes et al., 2022; Ubeda et al., 2019). The social value generated and distributed by an STP assumes significance as an evaluative performance metric. This viewpoint gains traction considering the increasing demand from institutional stakeholders for such metrics, aiding in justifying activities, including the assessment of returns on public investments. This paradigm shift, aligned with the principles of the NBN, redefines expenditure as value, a perspective seamlessly embodied in the adapted Polyhedral Model (Freeman, Retolaza, et al., 2020).

Additionally, the development of a stakeholder-centric tool within this context dovetails with the ongoing discourse on incorporating stakeholder perspectives into STP analyses (Germain et al., 2022). The research contribution not only equips with a practical tool but also accumulates invaluable insights (see *Chapter 3* for additional insights) for future analyses delving into stakeholder engagement within the governance and management framework of these parks.

3. Research Methodology

This chapter provides a comprehensive overview of the methodology employed in this research. It outlines the various phases undertaken and offers meticulous insights into key aspects of the study, including the adaptation of the Polyhedral Model to the context of STPs, its application at the European level, and the executed statistical analyses. By delving into these details and providing comprehensive explanations, the chapter furnishes the reader with an understanding of the study's methodological rigor. Additionally, it clarifies how the research objectives were achieved, results were acquired, and the main research question was addressed. Organised into five distinct sections, the chapter's structure is designed to meet the outlined goals.

The initial section (refer to *Chapter 3.1*) provides a complete view of the research design, outlining the four crucial stages carried out during the study's implementation. This section imparts a comprehensive understanding of the trajectory of the research. Subsequent sections delve into a more in-depth exploration of the methodology.

Specifically, the second section (refer to *Chapter 3.2*) explains the procedure followed to develop, test, and validate the SV analysis model adapted for the STP context. This critical stage facilitated the establishment of a robust model, thereby laying a solid foundation for wider experimentation at the European level. Subsequently, the third section (refer to *Chapter 3.3*) illustrates the application of the model at a European scale, involving fourteen STPs across six different nations. The constitution of this initial STP community, which enabled a more extensive field testing and the consequent creation of databases, is meticulously detailed.

The fourth and fifth sections are committed to exploring the statistical methodologies utilised to analyse the data derived from the expanded field experiment. The fourth section (refer to *Chapters 3.4*) introduces the exploratory cluster analysis methodology, aiming to determine whether the SV distribution among stakeholders is a suitable measurement framework to define a useful taxonomy of the companies. The fifth and final section (refer to *Chapters 3.5*) outlines the methodology adopted for the experimental development of a multilevel model. The aim of this analysis was to identify the variables both at aggregate and individual level exerting the most significant influence on value generation for the key stakeholder in this study - the employee.

In conclusion, this chapter shifts from a broad view of the research design to a detailed examination of the statistical methodologies employed, providing a thorough understanding of the research journey and the logic that underpins its approach. Ultimately, this chapter grants the reader an in-depth comprehension of the study's methodology, consequently enhancing their confidence in the reliability and validity of its findings.

3.1 Research Design: A comprehensive overview

Consistently with the guiding research question, sub-questions, and overarching as well as specific objectives for further exploration, a four-phase research design has been developed. However, prior to examining the details of this design, the driving force behind this research, namely the research question and objectives, will be revisited.

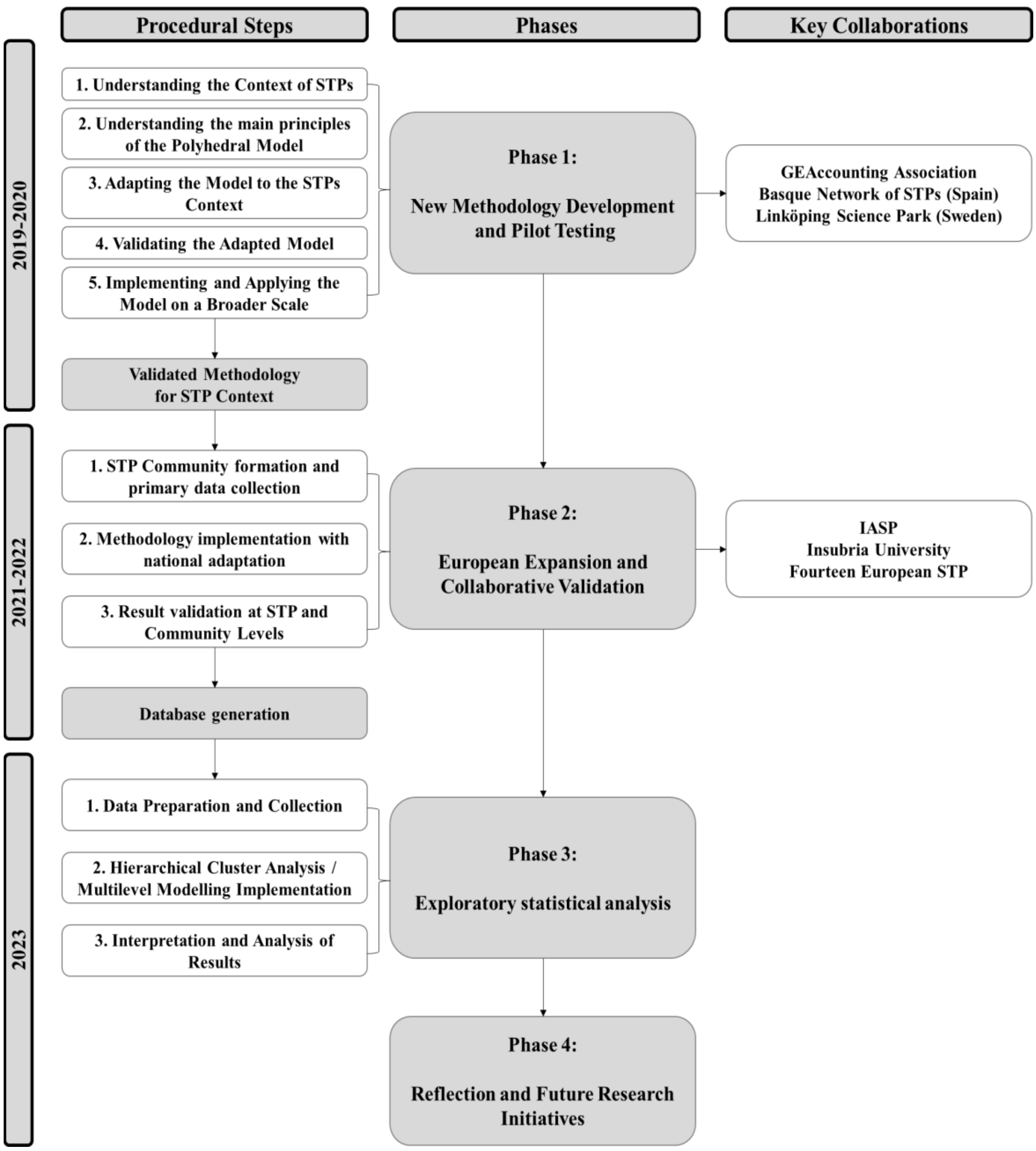
This study addresses the pivotal research question of how a methodology that uses secondary data can be developed to measure the SV generated and distributed by STPs to the key stakeholder. This methodology should not only offer convenience to potential users but also ensure the reliability of analysis quality. This central inquiry unfolds into five key considerations: accessing and integrating essential data for accurate STP analysis, standardising the methodology for effective secondary data use while ensuring adaptability, designing the methodology to deliver a STP monitoring tool, maintaining analysis accuracy with non-specific data, and validating the methodology with potential users for effectiveness. In addition, this exploratory research intends to perform two separate exploratory statistical analyses on the data collected from the application study on a European level. The first is a cluster analysis concerning the distribution of SV among main stakeholders. The second involves constructing a model that focuses on SV generation for a predetermined stakeholder - the employee in this case. The latter aims to identify the variables with the most significant impact relating the employee.

With this contextual preamble, it is now appropriate to proceed with the presentation of the developed and implemented research design.

As showed in the *Diagram 5* below and as previously outlined, the research design is structured into four primary phases. After an initial phase that established the methodological framework of the study, the first substantial research phase focuses on adapting the Polyhedral Model for its application to the context of STPs using secondary data. In the second phase, with the adapted model available for STP analysis, the focus shifted to its European-level application, encompassing 14 STPs across 6 countries. Moving on to the third phase, based on the data collected from the application and the extension of the study at the European level, attention turned to the statistical analyses outlined in the study, specifically hierarchical cluster analysis and multilevel model construction. Finally, as the culmination of the research, the fourth phase was dedicated to analytical discussions and conclusions drawn from the outcomes of the preceding three phases.

Diagram 5: Research Design

Diagram 5: Research Design



Source: Own elaboration.

The above *Diagram 5* intricately outlines the sub-phases corresponding to each phase of the methodological process. These sub-phases are comprehensively explored in their respective sections (Phase 1 - *Chapter 3.2*, Phase 2 - *Chapter 3.3*, Phase 3 - *Chapters 3.4* and *3.5*). Moreover, as shown in the diagram, each phase of this research has been designed with a functional sequence in mind. This means that the completion and validation of one phase is instrumental for the progression to the next. Only upon the successful development and validation of the adapted model in phase 1, the transition to the broader European-level application in phase 2 was possible. Similarly, the databases constructed in phase 2 served as the foundation for the statistical analyses of phase 3.

In general, with the present methodology, a two-cycle validation approach was conducted. During the initial phase, focusing on the adaptation of the Polyhedral Model to the STP context, crucial information was gathered to provide preliminary answers to the five sub-research questions (summarised above in the five considerations). Prepared with this newly adapted and validated model, the second phase extended its application to a larger European-level sample, consolidating the preliminary responses and affirming our initial outcomes in terms of model goodness and analysis result quality. In essence, through this dual validation process, was possible to bolster the robustness and reliability of the present work.

Building upon the robustness of the consistently validated results, which were rigorously examined across various contexts and iterations (as detailed in *Chapters 3.2* and *3.3*), the third phase of our research delved into exploratory statistical analyses. The goal was to leverage the databases generated by research efforts and identify two potential future pathways of investigation.

The first avenue is oriented towards analyses concerning the distribution of SV towards stakeholders, as outlined in the hierarchical clustering methodological framework (explained in *Chapter 3.4* and executed in *Chapter 4.3*). With the development and testing of a stakeholder-centric tool, investigating patterns in value distribution became imperative. The decision to conduct a cluster analysis was also influenced by the data availability from phase 2 and the keen interest of both academic and practitioner communities in comprehending societal impact.

Conversely, the second avenue directs attention towards assessing performance in terms of value generation, as depicted in the multilevel modelling methodological framework (elaborated in *Chapter 3.5* and executed in *Chapter 4.3*). Guided by a humanistic approach and recognising employees as pivotal stakeholders within any organisation (Aguado and Eizaguirre, 2020), the decision to centre this model around employees was stablished.

The successful culmination of this methodological path has facilitated the provision of a comprehensive response to the main research question. As explained in the following chapters, this accomplishment has been attainable through pivotal collaborations that unfolded during the research journey. Particularly, recognition is extended to the GEAccounting association for its methodological support in adapting the Polyhedral Model, to IASP for their contribution in broadening the study to a European level, and to all the STPs that engaged in diverse stages of application and testing of the adapted model for their participation and the insights given.

3.2 Adapting the Social Value Analysis Model for STPs

The adaptation of the Polyhedral Model for SV analysis to the context of STPs was carried out using a systematic procedure of tailoring general models to specific contexts (Bryman & Bell, 2015; Booth et al., 1997). This tailoring process can be divided into five primary stages.

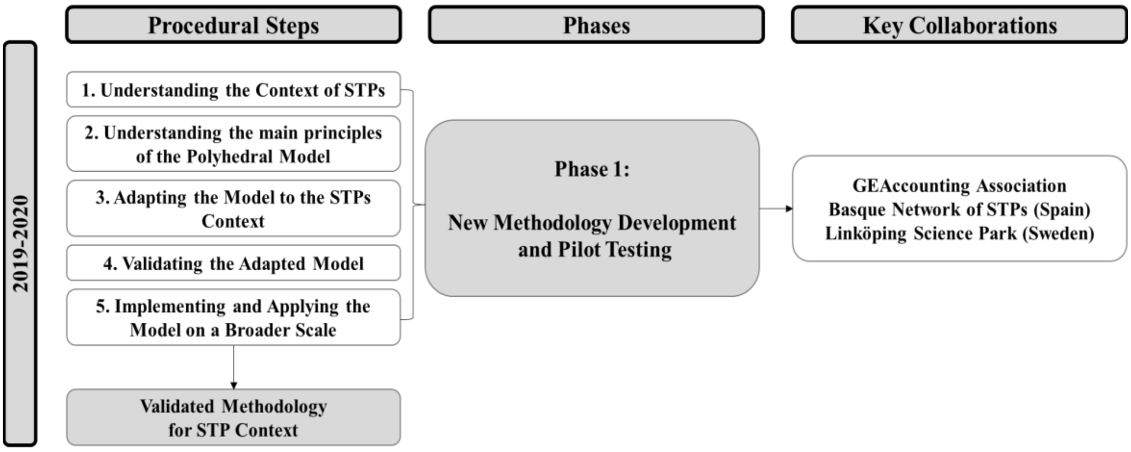
In the first stage, the specific context of analysis, namely the STPs, was identified and understood. This comprehension of the context is essential to ensure that the model's adaptation is both appropriate and meaningful. Simultaneously, during the second stage, a deeper understanding of the existing model for SV analysis, the Polyhedral Model, was developed. This phase involved understanding the functioning and key features of the model.

The third stage entailed the adaptation of the model to the specific context. Based on the characteristics of both the context and the general model, the adaptation procedures were initiated. During the fourth stage, the adapted model underwent a validation process through a series of tests and iterations with real-world applications to verify its applicability and implement the necessary modifications.

Finally, in the fifth stage, the model was implemented and applied iteratively to a broad sample, with final validation provided by the managers of the STPs participating in the study. It is worth noting that the process of adapting and enhancing the model continues as it is implemented and applied in the field, allowing for further optimisations and refinements.

Diagram 6: Research Design – Phase 1

Diagram 6: Research Design – Phase 1



Source: Own elaboration.

To gain an in-depth understanding of the STP context, collaboration was primarily established with the Basque Network of STPs, which includes three STPs located in the Basque Country, Spain. These three STPs are the members of the Basque network of STPs. This contact was made through prior acquaintance, and their interest in this exploratory research and readiness to participate contributed greatly to our study. These institutions are greatly renowned (both at the Basque and Spanish levels) and hold a strong position within the European STP community. In fact, it was their assistance that facilitated the involvement of a fourth STP, the Linköping Science Park in Sweden, in the development, testing, and validation of the adapted model. The latter is a distinguished park in Europe, often used as a benchmark. Therefore, it can be stated that this research phase involved working with a non-probabilistic sample. Initially, a convenience sample was used, based on accessibility and willingness to participate. Subsequently, a snowball sampling method was employed, facilitated by the initial collaboration with the first sample of three STPs (Blazquez et al., 2020).

During the stages of understanding and adapting the model, close collaboration was maintained with GEAccounting. This association, recognized as a main reference in the realm of Stakeholder Accounting, played a substantial role in the development of the Polyhedral Model (Retolaza et al., 2016). Working closely with the methodological holders of the original model enabled an accurate process and ensured the solidity and validity of the adapted model throughout its development.

This methodological and working approach, encompassing partners both on an application level and a method analysis level, facilitated immediate dual validation across the entire process. This aspect has significantly contributed to the robustness of the entire exploratory research (Blazquez et al., 2020). Throughout the entire study for the development of the adapted model, an iterative methodology, also referred to as an iterative development cycle, was employed. This approach facilitated a gradual refinement of the model based on the outcomes of diverse applications and tests. Additionally, valuable feedback from various study partners was incorporated during each testing phase, thereby enhancing both the model's quality and adaptability. Each iterative "test and improvement" cycle played a pivotal role in improving the model, enabling immediate identification and rectification of errors or inefficiencies. As a result, the model's quality and adaptability were continuously improved.

The main objective of adapting the model is to develop a tool that can effectively calculate and reconstruct the SV generated and distributed to the main stakeholders by the communities of organisations established in the STP. Consequently, the model's framework is rooted in its capacity to efficiently analyse a substantial number of organisations simultaneously, without the need for direct involvement from them. The sole primary source of information considered is the entity responsible for managing the park. This entity can provide essential details regarding the community of organisations, such as the organisation's name, VAT number, and the number of employees located within the STP. Subsequently, supplementary information about the organisations is collected from secondary sources, and the analysis primarily utilises secondary data. As a result, the model is predominantly tailored to operate using secondary data, requiring minimal primary input and ensuring a user-friendly experience.

By focusing the adapted model exclusively on the use of secondary data for calculating SV, the primary data source is the organisation's balance sheet and income statement. Therefore, the model is centred around reconstructing the SV generated by the organisation through its market activities. The identified database for extracting such data is the ORBIS Platform (Companies Financial Database - Bureau Van Dijk - A Moody's Analytics Company). This platform serves as the source for identifying relevant information fields to extract the necessary data for reconstructing and calculating the SV generated and distributed to key stakeholders, including employees, suppliers, customers, shareholders, financial entities, and public administrations.

Throughout the model's development, various challenges related to working with secondary data were addressed. Moreover, constraints arising from the research question were carefully considered and overcome. These include accessing and integrating crucial data for precise STP analysis, standardising the model for effective utilization of secondary data while ensuring its adaptability, designing the model to function as an STP monitoring tool, maintaining analysis accuracy with non-specific data, and validating the model's effectiveness with potential users (Lazkano and San-José, 2020).

In this regard, the methodology employed for model development followed a stepwise procedure. Initially, an iterative approach was undertaken, using the Basque STP network with its three parks as a testbed. Once the model had been validated through collaboration with these entities and the GEAccounting association, it underwent further testing by extending its application to a Swedish STP (Linköping Science Park). This additional step of validation aimed to assess the model's adaptability across diverse national contexts, encompassing both the suitability of the calculation procedure and the accessibility and availability of economic and financial data sourced from the ORBIS platform (Blazquez et al., 2020).

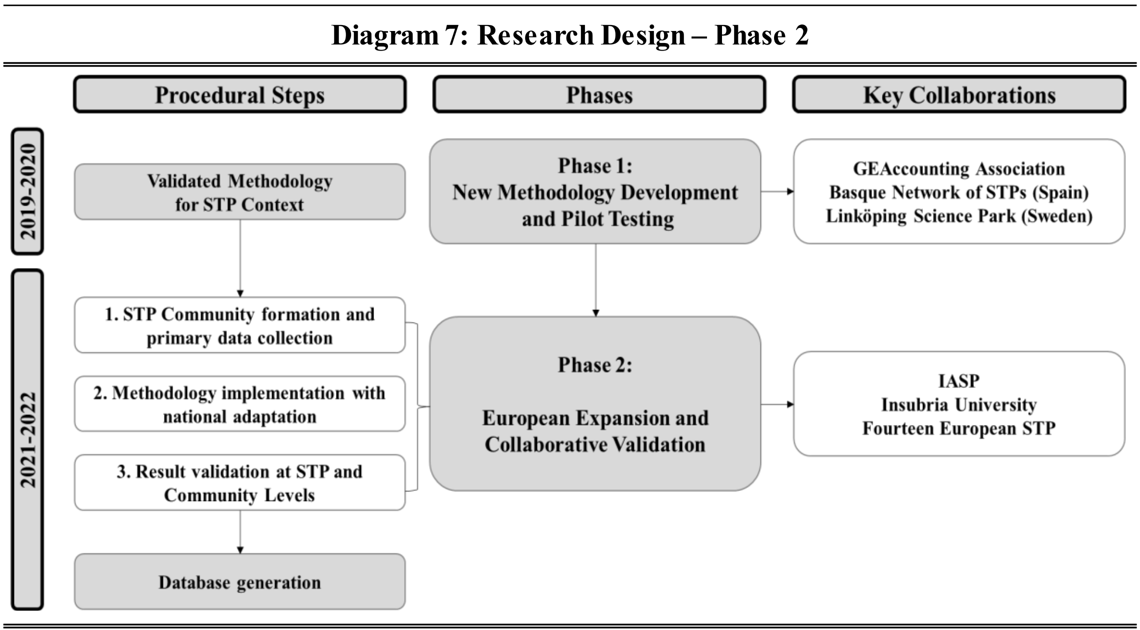
Subsequently, the work conducted, and the ensuing outcomes were disseminated through publication in a peer-reviewed scientific journal (Blazquez et al., 2020), thereby solidifying the adapted model's presence within scholarly literature. This strengthened validation not only reinforced the model's merit but also laid the groundwork for its expansion to a European scale. With this heightened methodological robustness, the study progressed to engage the International Association of Science Parks and Areas of Innovation (IASP) in the research's scaling-up phase.

3.3 Applying the New Methodology at a the European Level

The collaboration with the International Association of Science Parks and Areas of Innovation (IASP) played a pivotal role in the extended application of the model to a broader range of STPs across Europe. The publication of the methodology tailored to the STP context garnered the association’s keen interest, leading them to actively participate in this research phase, driven by their significant interest in the subject matter. IASP, being a global network of science parks and areas of innovation, brought not only an extensive reach within the STP community, but also an invaluable depth of insights, expertise, and methodological support. Their deep-rooted understanding of the intricacies of STPs across Europe significantly informed the study’s direction and depth, shaping the research framework and ensuring its pertinence to the European STP landscape.

The study’s extension unfolded through a systematic three-step procedure (see *Diagram 7* below) (Bryman & Bell, 2015; Booth et al., 1997). Firstly, efforts were directed towards establishing the STP community under analysis and gathering the primary data essential for model application. Secondly, the focus shifted to the model’s implementation, accompanied by its adaptation to the nuances of specific national contexts. Finally, the third step revolved around validating the results at both the individual STP and community levels. The following diagram concisely outlines the procedural stages undertaken during this phase.

Diagram 7: Research Design – Phase 2



Source: Own elaboration.

In the initial step of this research phase, the STP community was established in collaboration with IASP. A call was initiated targeting STP members of the association at the European level[2], inviting them to participate voluntarily in the research. In concurrence with the association, the study was delimited to the European context, avoiding global expansion. This decision was based on IASP’s intention to utilize one of their seven regional divisions, specifically Europe, as a testing ground. Additionally, considering the prior testing of the methodology with European nations (i.e. Spain and Sweden) and the limited access to ORBIS data for non-European businesses due to access credentials, the choice to focus the research on the European continent emerged as a natural course. This decision proved fitting due to both the conceptual similarities among European STPs and the accessibility of data necessary for model application.

[2] Call: *“Monetising the social value generated by STPs/AOIs”* 26 march 2021; IASP News

Throughout this phase, the association itself, through Laura Monasterio, IASP Knowledge & Project Manager, served as the main intermediary with potential participants. IASP managed contacts, applications, and the collection of primary data. It is pertinent to underscore the emphasis laid on data security during this phase. Given the sensitive nature of the data being shared and collected, stringent data security measures were implemented. Both our team and IASP ensured that all data was stored securely, with access restricted to only those directly involved in the research. The participating STPs were assured of the confidentiality of their information, and no data was disseminated or published without their explicit consent.

The interested STPs, in response to the call, expressed their interest and formally submitted applications to join in the study. To be selected, the STPs had to be able of providing essential primary data for model application, namely the list of organisations situated within the park, along with organisation names, European VAT identification numbers, and the number of employees present in their establishments within the STP. The call received a reasonable level of success, and from the received applications, fourteen STPs distributed across six distinct nations (see *Table 2* below) were able to meet the selection criteria and were involved. The primary reasons for the exclusion of other interested STPs from the study were either the absence or incompleteness of required information or internal regulations within the STP preventing the sharing of such information. Generally, the selected STPs already possessed the required information, some gathered the information, and others complemented the data already at their disposal. The establishment of this community and the collection of primary data demanded a significant commitment of time.

Table 2: Initial community of 14 STPs interested on SV analysis

Table 2: Initial community of 14 STPs interested on SV analysis

STP Name	Country	Region
UC3M Science Park - LEGANÉS TECNOLÓGICO	Spain	Madrid
Parque Científico y Tecnológico de Tenerife	Spain	Canary Islands
Parque Científico y Tecnológico de Bizkaia	Spain	Basque Community
Parque Científico Tecnológico de Gijón	Spain	Principality of Asturias
Parque Tecnolóxico de Galicia	Spain	Galicia
Ciudad Politécnica de la Innovación (Valencia)	Spain	Valencian Community
OpenZone	Italy	Lombardy
ComoNExT	Italy	Lombardy
KilometroRosso	Italy	Lombardy
Madan Parque de Ciencia	Portugal	Lisboa
TECMAIA Perque de Ciencia e Tecnologia de Maia	Portugal	Porto
Linköping Science Park	Sweden	East Middle Sweden
NOVI	Denmark	Nordjylland
University of Warwick Science Park	United Kingdom	Warwickshire

Source: Own elaboration.

In summary, the analysable STP community comprises six parks located in Spain, three in Italy, two in Portugal, and one each in Sweden, Denmark, and England. Among the involved STP Chief Executive Officers (CEOs), there are also people holding positions within the IASP. Notably, these include IASP Vice President Lena Miranda, who serves as the CEO of Linköping Science Park, and Salvatore Maiorana, CEO of KilometroRosso and President of IASP's European division.

From a methodological and technical perspective, this study consciously adopted a convenience sampling approach. Specifically, a non-probabilistic sampling technique was employed, with the participating subjects, the STPs, choosing to engage voluntarily. This decision was influenced by various factors. Firstly, the collaboration with IASP facilitated direct access to potential STP members, streamlining the recruitment process. Secondly, the study's scope was confined to the European context due to restricted access to ORBIS data for entities beyond Europe, coupled with prior preliminary investigations conducted in Spain and Sweden. This focus on Europe was also substantiated by the conceptual commonalities often found among European STPs. Thirdly, rigorous inclusion criteria mandated that STPs provide specific and comprehensive data, ensuring the participation of only those prepared with the needed information.

However, it is important to acknowledge the inherent limitations of the convenience sampling approach. The outcomes may not offer a fully representative view of all European STPs, given that the selection process was not entirely random. Potential selection bias might be present, as certain STPs might have shown greater inclination to participate than others. Moreover, certain STPs were excluded due to data constraints or internal regulations, potentially introducing bias into the sample. Nevertheless, the data acquired through this sampling method retains its value for the subsequent phases of this exploratory study (Blazquez et al., 2020).

Once the primary data from the initial pool of analysable STPs was gathered, the research progressed to the second step, involving the adaptation of the model to national contexts, subsequently applied to the fourteen STPs. For all fourteen cases, the model was effectively tailored to the specific country and the calculation procedure was applied. This phase also marked collaboration with the University of Insubria (Varese – Italy), specifically in the analysis of the three Italian cases, where Professor Alfredo Biffi, Director of the Team of Organisational Studies, played a significant role.

In this second step, which sets the stage for result validation and aligns with the exploratory statistical analyses planned for this study, a comprehensive questionnaire was developed to gather contextual insights about the STPs. To initiate the preliminary and experimental assessment of governance and management systems, a semi-structured questionnaire was selected as the primary tool for data collection, complemented by validation sessions conducted through guided discussions meetings. Concerning the questionnaire (refer to *Annex 1*), a streamlined structure featuring four key sections was chosen: *1) General Information, 2) Governance and Management System, 3) Stakeholder Management and Involvement,* and *4) Services for the Business/Organisational Community*. Each section encompassed 5 to 9 questions, employing short-answer formats that allowed the inclusion of descriptions, comments, or explanations. The structure and questions were collaboratively developed and validated in partnership with IASP and the University of Insubria, drawing on prior experience with surveys in this domain. The obtained results also facilitated the initial gathering of insights for forthcoming analyses concerning the management systems of the STPs.

Subsequently, within the third step, during the result validation process, individual STP managements were extended invitations for guided discussion meetings to validate the findings. The survey was sent to the organisation in charge of the STP management at the same time that the online meeting was convened. At that moment, a short presentation of the SV analysis outcomes pertaining to the specific STP was also shared. In fact, the participants at the consultation were fully informed and prepared for the discussions on both the SV analysis results and in-depth examination of the management and governance system.

Coherently, at the same meeting, the results of step two were presented and discussed with the representatives of the STPs. A guided discussion was also carried out to explore the park's particularities in terms of governance and management. The questionnaire's structure served as a guiding framework for the conversation. These dialogues delved deeper to enable a more nuanced comprehension of the very distinctive entities analysed. In these sessions, the STP results were validated, and the questionnaire responses were confirmed and supplemented. The insights garnered from these discussions are pivotal for the statistical analyses and furnish a robust foundation for the future analysis developments. This step of the project was also conducted in close collaboration with IASP; the association facilitated the administration of questionnaires and the coordination of meetings with the STP management.

During this phase, each participating STP received the results of the analyses conducted on their respective parks. Additionally, they were provided with recordings of the validation sessions held with the researchers and project partners. Responding to specific management inquiries, further tailored and specific analyses for each park were also supplied. The process was driven by a strong commitment to transparency and effective collaboration, as all STPs readily agreed to share their findings within the study community. This collective effort culminated in a closing validation workshop that marked the conclusion of this research phase.

As part of this finale, after the completion of the fourteen individual result validation meetings (as shown in the *Table 3* below), a final workshop was convened on March 13, 2023. The invitation extended to all STPs participating in the study. During this workshop, the final data was presented and openly discussed within the study community. This session was online, video-recorded and later disseminated, along with the materials presented, to all participants.

Table 3: European STP - Individual Validations Online Meetings

Table 3: European STPs - Individual Validations Online Meetings

STP Name	Country	Date
UC3M Science Park - LEGANÉS TECNOLÓGICO	Spain	January 28, 2022
Parque Científico y Tecnológico de Tenerife	Spain	March 2, 2022
Parque Científico y Tecnológico de Bizkaia	Spain	March 23, 2022
Parque Científico Tecnológico de Gijón	Spain	March 3, 2022
Parque Tecnolóxico de Galicia	Spain	March 2, 2022
Ciudad Politécnica de la Innovación (Valencia)	Spain	March 8, 2022
OpenZone	Italy	March 9, 2022
ComoNExT	Italy	March 9, 2022
KilometroRosso	Italy	April 13, 2022
Madan Parque de Ciencia	Portugal	May 18, 2022
TECMAIA Perque de Ciencia e Tecnologia de Maia	Portugal	March 3, 2022
Linköping Science Park	Sweden	March 10, 2022
NOVI	Denmark	April 1, 2022
University of Warwick Science Park	United Kingdom	April 26, 2022

Source: Own elaboration.

At the end of this phase, an extensive analysis was conducted on fourteen STPs. Specifically, was reconstructed and estimated the SV generated and distributed to the main stakeholders from the market activities of the organisations located within the park. As exposed earlier, the approach to calculating the STPs value involved assessing the SV generated by the constituent organisations. As a result of this process, a total of 799 organisations distributed across the fourteen studied STPs were analysed, effectively forming a substantial database. Simultaneously, facilitated by the park profiling questionnaire, another database was established, housing organisational and managerial information pertinent to the STPs. These two databases formed the essential foundation for embarking on the third phase of the study, which encompassed the envisaged exploratory statistical analyses.

In particular, the first database played a pivotal role in facilitating the exploratory cluster analysis, aiming to ascertain whether companies could be categorized into clusters based on their SV distribution among stakeholders (as discussed in Chapter 3.4). Meanwhile, data sourced from both databases, encompassing park-level and organisational performance, were employed in the experimental development of a multilevel hierarchical model. This model's objective was to identify the variables with the most pronounced influence on value generation for the central stakeholder - the employee (as explained in Chapter 3.5).

3.4 Hierarchical cluster analysis

As discussed previously, the creation of databases resulting from the European-level application has paved the way for the development of statistical analyses in the third phase of this research. Specifically, leveraging the database containing SV analyses conducted on a final sample of 799 organizations, an exploratory cluster analysis has been undertaken. This analysis investigates the distribution of SV generated by these organizations across their primary stakeholders, including employees, suppliers, customers, shareholders, financial entities, and public administrations. The main analysis aim is to determine whether the companies could be categorised into clusters based on their SV distribution among stakeholders.

To perform this exploratory analysis, a systematic three-step procedure was followed. In the initial step, the emphasis was on data, encompassing data collection and their preparation for cluster analysis. Subsequently, the second step encompassed the actual implementation of the hierarchical cluster analysis algorithm, also defining the optimal number of clusters. Finally, in the third step, attention was directed towards the interpretation and analysis of the results. For the purposes of this statistical analysis, the R statistical software was chosen as the primary tool (Kassambara, 2017; Everitt & Hothorn, 2011). The decision to employ R was informed by several compelling factors. As an open-source platform, R benefits from an active and expansive community that consistently contributes new packages and functionalities, affording unparalleled flexibility in analytical methodologies (Everitt & Hothorn, 2011). Its esteemed reputation for statistical rigour ensures accuracy in analyses, whilst its advanced visualisation capabilities allow for intricate graphical representations of data. Additionally, R's scriptable nature guarantees that analyses remain reproducible, sustaining research transparency and integrity (Kassambara, 2017; Everitt & Hothorn, 2011). The extensive documentation and support forums available further augmented our decision, assuring that any encountered challenges or queries could be promptly addressed.

Within the scope of the initial step of this procedure, it is important to clarify certain methodological aspects. Firstly, the foundational dataset for this cluster analysis was generated from the application of the SV analysis model across the fourteen STPs spanning six different nations. The resulting dataset presents an estimated value, reconstructed based on secondary data sources according to the analytical model adapted for STP context. From this dataset, values from a total of 799 organizations were available. It is essential to highlight that each of these organisations keeps a comprehensive dataset. The requirement for complete datasets stemmed from the stringent prerequisites of the SV analysis model, which necessitates the absence of missing values. While extensive, this collection is not a representative sample, but rather a comprehensive collection from the participating STPs.

The principal analytical focus revolved around how these organisations distributed their calculated SV, represented in percentages, among various stakeholders. These stakeholders, as previously mentioned, encompass employees, suppliers, customers, shareholders, financial entities, public administrations, and an additional category representing the percentage of value retained within the organisation itself. Prior to embarking on the cluster analysis, the data underwent a series of standardisation processes to ensure uniformity and comparability (Everitt & Hothorn, 2011). A robust methodology was employed to detect and eliminate outliers, which, if unaddressed, could introduce biases or distort the resulting clusters. For these steps, the widely recognised z-score method was utilised (Kassambara, 2017). This meticulous data treatment subsequently enabled the execution of the cluster analysis on a refined sample comprising 718 organisations.

A pivotal interpretive observation is that while the data is exhaustive for the chosen STPs, it originates from an adapted SV analysis model. As a result, the data represents a reconstructed estimate rather than direct empirical measurements. This subtlety holds significance when considering the insights and conclusions drawn, as with any estimated dataset, potential limitations may exist. Nevertheless, measures have been taken through a rigorous methodology and data handling to mitigate potential biases and ensure the robustness of the findings.

Following the data preparation phase, the focus shifted to the second step, which entailed the implementation of cluster analysis (Hennig et al., 2015; Gentle et al., 1991). A hierarchical clustering approach was adopted (Kassambara, 2017; Everitt & Hothorn, 2011), recognised for its prowess in identifying hierarchical and nested structures among organisations based on the distribution of SV across stakeholders. Coherently the Ward's method was employed for combining clusters in agglomerative approach. This specific method was preferred due to its objective: to minimise the sum of squared distances within each cluster in each step of the agglomerative process. In essence, using the Ward's method was possible to construct cohesive clusters (Kassambara, 2017), ensuring minimal internal variance, leading to a rational and well-defined categorisation of organisations. Regarding the choice of dissimilarity measure, the Euclidean distance was chosen (Kassambara, 2017; Everitt & Hothorn, 2011). This metric, representing the shortest linear distance between two points in a multidimensional space, was selected for its intuitive nature and suitability in scenarios where variables are continuous and metric. The Euclidean distance displays straightforwardness and geometric interpretability, providing a robust foundation for clustering decisions within a continuous space (Kassambara, 2017; Everitt & Hothorn, 2011). Adhering to such a methodical approach ensures not only the methodological rigour of the cluster analysis but also reinforces the robustness and reliability of the findings. However, it is important, during the process, to continually validate the results and ensure the quality of the input data to maintain the integrity of the conclusions.

Upon finalising the implementation stage, the subsequent methodological step entailed discerning the optimal number of clusters. To facilitate this objective, a dendrogram - a hierarchical tree diagram - was meticulously constructed, serving as a visual representation of the underlying similarity patterns among the organisations, and elucidating the sequence of cluster combinations (Kassambara, 2017; Everitt & Hothorn, 2011). To complement this visual appraisal and ensure analytical rigor, supplementary evaluation methodologies, notably the silhouette analysis, were integrated into the assessment process (Kassambara, 2017). Collectively, these methodological considerations and empirical insights converged on the determination that a five-cluster solution was the most appropriate choice for representing the data's inherent structure.

In the concluding step of the procedure, the focus shifted to the in-depth analysis and interpretation of the results derived from the categorization into five clusters. Methodologically, this entailed a rigorous examination of each cluster's distinct characteristics. It involved evaluating the specific attributes of organisations within each cluster, correlating these attributes with pertinent STP features, and delving into the intricate dynamics of SV distribution within the cluster. This analytical approach illuminated differentiated patterns of SV distribution, each revealing unique nuances.

To wrap up the methodology, insights were synthesised from the cluster analysis, culminating in a discourse on both practical and theoretical implications (Hennig et al., 2015; Gentle et al., 1991). These insights provided a deeper understanding of the varied paradigms of SV distribution identified within the dataset.

While the methodology employed is rigorous, some inherent limitations warrant mention. Firstly, the SV analysis model is based on reconstructed estimates, which might introduce certain degrees of approximation. Consequently, findings should be interpreted with this context in mind. Secondly, the sample, though comprehensive, is not a random representation, which might lead to selection biases. Furthermore, the nature of cluster analysis means that different clustering algorithms or distance metrics might yield slightly varied results, hence the specificity of the findings to the chosen method. Lastly, while efforts have been made to standardise and cleanse the data, any inconsistencies or errors in the primary data sources might inadvertently influence the results.

3.5 Multilevel Modelling

Within the realm of statistical analysis concerning modelling, data that were meticulously gathered and systematically organised were leveraged. Those data come from the extension of the study at a European level. This extended exploratory analysis capitalizes on data sourced both at the company level, encompassing the 799 examined organisations, and at the STP level, embracing the fourteen STPs hosting these organisations. This approach aims to identify the key variables, within the context of generating SV for a predetermined stakeholder - specifically the employee, as informed by the overarching humanistic orientation of this research.

A two-level model was adopted based, on the intrinsic structure of the data. This type of modelling accommodates the nested data structure, capturing variations at both the company and STP levels effectively (De Leeuw & Meijer, 2008). Such a methodology is particularly adept at addressing the in-depth research objective, which revolve around understanding the intricate dynamics between individual organisations and the broader STP environments within which they operate.

To conduct this exploratory analysis, a three-step procedure is adopted. The initial step was centred on data, encompassing the collection (conducted during the study's second phase), preparation for model development, and the execution of preliminary exploratory data analyses. Moving to the subsequent step, the actual operationalisation of the multilevel model took place, including model estimation (De Leeuw & Meijer, 2008; Austin, 2017). Ultimately, the third step focused on the model's validation, entailing diagnostic assessments and the interpretation of results. Consistent with prior considerations (see *Chapter 3.4*), the R statistical software was chosen as the primary analytical tool due to its compatibility and effectiveness in statistical analysis applications (Finch et al., 2016).

In this step, special attention was given to data preprocessing, which included strategies for handling missing data and identifying outliers. Omitting missing data is a decision that was not taken lightly. Although this could lead to potential loss of information, preserving the quality of the dataset was paramount. In this context, omission was chosen over imputation to avoid potential distortions or the introduction of bias. As for outliers, they were identified using z-score method (De Leeuw & Meijer, 2008). Each outlier was then analysed to determine if it was a genuine error or an extreme yet valid variation. Based on this assessment, appropriate action was taken for each outlier. Consequently, during model construction, variable selection incorporated the acknowledgment of reduced sample size due to missing data and outlier exclusion.

Moreover, the implementation of variable transformations became imperative, as they played a critical role for ensuring model accuracy and interpretability. Techniques such as logarithmic and cubic transformations, were instrumental in achieving this goal. Additionally, the coding of specific categorical and numerical variables adhered to established best practices within the field (De Leeuw & Meijer, 2008; Finch et al., 2016). The primary motivations behind these procedural applications lie in enhancing analytical simplicity and effectively managing potential outliers, thereby mitigating their impact. To elucidate further, a numerical variable was converted into categorical one through a process known as binning.

For the exploratory analysis, a range of tools, including histograms, scatter plots, and correlation matrices, was employed. The primary objective of this analytical endeavour was threefold: firstly, to evaluate the distribution patterns of variables;

secondly, to identify potential correlations among these variables; and thirdly, to ascertain the extent of variability present both within and between the hierarchical levels.

The subsequent step focused on the operationalisation of the model, encompassing its specification, assumption validation, and estimation. Accordingly, the analysis initiated with a null model, devoid of predictors. The primary objective behind this strategy was to evaluate the inherent variability between groups. This stage was foundational in two ways: firstly, in hierarchical analyses, it serves as a baseline for comparison when predictors are introduced, and secondly, it provides insight into the potential significance of the predictors that would be subsequently introduced. Building upon the insights gained from the null model, the model was progressively refined. Initially, fixed effects were incorporated, entailing the inclusion of predictive variables relevant to both the organisational and STP levels. In the final part of this process, random effects were introduced to account for the variability across STPs, considering the clustering at the STP level (Austin, 2017, De Leeuw & Meijer, 2008, Finch et al., 2016) This decision is grounded in the hypothesis that the differences among STPs are not merely coincidental but imply structural variations in how they internally influence organizations.

In line with this, prior to model estimation, it was also crucial to validate its assumptions to ensure the reliability and interpretability of results. The validation of assumptions is a pivotal point in hierarchical modelling (De Leeuw & Meijer, 2008, Hox, 2010). Such models, by their nature, can be complex, and violating the assumptions can lead to incorrect inferences. Hence, utmost priority was given to selecting and implementing the most appropriate diagnostic tests, ensuring the model accurately reflected the data (De Leeuw & Meijer, 2008).

Firstly, it was verified that the residuals exhibited approximate normal distribution. This validation is crucial as non-normally distributed residuals could indicate that the model inadequately captures data structure. Specifically, preliminary tests were conducted, including the Shapiro-Wilk test and Quantile-Quantile Plot (Q-Q plot) (Finch et al., 2016). The former assessed potential normality in data distribution, while the latter graphically scrutinised the quantile distribution of data against the theoretical normal distribution.

Thirdly, multicollinearity among predictors was evaluated to confirm its absence. This consideration is pivotal since in the presence of multicollinearity, two or more predictors in the model are highly correlated, making it challenging or impossible to isolate the independent effect of each predictor (Finch et al., 2016). Consequently, without identification and addressing during model construction, it can lead to unstable coefficient estimates that are difficult to interpret. Hence, the Variance Inflation Factor (VIF) analysis was conducted to measure how much the variance of an estimated regression coefficient increases when predictors are correlated (De Leeuw & Meijer, 2008, Finch et al., 2016).

After validating those fundamental assumptions, the model estimation process was initiated. For the analysis, the "Linear Mixed-Effects Regression" (LMER) package within the R environment was employed. LMER stands as an effective methodology used for modelling both fixed and random effects within a hierarchical data structure (Finch et al., 2016). This holds significance in the research context where organisations are nested within STPs. This function not only enables modelling of variability between and within groups, but also accommodates correlations and non-constant variance patterns within the same groups. Accordingly, to enhance parameter estimation efficiency within the model, the "Bound Optimization BY Quadratic Approximations" (BOBYQA) numerical optimizer was utilized. BOBYQA is an algorithm that seeks solutions without the need to estimate either the Hessian matrix or the Jacobian matrix, rendering it efficient and suitable for problems involving a large number of variables (Finch et al., 2016).

The choice of this optimization technique, the Restricted Maximum Likelihood (REML) algorithm, aims to ensure model convergence towards a solution that maximizes likelihood, thus yielding accurate and reliable parameter estimates within the model (Finch et al., 2016).

In the ultimate step of the procedure, the focus shifted toward model validation and diagnostic assessment, setting the stage for subsequent interpretation of results. At the outset, it is crucial to emphasise that particular attention was devoted to evaluating the model's appropriateness in relation to the observed data. The alignment between the model and empirical data was progressively scrutinized through a sequence of goodness-of-fit tests. This included, for instance, confirming the randomness of model residuals and the absence of discernible patterns or trends, which could signal model inadequacies.

Concurrently, in the pursuit of finalising the model specification, a series of model comparisons were executed. These comparisons encompassed diverse sets and combinations of predictors, alongside varying causal effect configurations, subject to evaluation through metrics such as the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Optimal model selection was facilitated through the application of information criteria like AIC and BIC. These criteria were valuable as they not only assessed the model's fidelity to the data but also penalised overly complex models by considering the number of parameters. Thus, utilising these criteria was possible to reach a balance between a well-fitting model and one that remained suitably uncomplicated, adhering to the principle of parsimony (De Leeuw & Meijer, 2008, Finch et al., 2016).

Throughout this process, the assessment of multicollinearity among predictors was consistently upheld, guided by the analysis of Variance Inflation Factor (VIF) to detect and quantify it. Moreover, to ensure the quality and validity of the adopted multilevel hierarchical model, a comprehensive array of diagnostic checks was conducted. These diagnostic assessments assume pivotal importance in validating the assumptions underpinning hierarchical models and ensuring the reliability of the model's outcomes. For this purpose, activities such as residual analysis, tests of normality, verification of multicollinearity, assessment of random effects, and the identification of outliers were executed (De Leeuw & Meijer, 2008, Finch et al., 2016).

This phase encompassed the utilisation of residual plots to scrutinize randomness and the absence of patterns in the residuals. Such graphical representations provide visual insight into the discrepancies between observed and predicted values by the model. Normality of residuals was validated using a Q-Q Plot, which contrasts residual distribution with that of a theoretical normal distribution, as previously discussed. Additionally, the Shapiro-Wilk test was employed as a formal test for normality. Furthermore, as reiterated throughout this process, the VIF was employed to quantify and diagnose the presence of multicollinearity among explanatory variables. On the other hand, random effects within the model were explored and represented using DotPlots, which visually illustrate the distribution of these effects (De Leeuw & Meijer, 2008, Finch et al., 2016). Numerical estimation offered further insights into their magnitude and direction. Ultimately, to detect potentially influential outliers, the Cook's distance was employed (De Leeuw & Meijer, 2008).

Upon the culmination of this sophisticated procedure, the model reached its definitive form. As evident from the described and conventionally acknowledged methodology, the model's creation adheres to an iterative process, advancing through distinct phases of implementation.

In conclusion, the adoption of the multilevel hierarchical model has facilitated a detailed understanding of the dynamics between organizations and the STPs in which they operate. Through a rigorous data pre-processing procedure, model validation, and diagnostics, it was possible to construct a robust and reliable model. This model can serve as a benchmark for future research in this domain. In the subsequent chapter, it will be presented the finalised model and delve into its implications in depth (see *Chapter 4.3.2*).

4. Results

In this chapter, the research outcomes achieved over the past four years will be systematically unveiled in alignment with the phases delineated in the research design (refer to *Chapter 3.1*). The objective here is to offer a comprehensive synthesis of the progress and achievements attained throughout the distinct stages of the research process. These phases follow a functional and sequential progression, wherein the findings of each antecedent phase lay the groundwork for the subsequent one. This methodological framework ensures a coherent narrative flow, guiding readers through the evolution of the research. The outcomes of each phase will be presented sequentially within designated sub-chapters, allowing for a clear delineation of each stage's findings. Within these sub-chapters, the results will be outlined in accordance with the specific methodologies detailed in each corresponding section (see *Chapters 3.2-3.5*). Following this, a thorough and transparent examination of each result will ensue, including an exploration of limitations and potential avenues for future research. Notably, each sub-chapter will conclude with its own set of conclusions, thereby contributing to an overarching and comprehensive grasp of the research's outcomes.

In the first sub-chapter, the focus will be on the outcomes of the initial research phase. This phase involved adapting the social value analysis model to the context of STPs. The sub-chapter will provide insights into the model's adaptation process, discussing encountered challenges, the strategies employed to overcome them, and showcasing the practical outcomes of its experimental application in two preliminary national contexts (Spain and Sweden). Furthermore, this section will critically analyse the developed methodology's efficacy, utility, limitations, and potential applications. The sub-chapter will culminate in conclusions drawn from the findings of this initial research phase.

The successive sub-chapter will delve into the results of the second research phase, which pertains to the model's application on a European scale. Here, the process of adapting the model to diverse national contexts will be expounded upon, underscoring the model's adaptability and flexibility. The presentation of results from the application across 14 STPs within the initial analysis community will be accompanied by validation from park management. Consistent with the chapter's structure, a rigorous critical analysis of the findings and the model's applicability will be presented. This section will also delve into observed limitations and suggest potential research avenues. The sub-chapter will conclude with synthesized insights drawn from these outcomes.

The following sub-chapter will present a comprehensive analysis of the results from the third research phase. This phase focused on exploratory statistical analyses conducted on the databases generated during the project's second phase. In the first case, the application of cluster analysis will be detailed, followed by the presentation, analysis, and discussion of the obtained outcomes. A similar approach will be adopted for the multilevel model, wherein its development, presentation, analysis, and implications will be systematically covered. For both cases, potential avenues for future research, identified limitations and conclusions will be outlined.

Throughout these three sub-chapters dedicated to presenting research outcomes, the attainment of preset research objectives will be clarified, allowing for the comprehensive exploration, identification, presentation, and discussion of elements forming the responses to the research's sub-questions. These insights collectively address the overarching main research question, guiding the entire study. As a research endeavour characterised by exploration, it signifies a starting point rather than a definitive conclusion, laying the groundwork for potential future advancements and in-depth investigations.

4.1 Adapted Methodology for Social Value Analysis in STPs

This chapter predominantly focuses on presenting and discussing two pivotal aspects. Firstly, it delves into the outcomes resulting from the adaptation of the Polyhedral model to suit the context of STPs, providing insights into the resultant model. Secondly, it explores the findings arising from the experimental application conducted during the 2019/2020 biennium. It is important to emphasise that these contents were previously published in 2020, featuring in a peer-reviewed journal (Blazquez et al., 2020). Thus, it is essential to acknowledge the preexisting dissemination of these contents. This publication significantly contributed to the research plan, notably facilitating its expansion to a European scope (see to *Chapter 3.1*).

This initial phase was devoted to addressing the core research question: *"How can a measurement tool based on secondary data be developed to assess the SV generated by STPs in a manner convenient for key potential users and reliable in terms of analysis quality?"* This stage laid the foundational groundwork for subsequent research phases. During this preliminary model development step, the five sub-questions also guided the process, imposing constraints that steered the model's evolution.

More specifically, this central inquiry, aligned with the sub-questions, unfolds into five key considerations and constraints. These encompass accessing and integrating essential data for accurate STP analysis, standardising the model for effective utilisation of secondary data while ensuring adaptability, designing the model to function as an STP monitoring tool, maintaining analysis accuracy with non-specific data, and validating the model's effectiveness with potential users. Each of these dimensions played a pivotal role in shaping the model's development.

As a result, the aim of this process was to develop a methodology which could conduct to a tool applicable within STPs, facilitating the reconstruction and estimation of the SV generated by the community of resident organisations. Furthermore, it aimed to elucidate how this value is distributed among key stakeholders, including employees, suppliers, customers, shareholders, financial entities, and public administration. Consequently, the resultant methodology had to be tailored to accommodate secondary data utilisation, striking a balance between a standardised structure to ensure widespread replicability and the necessary flexibility for adaptation across diverse national contexts. Simultaneously, ensuring the methodology's practical applicability required the establishment of a user-friendly implementation procedure.

This procedure empowers STP managers to conduct analyses utilising pre-existing data, specifically essential identification information concerning the resident organisations, without necessitating direct engagement from these entities.

Considering the overarching final goal and the initial constraints that guided the formulation of this novel methodology, a comprehensive evaluation of all the aforementioned aspects was undertaken.

In pursuit of this overarching objective, a meticulously devised roadmap, as detailed in the dedicated methodology chapter (see Chapter 3.2), was followed. This systematic journey consisted of five steps, each contributing to the refinement and realization of the research aim:

1. Understanding the Context of STPs
2. Understanding the main principles of the Polyhedral Model
3. Adapting the Model to the STPs Context
4. Validating the Adapted Model
5. Implementing and Applying the Model on a Broader Scale

Throughout this journey, the involvement of the GEAccounting association played a pivotal role. Their methodological guidance and expertise lent credibility to the process, ensuring the model's validity and reliability. Adhering to the foundational principles of the original model – universality, systematicity, cross-sectoral applicability, integrity, multistakeholder perspective, and reliability – the developed model emerged as a faithful embodiment of the New Business Narrative's guiding principles (see *Chapter 2.2.1*) (Freeman et al., 2020).

As elucidated below, the development of an adapted model that met all the necessary criteria proved feasible. This involved not only providing a faithful response to the core research question but also staying aligned with the foundational principles of the original model, ensuring congruence with the assumptions of stakeholder accounting. The subsequent section will delve into the final methodology, detailing how the constraints were addressed and the strategies employed to navigate and overcome the associated challenges. Following this, dedicated sections will be devoted to discussing the application of the model and subsequently to engaging in a comprehensive discussion and drawing conclusions specific to this initial research phase.

4.1.1 Social Value Analysis adapted for STPs

The upcoming section delves comprehensively into the tailored Social Value analysis procedure designed specifically for STPs. This serves as an essential preamble to understanding the procedure's development and its ultimate configuration within the STP framework.

The outcomes unveiled here, encompassing both the implementation procedure and the calculation formula for SV, have evolved through systematic progression from steps one to four, as detailed in the methodology (see *Chapter 3.2*). Moreover, the collaborative involvement of the Basque Network of STPs (located in the Basque Country, Spain) as the practitioner arm, along with GEAccounting Association's role as experts of the original model within the academic-scientific realm, has been instrumental. As a result, after a series of iterative enhancements and validations from both research partners, the methodology emerged as a validated process. This consensus allowed for a seamless transition to the fifth step, which involved its broader application, as detailed in the subsequent section.

Collaboration with the Basque Network of STPs not only enriched insights into the STP ecosystem and its dynamics but also, crucially, illuminated the data landscape. More specifically, it elucidated the primary data commonly at the disposal of these parks concerning their resident organisations. Conversations and hands-on iterations highlighted the absence of a systematic, let alone annual, collection of such data, particularly concerning the number of active employees within these organisations' facilities within the STP. Although data collection efforts often employed questionnaires, consistently low response rates resulted in incomplete records. A salient challenge emerged in accessing accurate annual trends in terms of employees within the parks. A secondary challenge pertained to tracking the growth and evolution of organisations within the STP, where information on departures and new entries lacked systematic monitoring unless tied to lease agreements. Ongoing efforts are addressing these challenges and improving data reliability, though these initiatives remain a work in progress. Consequently, the procedure, as presently conceptualized, ideally suits annual analysis and longer-term monitoring. As a result, while the procedure ideally suits annual analysis and longer-term monitoring, the application of full-scale monitoring remains unexplored due to the current lack of comprehensive primary data consistently collected over time and the resource and time constraints inherent to STPs in gathering such information.

Moreover, in formulating both the procedure and the calculation formula for secondary data analysis, it is essential to highlight that the adapted SV analysis for STPs primarily focuses on market-based SV, often referred to as the Social Impact of Economic Activity (SIEA). Operating with secondary data offers the advantage, as later elucidated, of relatively quick and straightforward value calculation across multiple organisations, utilizing data sourced from specialised databases encompassing specific economic and financial facets. Nonetheless, this analytical approach has limitations, particularly concerning other dimensions of SV, such as non-market and emotional value. For these dimensions, the comprehensive Polyhedral Model, coupled with close collaboration with analysed organisations, remains imperative. In this context, the examination takes an indirect trajectory. The procedure's primary intent is to provide a rapid and preliminary estimation of the value generated by resident organisations' economic activities, rather than to deliver an exhaustive analysis of the overall SV within the STP, considering the three dimensions. The outcomes offer an initial touchpoint to sensitise STP managers to the subject.

Regarding stakeholders factored into SV reconstruction, optimization endeavours have honed the procedure and calculation to furnish an SV-SIEA tailored to key and overarching stakeholders: employees, suppliers, customers, shareholders, financial entities, and public administration.

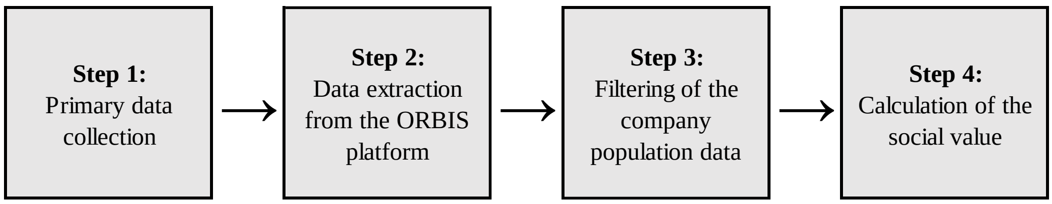
Concluding this introductory preamble, the essence of the procedure can be distilled into four pivotal steps, as outlined below:

1. **Primary Data Collection:** This initial step involves gathering primary data essential for the analysis, aiming to acquire pertinent information about the organisations within the STP.
2. **Data Extraction from the ORBIS Platform:** The subsequent stage entails the retrieval of relevant data from the ORBIS Platform (Companies Financial Database - Bureau Van Dijk - A Moody's Analytics Company), a specialised database containing crucial economic and financial data.
3. **Filtering of Company Population Data:** In this phase, the collected data is meticulously filtered to refine the dataset, ensuring its accuracy and relevance to the analysis.
4. **Calculation of Social Value (SV-SIEA):** The final step involves applying the calculated Social Impact of Economic Activity (SV-SIEA) formula to assess the social value generated within the STP and distributed to key stakeholders.

The summarized procedure, along with informative annotations, is visually depicted in the accompanying *Figure 1*. Each step is subsequently elucidated in a detailed manner.

Figure 1: Social Value (SV) Monetisation Procedure in the context of STPs

Figure 1: Social Value (SV) Monetisation Procedure in the context of STPs



Notes:

- **Step 1: Primary data collection**
  Data needed: 1) Name of each company at the STP, 2) European VAT identification number, 3) Number of employees at the company's workplace at the STP.
- **Step 3: Filtering of company population data**
  Criteria: 1) State of company activities, 2) Data availability, 3) Obsolete data, 4) Availability of total of employees and nr. of workers at the STP, 5) Completeness of accounting data, 6) Data distortion.

Source: Own elaboration based on Blazquez et al. (2020)

Step 1: Primary data collection

The first stride of the procedure, denoted as Step 1, entails the collection of fundamental primary data that lays the groundwork for the subsequent methodology. This preliminary phase involves acquiring three specific types of information: the names of companies situated within the STP, their corresponding European VAT identification numbers, and the count of employees stationed at each company's STP workplace.

The significance of company names and VAT numbers lies in their pivotal role in identifying entities within the ORBIS platform. This platform serves as the primary source from which an array of essential information and data is extracted, forming the bedrock for ensuing analyses. This strategic approach facilitates a seamless transition from primary data to the utilization of secondary data, a fundamental aspect essential for executing the subsequent social value calculation.

The employee count data holds a significant role in assessing the value generated by companies within the unique STP context. Given that STPs often host multinational corporations or conglomerates with distributed operational sites, understanding the dispersion of their workforce is crucial. By incorporating employee count data, a precise evaluation of the value generated by the specific segment of a company located within the STP is achieved. This approach enables a focused measurement, effectively capturing the contributions of individual units situated within the park.

However, it’s imperative to acknowledge the challenges associated with obtaining direct and specific accounting data from business units within the park. Practical constraints, such as limited availability, outreach to numerous companies, and substantial resource allocation, pose hindrances. To address this limitation, an estimation approach is adopted based on the assumption that the value generated by a multinational or multi-site company correlates with the collective output of its constituent units. This conceptual foundation underscores the value’s proportional relationship with the number of employees within the STP.

Insights from practical trials with the Basque Network of STPs underscored important considerations during this initial phase. Challenges encompass potential data dispersion across separate databases, necessitating cross-referencing due to diverse purposes. Additionally, the data collected from these databases may lack systematic and periodic collection due to non-annual voluntary questionnaires. The collection of employee-related data, often solicited through voluntary questionnaires, results in varied responses, particularly from large corporations providing less granular information.

Addressing data gaps is achieved through direct data collection, enhancing precision and validation.

In practice, the acquisition of these critical pieces of information occurs as follows. When applying the procedure, the STP management entity is approached to provide the data. The entity subsequently furnishes the required information in the form of a comprehensive list. This approach obviates the need for direct engagement with individual organisations, aligning with the unique interlocutor principle and streamlining the social value analysis process. This method minimizes direct interference with the analysed organisations and adheres to the philosophy of seeking concise, foundational data to drive subsequent analytical steps while ensuring simplicity and ease of application.

The ensuing step, as elaborated below, capitalizes on the information gathered in this primary data collection phase. This meticulous methodology, initiated through systematic and succinct data acquisition, lays the groundwork for the subsequent steps, culminating in a comprehensive social value analysis tailored to the distinctive STP context. The meticulous handling of these foundational stages is pivotal for both the integrity of the analysis and its unobtrusive application within the STP ecosystem.

Ultimately, a comprehensive initial database, comprising company names, VAT numbers, and employee counts in STP facilities, establishes a foundation for enhanced accuracy in subsequent social value analyses. The VAT number assumes a cornerstone role for the ensuing step, the employee count holds a pivotal position in transitioning to the subsequent phase, and the company name acts as an integral control element throughout this procedural journey.

Step 2: Data extraction from the ORBIS Platform

Continuing from the initiation of Step 1, the subsequent phase, Step 2, engages a meticulous data extraction process from the ORBIS platform. As previously elucidated, the foundational point remains the list of VAT numbers, serving as the gateway to accessing the ORBIS database to identify the constituent companies within the STP community. This repository-driven extraction encompasses a dual objective - gathering pivotal accounting data imperative for social value calculations and acquiring contextual data for control and validation purposes. A comprehensive depiction of primary accounting and financial data, in conjunction with relevant control information, is presented in *Table 4* (in following page).

The left column of *Table 4* delineates eight fundamental accounting variables sourced from the Balance Sheet and Profit Loss Account records. These variables - "*Sales*", "*Added value*", "*Cost of employees*", "*Taxation*", "*P/L (Profit/Loss) after tax*", "*Depreciation & Amortization*", "*Financial expenses*" and "*Financial revenue*" - constitute the foundational bedrock for the reconstruction and estimation of the Social Impact of Economic Activity (SIEA), a core facet of the SV. Additionally, the inclusion of the ninth variable, "*Operating revenue (Turnover)*", serves as a corroborative instrument, verifying the coherence and credibility of the company's economic landscape. A detailed explanation of the methodological nuances underpinning the calculation of social value is expounded upon in the subsequent subsection.

Table 4: ORBIS Platform – Financial and Control information

Table 4: ORBIS Platform – Financial and Control information

Financial information		**Control information**	
Information/data ORBIS Nomenclature	**Purpose**	**Information/data ORBIS Nomenclature**	**Purpose**
Sales th EUR Last avail. Yr	Calculation – SV customers	Company name	Control and company identification
Added value th EUR Last avail. yr	Calculation – SV suppliers	European VAT number	Company identification and tracking
Costs of employees th EUR Last avail. Yr	Calculation – SV employees and public administration	NACE Rev. 2, core code (4 digits)	Cross-check company and sector
Taxation th EUR Last avail. Yr	Calculation – SV public administration	Status	Identification of the activity status of the holding (Step 3 key information)
P/L after tax th EUR Last avail. Yr	Calculation – SV shareholders	Standardised legal form	Identification of the obligation to present accounts
Depreciation & Amortization th EUR Last avail. Yr	Calculation – SV retention	Last avail. year	Identification of the accounting information obsolescence (Step 3 key information)
Financial expenses th EUR Last avail. Yr	Calculation – SV financial entities	Number of employees Last avail. yr	Identification of the organisation size (Step 3 key information)
Financial revenue th EUR Last avail. Yr	Calculation – SV financial entities	Capital th EUR Last avail. yr	Control and plausibility of the accounting data
Operating revenue (Turnover) th EUR Last avail. Yr	Calculation and control – SV customers	Fixed assets th EUR Last avail. yr	Control and plausibility of the accounting data

Notes:
-th EUR Last avail. Yr = thousands of EUROS and last available year
-SV = Social Value

Source: Own elaboration based on Blazquez et al. (2020)

The selection of these specific variables emerged from a comprehensive evaluation of diverse fields accessible within ORBIS repositories. The culmination of this evaluative process led to the preference for extracting accounting data from the repository titled "*Financial Data - Global standard format - Corporate - Balance sheet and Profit loss account*". The selection criteria rested on two core facets: the frequency of data compilation by companies and the pertinence of the extracted data in deriving values critical for social value calculation across six principal stakeholder categories: workers, suppliers, customers, shareholders, financial entities, and public administration.

In cases where the availability of data concerning "*Added value*" displayed diminished compilation rates, rendering them unsuitable for direct application, a pragmatic approach was adopted. For companies lacking "*Added value*" data, a proxy-based strategy was pursued to estimate value addition. This approach hinged on the availability of essential information, notably "*Cost of employees*," "*Taxation*," "*P/L (Profit/Loss) after tax*", "*Depreciation & Amortization*", necessary for facilitating the estimation[3]. For entities equipped with this information, their self-estimated values as collected from the ORBIS Platform were harnessed.

Regarding the reconstruction of SV for suppliers, precise entries within ORBIS requisite for the reconstruction process were exhibited limited data availability. In response, a pragmatic strategy involving proxy utilization was embraced[4]. This practical manoeuvre encompassed deriving estimates from the declared "*Added value*" information (as documented in Orbis) or through the application of a designed proxy, as previously explained. This adaptive approach streamlined the reconstruction process while effectively addressing gaps inherent in original ORBIS entries.

Consequently, this pragmatic approach enabled the inclusion of a broader array of eligible companies in the calculation process. This enhanced inclusivity was achieved despite the inherent variations in the comprehensiveness and precision of specific accounting variables within the ORBIS database.

[3] Estimated value added: sum of"Cost of employees," "Taxation," "P/L (Profit/Loss) after tax", "Depreciation & Amortization"
[4] See explanation in Step 4 description.

Crucially, the extracted values for each accounting variable harmonize with the last available accounting year. This temporal alignment accommodates reasonable delays in value computation by companies and serves a pivotal criterion for Step 3 - selection of company population data. This succeeding step strategically identifies organisations suitable for calculating the Social Value of the STP (SV-SIEA).

In contrast, the right column of *Table 4* encapsulates control data points drawn from ORBIS, encompassing company identification and contextual assessment. These data points perform a dual function: they discern companies (e.g., "*Company name*"; "*European VAT number*") and support the meticulous selection or exclusion process in Step 3 (e.g., "*Status*"; "*Last avail. year*"; "*Number of employees*"). Notably, the information "*Standardised legal form*" aids in distinguishing foundations and associations generally exempt from submitting accounts to commercial registers in specific countries. This expounds instances where accounting records might be absent. Ultimately, control data points like "*Capital*" and "*Fixed assets*" contribute to refining comprehension of company size and validating employee figures through cross-referencing with indicated payroll data.

It is essential to reiterate that the ORBIS platform operates as a data aggregator, implying that its effectiveness in collecting and amalgamating organisational data varies. The precision and comprehensiveness of information drawn from this platform are significantly influenced by the jurisdiction where an organisation is headquartered and the specific national regulations governing data disclosure. Moreover, these regulations may vary based on the organisation's legal structure. Despite these inherent limitations, ORBIS stands as a viable option, serving as the primary conduit for secondary data collection in this procedural step.

The decision to prioritize the ORBIS platform stems from several factors. Notably, the platform enjoys widespread adoption and has garnered a distinguished reputation within the domains of financial and management analysis. This standing is attributed to the platform's expansive coverage and reliability as a repository of financial data. Furthermore, the platform's capability to provide detailed and up-to-date financial insights is noteworthy. Additionally, researchers' accessibility to extract data from this platform is facilitated through specific licensing agreements established with University of Applied Sciences and Arts of Southern Switzerland and Deusto University[5].

Hence, the conscious selection of ORBIS as the principal data source is underscored by its prominence, capacity to furnish comprehensive financial insights, and the facilitated researcher access to its data extractions. These factors collectively affirm its appropriateness as a foundational element for compiling secondary data within this specific procedural step.

In conclusion, upon the culmination of Step 2, a comprehensive database is assembled, encompassing information pertaining to the organisations situated within the STP and for which primary data was collected in Step 1. With this consolidated database in place, the transition to Step 3 is facilitated. In Step 3, specific criteria are applied to ascertain organisations suitable for subsequent analysis.

[5] Institutions the researcher belong to.

Step 3: Filtering the company population

Following the compilation of the initial comprehensive database containing information about the companies within the STP community, attention shifts to the selection phase, where the objective is to identify companies eligible for computing the Social Value (SV-SIEA) generated and distributed by the STP. This selection process is guided by a set of discerning criteria: 1) Company Activity Status, 2) Data Availability, 3) Currency of Data, 4) Employee Information, which encompasses both the number of employees within the STP (provided by the STP manager) and the overall workforce count of the organisation (derived from ORBIS), 5) Data Integrity, and 6) Data Consistency.

Instances where these criteria are not satisfied lead to the exclusion of respective organisations from the calculation process. This methodological choice aims to mitigate distortions in stakeholder value estimations arising from incomplete information. As a result, the analysis focuses solely on companies equipped with comprehensive, up-to-date, and unaltered accounting data, ensuring precision in value estimation for primary stakeholders.

Concerning the first criterion, the analysis encompasses solely organisations designated as "*Active*" within the ORBIS field "*Status*". In simpler terms, only companies actively engaged in economic activities are considered.

The second criterion utilizes the ORBIS field "*Last avail. Year*", indicating the most recent year for which accounting records were submitted. Consequently, companies lacking a date in this field are automatically excluded. Such entities, devoid of accessible accounting data, are unsuitable for social value calculations. Notably, as previously mentioned, certain entities withhold data due to organisational legal structures.

Similarly, the third criterion utilizes this field to exclusively consider companies with updated data. This is achieved by setting a cutoff date, typically accounting for a three-year lag in data updates. Hence, organisations featuring accounting records post the designated cutoff date are considered For instance, during the experimental application in spring 2020, the cutoff year was set at 2016.

The fourth criterion revolves around employee data, necessitating information from both the STP management entity - pertaining to the count of employees established within the STP - and the total workforce information sourced from the ORBIS field "*Number of employees*". Those data streamline the estimation of the proportion of value stemming from a company's economic activities within the STP. Only companies with accessible employee data are included, and this data also plays a key role in calculating the per capita social value indicator within the STP (see Chapter 4.1.2).

The fifth criterion emphasises data completeness, particularly concerning the accounting variables necessary for stakeholder social value calculation (as presented in *Table 4* - left column). For a company to be considered, it must possess values for all variables on the list, ensuring result accuracy by minimizing distortion. Similarly, the sixth criterion serves as a final check, ensuring data consistency and plausibility. An illustrative example includes cross-referencing the "*Value Added*" entry from ORBIS with the corresponding "*Sales*" value of the organisation to ascertain that the generated value add does not exceed the organisation's recorded sale value.

By synergistically applying these selection criteria, meticulous oversight of available data is upheld. This approach facilitates a comprehensive analysis of the STP's organisational community and enables targeted evaluations of excluded companies across distinct selection stages. Through the application of these six criteria, the cohort of companies suitable for calculating the social impact resulting from economic activity is determined, marking Step 4 in this procedural framework.

Step 4: Calculation of Social Value

In this concluding step, leveraging the refined database, the focus shifts to the practical calculation of the SV, with a specific emphasis on assessing the Social Impact from Economic Activity (SIEA) concerning the six core stakeholders: workers, suppliers, customers, shareholders, financial entities, and public administration. As previously emphasised, before to engaging in the calculation process, it is crucial to adjust the accounting metrics for each entity. This entails considering the correlation between the employee count provided by the STP manager and the corresponding count listed in ORBIS under the "*Number of employees Last avail. Year*". This ratio-based alignment ensures a methodical calculation, with adjustments applied only when the ratio is below 100%. It is essential to underscore that while this methodology relies on estimative proxies, the utilization of precise primary data remains fundamental for attaining precise outcomes.

Following the establishment of a streamlined database encompassing the accounting details of individual companies within the STP, the procedure advances to quantify the SV-SIEA for each company concerning the six pivotal stakeholders. The cumulative SV-SIEA of each assessed organisation encapsulates the value generated and distributed by the STP. This SV-SIEA is intrinsically moulded by the grouping of companies under analysis. Importantly, the procedure consciously refrains from resorting to proxies for the purpose of generalizing and estimating the total value of the STP, encompassing its entire organisational population. The ensuing *Table 5* provides an illustrative breakdown of the SV-SIEA calculation for each stakeholder, including the value retained within the organisation itself.

Table 5: Social Value Calculation

Table 5: Social Value Calculation

Stakeholder	Code	Calculus / Proxy – Social Value (SV)
Customer	SV-C	SV-C = $\text{Sales}_{\text{ORBIS}}$
Supplier	SV-S	SV-S = ($\text{Sales}_{\text{ORBIS}}$ – Value $\text{Added}_{\text{ORBIS}}$) * 43%
Public administration	SV-PA	SV-PA = ∑ (O-VAT; O-VAT; O-SSC; E-SSC) + If(O-TAX > 0)
VAT	O-VAT	*O-VAT = Value Added $_{ORBIS}$ * %VAT $_{DB\_National\%}$*
VAT induced supplier	S-VAT	*S-VAT = (SV-S * %VAT $_{DB\_National\%}$) / 43 * 100*
Employer paid - Social security contributions	O-SSC	*O-SSC = Costs of employees $_{ORBIS}$ * %O-SSC $_{DB\_National\%}$*
Employee paid - Social security contributions	E-SSC	*E-SSC = Costs of employees $_{ORBIS}$ * %E-SSC $_{DB\_National\%}$*
Taxation	O-TAX	*O-TAX = Taxation $_{ORBIS}$*
Employees	SV-E	SV-E = *Costs of employees $_{ORBIS}$* * (1 - %E-SSC $_{\text{DB\_National\%}}$ - %O-SSC$_{\text{DB_National\%}}$)
Shareholders	SV-Sh	SV-Sh = P/L after $\text{tax}_{\text{ORBIS}}$
Financial entities	SV-FE	SV-FE = ∑ ASS (Financial $\text{expenses}_{\text{ORBIS}}$; Financial $\text{revenue}_{\text{ORBIS}}$)
Organisation	SV-O	SV-O = Depreciation & $\text{Amortization}_{\text{ORBIS}}$
Total SV:	SV-T	**SV-T = ∑ (SV-C; SV-S; SV-E, SV-PA, SV-Sh, SV-FE, SV-O)**

Note: The origin of the data is denoted as a subscript: "ORBIS" if it represents an accounting value from the ORBIS platform, and "DBNational%" if it is a percentage extrapolated from the specific national Doing Business report.

Source: Own elaboration based on Blazquez et al. (2020)

The *Table 5* presents a comprehensive breakdown of the proxies harnessed to provide an approximate assessment of SV-SIEA for each stakeholder. These proxies have been refined through practical application within diverse case studies spanning various countries, such as the Basque Network of STPs in Spain and the Linköping Science Park in Sweden (see *Chapter 4.1.2*). This empirical refinement has enabled the generalization of these proxies, making them adaptable to the specific contextual nuances of STPs across nations. The strategic choice to obtain standardised tax percentages from the World Bank Group's national Doing Business Report for distinct countries - specifically, Value Added Tax (VAT) and Social Security Contributions (SSC) - is instrumental in the calculation of SV-SIEA, particularly concerning employees, and to some extent, public administration (World Bank Group, 2020d, 2020e). The integration of these data along with the utilization of the ORBIS Platform for accounting data, enhances the methodology's versatility, rendering it applicable not only across a spectrum of European nations but also on a global scale. This strategic alignment provides standardised insights into the regulatory intricacies of 190 countries as well as the accounting intricacies of business entities in diverse geographical domains (World Bank Group, 2020d). Hence, the calculation methodology explicated in *Table 5* exhibits considerable potential for widespread implementation across all European STPs (see *Chapter 4.2*).

For specific stakeholders, namely customers, shareholders, and the organisation itself, SV-SIEA aligns directly with pertinent accounting metrics. For customers, SV-SIEA corresponds to sales figures (see $\text{Sales}_{\text{ORBIS}}$), while for shareholders, it is tethered to the net operating result (see $\text{P/L after tax}_{\text{ORBIS}}$). For the organisation itself, SV-SIEA embodies the value of depreciation (see $\text{Depreciation \& Amortization}_{\text{ORBIS}}$). This latter value represents the portion of SV-SIEA retained by the organisation, add to the cumulative SV-SIEA of other stakeholders to culminate in the comprehensive value generated and apportioned by the analysed entity.

Distinct calculations come into play when addressing the four remaining stakeholders - financial entities, suppliers, public administration, and employees -

necessitating the employment of proxies. Regarding SV-SIEA associated with financial entities, the aggregation of the organisation's financial revenue and expenses (see Financial revenue$_{ORBIS}$ and Financial expenses$_{ORBIS}$) as absolute values is undertaken due to their reciprocal contribution to the value received by financial institutions.

To approximate the value attributed to suppliers, a proxy rooted in the research of Retolaza et al. (2016a) has been formulated. This proxy posits that the value associated with suppliers is estimated at 43% of the difference between the organisation's value added (see Value Added$_{ORBIS}$) and its corresponding sales (see Sales$_{ORBIS}$). This proxy adoption is substantiated by the absence of accessible data for reconstructing the organisation's generated value added and accounting specifics related to supply costs, as expounded in the preceding subsection.

Concerning the SV-SIEA allocated to the public administration, it encompasses a multifaceted composition, incorporating various components. These components include the organisation's own value-added tax (O-VAT), the value-added tax imposed on suppliers (S-VAT), the social contributions paid by the organisation (O-SSC), the social contributions paid by employees (E-SSC), as well as the taxes remitted by the organisation (O-TAX). The cumulative SV-SIEA attributed to the public administration is calculated as the summation of the first four components, with the potential addition of a fifth component in cases characterized by positive values. This proxy framework assumes a context of timeless analysis; for scenarios involving longitudinal analysis, provisions must be made to accommodate negative tax values.

It is important to note that for taxes paid, the point of reference is the value reported in the organisation's official records (as indicated in Taxation$_{ORBIS}$). For social security contributions, both those covered by the organisation (O-SSC) and those assumed by employees (E-SSC), the specific percentage applicable to the country is basically applied. The computation of value-added tax paid entails the direct application of the national tax rate (as specified in $VAT_{DB\_National\%}$) to the organisation's declared value added (as indicated in Value $Added_{ORBIS}$). The proxy-driven estimation technique draws on the methodology proposed by Retolaza et al. (2015), assuming the calculation of value-added tax through the SV-SIEA allocated to suppliers (SV-S). This calculation is based on the national tax rate ($VAT_{DB\_National\%}$) and is accounted for at a rate of 100% (as depicted in *Table 5*).

Finally, the calculation of SV-SIEA of employees is derived by subtracting both the social security contributions paid by the employer (O-SSC) and those paid by the employees themselves (E-SSC) from the reported wage bill (see Costs of $employees_{ORBIS}$), with these contributions constituting integral parts of the public administration's SV-SIEA. The precise formula for this direct calculation is provided in the accompanying *Table 5*.

In conclusion, this procedural framework effectively calculates the SV-SIEA generated by individual organisations and delineates its distribution among stakeholders. Furthermore, this methodology strikes an optimal balance between approximating SV-SIEA using available secondary data and facilitating the management of substantial data volumes. The technical implementation leverages spreadsheets (e.g., Microsoft Excel Software), affording control over analysis parameters for accuracy and streamlined data handling. Notably, as demonstrated in application cases (see *Chapter 4.2.1*), this methodology has successfully facilitated the concurrent analysis of several hundred organisations within STPs, along with territorial analyses encompassing thousands of entities as presented in the following section.

4.1.2 Social Value Analysis in STPs: A Seminal Application

In this section, the focus is on a seminal experiment aimed at implementing the adapted methodology at a real scale in the field. This experiment constitutes an integral part of the fifth step within the STP-context model adaptation procedure, as outlined in the methodology (see *Chapter 3.2*). Following the development of the SV analysis procedure for STPs and obtaining approval from development partners – namely, GEAccounting and the Basque Network of STPs (Spain) – the subsequent step was executed as per the delineated methodology. To conduct a comprehensive test of the model's efficacy, the Linköping Science Park (Sweden) was engaged. The application of the four-step process detailed in the previous section – encompassing primary data collection and the application of calculations to derive the Social Impact from Economic Activity (SIEA) across key stakeholders (i.e., employees, suppliers, customers, shareholders, financial entities, and public administration) – was carried out. This rigorous testing also included adapting the model to a distinct national context in Europe, specifically Sweden.

Within the framework of this experiment, an additional analysis was performed within the territorial context. A secondary version of the model was developed to calculate the SV generated and distributed by companies situated within the territory where the STP is located. To achieve this, a three-step procedure relying entirely on secondary data was devised. The primary objectives of this supplementary analysis were twofold: firstly, to ascertain the model's functionality on a larger scale, considering the extensive analysis involving thousands of organisations; secondly, to establish an initial benchmark for comparing the estimated value generated by the STP with the value attributed to the territory in which it operates. It is important to recognize the limitations of this approach, particularly the challenges in proportionately attributing employees active within the territory versus those located in other branches. The proportional allocation procedure utilized in the STP analysis could not be applied due to the chosen methodological framework (which relies entirely on secondary data and utilises the same databases as the STP procedure). As a result, precise data regarding the distribution of personnel across various locations within the analysed organisation are unavailable, and the reconstructed value essentially represents that of the entire organisation registered in the territory. This limitation in analytical precision must be considered when interpreting the analysis results. However, despite this constraint and full awareness of it, a preliminary comparative indicator was employed. This indicator involved assessing the per-capita SV generated by both the STP and the territory.

Consequently, subsequent sections proceed with presenting the adapted model for territorial analysis. This is followed by the presentation of the application to four comprehensive cases – specifically, the three parks within the Basque Network of STPs and the Linköping Science Park – for both the STP and territory procedures. The section culminates in showcasing the results obtained from this experimental approach.

4.1.2.1 Social Value analysis adapted for territorial context

In contrast to the adaptation customized for STP contexts, the approach employed for territory analysis is specifically tailored to the utilization of secondary data. This method unfolds in a sequential manner, consisting of three key steps:

1. **Preliminary Company Selection and Data Extraction from the ORBIS Platform:** In this initial step, companies are selected, and pertinent data is extracted from the ORBIS Platform.
2. **Secondary Filtering of Company Population Data:** Following the preliminary selection, a secondary filtering process is applied to the population data of these companies.
3. C**alculation of the Social Impact of Economic Activity (SIEA):** The third step involves the computation of the Social Impact of Economic Activity (SIEA).

While steps 1 and 2 may exhibit some deviations from the STP procedure, step 3 closely aligns with step 4 in the STP methodology. Consequently, the calculation of SIEA employs the same dataset and methodology, facilitating the comparison of results. The following descriptions delineate these three steps, highlighting distinctions in comparison to the STP context.

Step 1: Preliminary selection of companies and data extraction from the ORBIS Platform

During this initial phase, data collection is carried out directly within the ORBIS platform. Utilizing its search and filtering functionalities, organisations situated within the specified reference territory are preliminarily screened for eligibility based on four specific criteria. These criteria are sequentially and hierarchically applied to refine the pool of eligible companies: 1) Company location, 2) Entity type, 3) Company activity status, and 4) Data availability.

In the first criterion, enterprises operating within the designated reference territory are identified using the ORBIS filter "*Location - NUTS classification*", which exclusively isolates organisations affiliated with the same geographical area as the STP. The NUT3 level of territorial delineation is employed as the selected degree of granularity.

The second criterion categorizes organisations based on their entity type. To align with the types of companies typically found in STPs, the ORBIS filter "*Activities and Industry - Entity type*" is employed, designating the categories "*Corporate and Foundation/Research institute".*

For the third criterion, the focus is on identifying active entities. The search filter "*Company – Status*" is employed, specifically targeting companies falling within the macro-category of "*Active companies".* This step mirrors the procedure followed in the STP context.

The fourth criterion employs the "*Financials - Available accounts*" filter to extract entities based on the most recent year in which they updated their financial records. In this case, precise date ranges are selected, allowing for a three-year window of potential update delays, akin to the approach employed for STPs. In the practical application of this seminal experiment done in 2020, dates subsequent to 2016 were considered.

Upon the establishment of these selection criteria, both accounting information for SV calculation and contextual information for data validation and plausibility are extracted, mirroring the approach utilized in the STP context. Subsequently, the initial database is prepared for the subsequent step of filtering.

Step 2: Secondary Filtering of Company Population Data

Following the preliminary selection in ORBIS, the second step replicates the approach used in the STP context by applying the last two filtering criteria: completeness of accounting data (as seen in STP context - Step 3 - Criterion 5) and data distortion (as seen in STP context - Step 3 - Criterion 6).

Concerning the completeness criterion, an assessment is made regarding the presence of information in the ORBIS field labelled “*Number of employees Last avail. Year”*. This evaluation serves to exclusively include companies providing data on the number of employees, starting from a minimum of one. This data is crucial for calculating the hypothetical Social Value - Social Impact of Economic Activity (SV-SIEA) per capita generated by the analysed territory. Importantly, this same information is accessible within the context of the STP analysis, enabling an initial comparative assessment.

By implementing these additional criteria, a refined database is obtained, poised for subsequent calculations to estimate the SV-SIEA attributed to the population of companies associated with the territory under examination.

Step 3: Calculation of Social Value

As introduced in this subsection, the calculation procedure aligns technically with Step 4 within the STP context (refer to STP context - Step 4). Notably, the primary distinction lies in the unfeasibility of proportionally reconstructing accounting data based on the workforce operating within the specific territory associated with the selected company. Particularly, given the substantial number of organisations under analysis and the lack of consistent access to such data across entities, achieving efficient and effective data reconstruction is unattainable. As demonstrated in the subsequent section, using the application cases of the Basque Network and the Linköping Science Park, the number of companies analysed within each territorial scope reaches into the thousands.

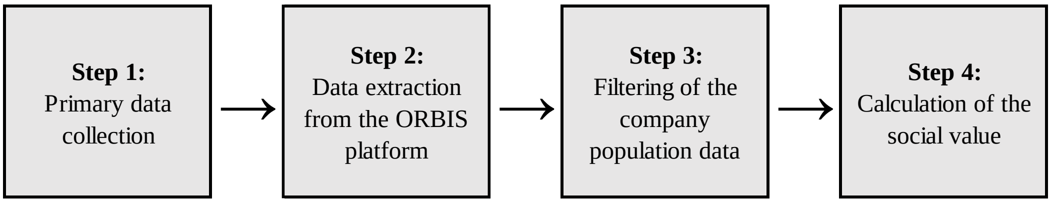
4.1.2.2 Case applications, results and preliminary insights

Following the methodological adaptation of the Polyhedral model for application in the STP context, along with the associated reference territories (as depicted in Figure 2), initial tests were conducted in collaboration with the Basque Network of STPs and the Linköping Science Park. In this seminal experiment, the methodology was applied to four STPs and their corresponding territories, uncovering critical aspects that should be considered when interpreting the initial findings for each park and its territory.

Figure 2: Social Value (SV) Monetisation Procedures in STP and Territorial Contexts

Figure 2: Social Value (SV) Monetisation Procedures in STP and Territorial Contexts

Procedure for STP Context

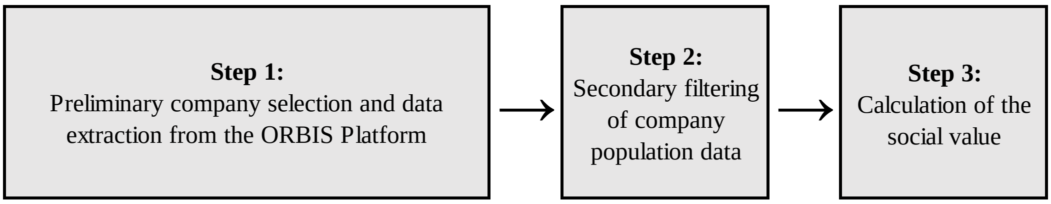


Notes:

- Step 1: Primary data collection
Data needed: 1) Name of each company at the STP, 2) European VAT identification number, 3) Number of employees at the company's workplace at the STP.

- Step 3: Filtering of company population data
Criteria: 1) State of company activities, 2) Data availability, 3) Obsolete data, 4) Availability of total of employees and nr. of workers at the STP, 5) Completeness of accounting data, 6) Data distortion.

Procedure for Territorial Context



Notes:

- Step 1: Preliminary company selection and data extraction from the ORBIS Platform
Criteria: 1) Company location, 2) Entity type, 3) Company activity status, and 4) Data availability

- Step 2: Secondary filtering of company population data
Criteria: 1) Completeness of accounting data, 2) Data distortion.

Source: Own elaboration based on Blazquez et al. (2020)

In consideration of privacy concerns and in alignment with agreements established with park management entities, individual organisational results remain undisclosed (as researchers are the upholders of this information). Therefore, only aggregated data pertaining to the park are presented. This same approach is consistently applied in managing data at the territorial level.

The following section presents the application of the methodology to the four cases, providing results and preliminary observations. It is essential to emphasise that this initial assessment primarily aims to validate the feasibility and practical applicability of the adapted methodology when working with secondary data.

In line with the previously outlined procedure, the initial phase involved primary data collection. For each STP, lists containing company names, VAT numbers, and the number of employees at the STP were obtained.

For these initial assessments, the reference year selected was 2018. This choice was primarily motivated by data accessibility considerations. Conducting data collection in spring 2020 made it likely that most companies had already closed, validated, and potentially published their financial statements for 2018. Consequently, each STP manager retrieved lists of companies established within the park as of December 31, 2018, from their respective facility databases. It is essential to note that the primary goal of these initial experiments was to provide a preliminary estimate of the SV generated by the STP, rather than a precise annual calculation for 2018. For precise annual calculations, as previously discussed, having a set of annual primary data illustrating the evolution of the STP business community and its workforce is essential. In contrast, for this specific case, as outlined in the methodology, the last available year of financial accounts was used (with a maximum extended period of 3 years). Within the population of companies analysed in the four cases, it was observed that the percentage of data updated to 2018 ranged from 89% to 100%. It is noteworthy that for a small portion of cases (less than 10%), potential deviations in values may occur due to information collected from different periods (e.g., ORBIS Platform's last available year) and various data collection systems (e.g., internal park questionnaires). However, this generally had no significant impact on the results.

Regarding the reconstruction of primary data, it was noted that associating names with VAT numbers presented minimal challenges. Conversely, associating the number of employees with a specific company proved more complex, mainly due to the need to cross-reference information from different databases. This process could result in the generation of incomplete initial lists, leading to a reduction in the population of analysable companies. As indicated in *Table 6* below, a loss of analysable entities, ranging from 1% to 8% compared to the total number of STP companies, was observed due to the absence of VAT number information. Furthermore, in terms of data related to the number of employees, a loss ranging from 7% to 33% was observed. This partly accounted for why, at the end of step 3 of the procedure, approximately 50% of the companies comprising the STP communities were utilised. As previously mentioned, this issue could be effectively managed through direct data collection.

As this was a first experiment to verify the applicability of the method and the accessibility of the necessary information, all the companies on the lists that had a VAT number were searched on the ORBIS platform and not only those with complete initial information. The objective was to assess the level of information availability within the platform, resulting in a positive outcome. In particular, the *Table 6* below labelled

"*ORBIS – VAT Number Found*" illustrates that more than 96% of the companies subjected to the search yielded a positive response.

Table 6: STP database creation - Identification of analysable organisations – Seminal Experiment - STPs

Table 6: STP database creation - Identification of analysable organisations - Seminal Experiment - STPs

	STP 1			**STP 2**			**STP 3**			**STP 4**		
Data source: Orbis Platform	**No. Firms**	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**
Organisations Names	266	*100%*		141	*100%*		144	*100%*		367	*100%*	
Organisations with VAT No.	245	*92%*		138	*98%*		143	*99%*		352	*96%*	
Organisations with No. Workers	191	*78%*	11'100	109	*79%*	5'092	97	*68%*	3'357	341	*92%*	6'304
ORBIS - VAT No. Searched	245	*100%*		138	*100%*		143	*100%*		352	*100%*	
ORBIS - VAT No. Found	234	*96%*		133	*96%*		141	*99%*		352	*100%*	
Active organisations	211	*86%*		125	*91%*		139	*97%*		339	*96%*	
Data availability	179	*73%*		100	*72%*		105	*73%*		336	*95%*	
Data up-to-date	173	*71%*		90	*65%*		100	*70%*		330	*94%*	
Orgs. with No. Workers	**138**	*56%*	**8'034**	**72**	*52%*	**2'672**	**63**	*44%*		**255**	*72%*	**6'078**
Complete accounting data	132	*54%*		69	*50%*		62	*43%*		108	*31%*	
Data without distortion	**124**	*51%*	**7'290**	**62**	*45%*	**2'608**	**53**	*37%*	**2'348**	**107**	*30%*	**3'084**

Source: Own elaboration based in Blazquez et al. (2020)

Following the extraction of data and information pertaining to companies identified by their VAT numbers from ORBIS, the completion of step 2 in the procedure marks the transition to step 3: the filtering of company population data. During this phase, companies are selected based on the six criteria detailed in the previous section:

1. State of company activity
2. Data availability
3. Currency of Dat
4. Presence of information on employees established in the STP Employee Information, which encompasses both the number of employees within the STP (provided by the STP manager) and the overall workforce count of the organization (derived from ORBIS)
5. Completeness of accounting data
6. Data distortion

Regarding the first criterion, it is noteworthy that between 86% and 96% of the entities satisfy the selection criteria, resulting in a relatively modest information loss, ranging from 2% to 10%. Some cases involve changes in company names within the park or the closure and opening of companies affiliated with the same corporate group.

Concerning the second criterion, which pertains to data availability, the extent of information loss varies from 1% in the most favourable scenario to 24% in the least favourable scenario. This loss is occasionally attributed to the prevalence of foundations, associations, and non-profit organisations, which, under specific conditions, are not obliged to disclose their financial accounts. Consequently, ORBIS lists the entity, but the financial account entries remain empty. Within the context of STPs, these entities are primarily engaged in research activities and frequently adopt the legal form of non-profit foundations.

In relation to the third criterion, which addresses data obsolescence, it is observed that only between 1% and 7% of organisations within the four STPs lack updated data, implying data postdating the year 2016. This indicates that having access to primary data on an annual basis enables the application of the same methodology for potential longitudinal studies, facilitating the analysis of trends over specific periods – monitoring aspect on the application of the model.

Conversely, under the fourth criterion, which concerns the presence of primary information on the company workforce within the STP, a substantial reduction in eligible entities for analysis is shown. Specifically, a percentage ranging from 13% in the most favourable case to 26% in the least favourable case of companies are excluded from analysis. It is worth noting that in one instance, numerous organisations were excluded because they reported zero employees. In another case, the STP featured a substantial presence of corporate groups, resulting in an aggregate figure being reported under the VAT number of the parent company. In such cases, a proxy measure was employed, considering the aggregate of the entire group (comprising all its constituent companies) and calculating the relevant proportion. Consequently, for some STPs, the final number of cases analysed exceeded the initially indicated number of companies. However, the results pertaining to the generated and distributed SV-SIEA remain appropriately proportional to the number of employees reported by the company groups. In anticipation of future applications of the methodology, these aspects can be effectively addressed through the completion and verification of the primary data list.

Considering the fifth and sixth criteria, it is observed that for the fifth criterion, which evaluates the completeness of accounting data, a loss of approximately 2% of companies is recorded. As for the sixth criterion, which assesses data distortion, the maximum loss is 6%. Notably, in a specific STP case, the criterion of completeness of accounting data results in a loss of analysable entities totalling 42%, primarily due to the absence of information on added value. However, there is no loss attributed to data distortion.

Consequently, upon the conclusion of this procedure, four clean databases were generated for the calculation of the SV-SIEA, encompassing 346 organisations employing 15,330 individuals across the four STPs.

Table 7 presents the number of eligible organisations for each territory based on criteria from steps one and two. The initial criterion involves gathering all companies registered with the NUTS3 code corresponding to the analysed territory in ORBIS.

Table 7: STP database creation - Identification of analysable organisations - Seminal Experiment - Territories

Table 7: STP database creation - Identification of analysable organisations
Seminal Experiment - Territories

Data source: Orbis Platform	STP's Territory 1			STP's Territory 2		
	No. Firms	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**
ORBIS - Selection NUTS3	101’086	*100%*		66’183	*100%*	
Corp. And Found./Research institute	98’198	*97%*		64’929	*97%*	
Active organisations	67’677	*67%*		49’893	*75%*	
Data available and up-to-date > 2016	19’539	*19%*		12’854	*19%*	
Orgs. with No. Workers	**14’098**	*14%*	**395’682**	**10’167**	*15%*	**198’946**
Complete accounting data	13’696	*14%*	340’707	9’909	*15%*	197’647
Data without distortion	**13’157**	*13%*	**332’822**	**9’555**	*14%*	**192’145**

Data source: Orbis Platform	STP's Territory 3			STP's Territory 4		
	No. Firms	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**
ORBIS - Selection NUTS3	29’168	*100%*		77’397	*100%*	
Corp. And Found./Research institute	28’002	*96%*		75’762	*98%*	
Active organisations	20’931	*72%*		60’919	*79%*	
Data available and up-to-date > 2016	5’625	*19%*		52’189	*67%*	
Orgs. with No. Workers	**4’263**	*15%*	**74’455**	**14’058**	*18%*	**181’364**
Complete accounting data	4’137	*14%*	67’609	4’045	*5%*	93’224
Data without distortion	**3’952**	*14%*	**66’084**	**3’945**	*5%*	**92’785**

Source: Own elaboration based in Blazquez et al. (2020)

This initial selection creates a pool of companies from which eligible candidates for analysis are chosen. Subsequently, by considering the type of company, a modest reduction in the pool, ranging from 2% to 4%, is observed. The third criterion, focusing on active companies, further reduces the eligible organisations, ranging from 19% to 30%. Regarding data availability (the fourth criterion), two distinct trends emerge. In one case, there’s a relatively minor reduction in the pool, approximately 11%, indicating that 67% of organisations possess up-to-date data as of 2016. Conversely, in the other three cases, a contrary phenomenon is observed, with a reduction in the pool ranging from 48% to 56%. In these instances, only around 20% of registered companies in those territories have updated accounting data available in ORBIS.

Moving on to the selection criteria in step 2, the initial focus was on companies with available personnel-related information. One territory exhibited an exclusion rate of 49% of companies, while for the other cases, it was approximately 5%. In the territory with a significant reduction, there was an additional 13% reduction based on the completeness of data criterion. In the remaining three cases, the reduction was almost negligible. This experience highlights that, in some cases, the predominant selection of organisations occurs primarily based on data availability and completeness. In certain instances, few companies possess up-to-date information, but most of them contain key data for consideration in the analysis. Conversely, in other cases, numerous organisations have updated information, yet unfortunately, only a minority meet the completeness requirement for calculation application.

Lastly, concerning the last criterion, the exclusion of organisations is nearly insignificant. The companies selected for territory analysis range from 5% to 14% of the enterprises registered in the respective territory. When comparing the number of enterprises selected for the calculation of SV-SIEA with the number of enterprises with up-to-date data as of 2016 (i.e., operational entities), approximately 70% of the operational enterprise population is considered in the three cases without data distortion (due to incomplete data).

Through this selection procedure, four clean databases have been established for the territories in which calculations of the SV-SIEA will be conducted. This entails an analysis of 30,609 organisations employing a total of approximately 700,000 individuals.

After applying the calculation method outlined in *Chapter 4.1.1*, the results in *Table 8* illustrate the monetised SV-SIEA. These results are available for both the STPs and the reference territories in each of the four cases. In the upper section of the table, the initial value represents the monetisation of the generated SV-SIEA, measured in thousands of euros. Below, you will find data regarding the number of organisations included in the calculation and the corresponding number of employees. For STPs, this refers to actively engaged employees within the organisations located in the park, and the value is proportionate to their presence. In contrast, in the territorial analysis, employees encompass the entire organisation. These data are essential for calculating key parameters for comparison: SV-SIEA per capita per company and SV-SIEA per capita per employee.

In the lower section of the table, the distribution of the generated SV-SIEA is illustrated, both in thousands of euros and as a percentage, among the primary stakeholders (i.e., workers, suppliers, customers, shareholders, financial entities, and public administration), along with the portion retained within the company. It should be noted that the absolute values derived from this analysis pertain only to a subset of the companies within the STP. Notably, the value generated by non-profit research centres is excluded. Therefore, these results offer an initial perspective on the overall value generation and distribution within an STP, highlighting how it is allocated among the key stakeholders. The comprehensive value generated by the entire STP would surpass what is presented in *Table 8* if all organisations within the parks could be considered via secondary data sources.

Table 8: Creation and Distribution of Social Value by STPs and Reference Territory

Table 8: Creation and Distribution of Social Value by STPs and Reference Territory

Data source: Orbis Platform	Case 1		Case 2	
	STP	Territory	STP	Territory
Aggregated Social Value	€ 3’681’105	€ 164’106’613	€ 864’974	€ 69’276’203
Number of Organisazion	124	13’157	62	9’555
Number of Workers	7’290	332’822	2’608	192’145
Social Value per Organization	€ 505	€ 493	€ 332	€ 361
Social Value per Worker	€ 29’686	€ 12’473	€ 13’951	€ 7’250
Distribution in value:				
Customers	€ 1’971’357	€ 90’874’614	€ 452’054	€ 38’009’589
Suppliers	€ 523’075	€ 29’881’324	€ 110’631	€ 11’384’986
Workers	€ 230’007	€ 7’865’348	€ 77’851	€ 4’931’002
Public Administration	€ 568’292	€ 24’694’054	€ 145’506	€ 11’161’119
Company's Retained	€ 193’011	€ 3’216’773	€ 30’850	€ 1’503’036
Shareholders	€ 121’333	€ 3’670’360	€ 34’482	€ 1’443’125
Financial Entities	€ 74’031	€ 3’904’140	€ 13’599	€ 843’345
Distribution in percentages:				
Customers	54%	55%	52%	55%
Suppliers	14%	18%	13%	16%
Workers	6%	5%	9%	7%
Public Administration	15%	15%	17%	16%
Company's Retained	5%	2%	4%	2%
Shareholders	3%	2%	4%	2%
Financial Entities	2%	2%	2%	1%

Data source: Orbis Platform	Case 3		Case 4	
	STP	Territory	STP	Territory
Aggregated Social Value	€ 832’299	€ 27’435’002	€ 1’251’680	€ 40’849’401
Number of Companies	53	3’952	107	3’945
Number of Workers	2’348	66’084	3’084	92’785
Social Value per Organization	€ 354	€ 415	€ 406	€ 440
Social Value per Worker	€ 15’704	€ 6’942	€ 11’698	€ 10’355
Distribution in value:				
Customers	€ 442’708	€ 15’048’272	€ 632’739	€ 22’193’319
Suppliers	€ 127’446	€ 4’644’947	€ 136’661	€ 6’253’783
Workers	€ 61’863	€ 1’752’631	€ 133’085	€ 2’503’947
Public Administration	€ 147’449	€ 4’434’221	€ 248’632	€ 7’948’806
Company's Retained	€ 23’748	€ 602’210	€ 28’786	€ 686’779
Shareholders	€ 12’796	€ 503’330	€ 59’953	€ 1’044’418
Financial Entities	€ 16’289	€ 449’391	€ 11’824	€ 218’349
Distribution in percentages:				
Customers	53%	55%	51%	54%
Suppliers	15%	17%	11%	15%
Workers	7%	6%	11%	6%
Public Administration	18%	16%	20%	19%
Company's Retained	3%	2%	2%	2%
Shareholders	2%	2%	5%	3%
Financial Entities	2%	2%	1%	1%

Source: Own elaboration based in Blazquez et al. (2020)

In these four cases, STPs exhibit a range in the SV-SIEA, with values ranging from 800 million euros for small parks to over 1 and 3 million euros for large parks, as detailed in the *Table 8*. Caution is warranted when estimating the value generation per employee, which varies between 330 and 500 thousand euros, and the value generated per company, which varies between 7 and 29 million euros.

Comparatively, the values for the territories span from 350 to 490 thousand euros per employee and from 7 to 12 million euros per company. Notably, the value per company typically tends to be higher in STPs (SV-SIEA per Company). Simultaneously, it is important to highlight that the value per capita for STPs (SV-SIEA per Employee) aligns with the corresponding territory. These values, in the case of STPs, are based on a subset of their total community, as not all organisations were eligible for the calculation. In contrast, for territories, no adjustments were made based on the geographic distribution of employees. This underscores the importance of approaching the comparison and interpretation of these values with due diligence.

Emerges of particular interest in this experiment is the distribution of this value among various stakeholders. In the analysis, a common pattern emerges within STPs: they tend to redistribute more value to stakeholders like workers and shareholders. Additionally, STPs exhibit a higher retention of value within the company and proportionally distribute less value to suppliers and public administration. However, there is no clear trend concerning financial entities. These findings warrant further investigation. For the present discussion, delving deeper into the results is avoided, as they extend beyond the initial objectives.

In this seminal experiment, a focal point of research interest was the distribution of value among various stakeholders. Within this analysis, a consistent pattern emerges among STPs: a propensity to allocate more value to stakeholders like employees and shareholders. Furthermore, STPs tend to retain a higher proportion of value within the company, while proportionally distributing less to suppliers and public administration. Nevertheless, there is no clear discernible trend regarding financial entities. These preliminary observations prompted the development of an exploratory cluster analysis methodology, with the aim of investigating whether the distribution of SV-SIEA among stakeholders could serve as a suitable framework for defining a useful taxonomy of companies (see the methodological approach in *Chapter 3.4* and the results in *Chapter 4.3.1*).

By meticulously implementing this methodology and adhering to the prescribed procedure, comprehensive databases were generated for each STP and its respective territory. In this seminal experiment, these databases serve as valuable resources for various analyses, encompassing factors such as SV-SIEA generation and distribution based on company size, structure, maturity, and more. These aspects warrant further exploration in future research to identify potential analyses that can be conducted with the collected data. In fact, park managers were able to recognize their own park from the presented data, and by comparing the obtained values with the number of organisations analysed, they found the results plausible. They possess a deep understanding of their community of organisations, and simply by examining the number of organisations analysed and the count of employees they employ within the park, they can confidently assess the accuracy of the reconstruction. This pioneering experiment underscores the methodology’s adaptability for precise quantitative analysis.

The ORBIS Platform emerged as a valuable data source for collection purposes and harbours strategic potential for expanding this study at a European level, as subsequently tested and reported in the next *Chapter (4.2)*. Furthermore, it allows for specialised analyses concerning the STP's community of companies, such as identifying their field of activity using Nomenclature of Economic Activities (NACE) codes. This additional information can be instrumental for subsequent analyses focusing on the creation and distribution of value within possible clusters of companies within the STP.

The composition of the STP's business community, encompassing various types of companies (e.g., start-ups, spin-offs without an established accounting history, foundations exempt from financial statement filings, large corporate groups employing diverse information presentation systems, etc.), can significantly impact the number of entities remaining after the selection process. An understanding of this composition is pivotal for the analysis and interpretation of the obtained values.

To bolster the accuracy of this analysis and curtail the exclusion rate of companies, enhancing the completeness of initial data is necessary. Additionally, exploring the feasibility of collecting primary data to complement accounting information can be advantageous.

Those tested adaptations of the Polyhedral model enable precise calculations, even when exclusively relying on available secondary data, as evidenced in the case of territorial analysis. It enables the concurrent analysis of multiple STPs without causing disruptions or interference with STP managers and companies.

The insights derived from this analysis empower STP management to make strategic decisions and offer support to key decisions with stakeholders, including public funding bodies and local and regional authorities. It undoubtedly contributes to the ongoing discourse on STP performance measurement, serving the interests of practitioners, policymakers, and local communities.

In conclusion, the monetised values can complement other indicators, yielding a comprehensive overview of an STP's overall performance and offering valuable insights for stakeholders actively engaged in the STP's activities, governance, and management.

4.1.2.3 Conclusion and discussion of the Seminal Experiment

Science and Technology Parks (STPs) were established at the European level with the primary objective of contributing positively to regional economic development, primarily at the regional level (Aguado, 2007). Consequently, many regional governments worldwide, particularly within the European Union and the United Kingdom, invested in creating these technological infrastructures, often establishing them as non-profit foundations. STPs have played a significant role in incubating emerging economic sectors and fostering the growth of new jobs and companies. Traditionally, the number of jobs created and the emergence of new companies served as fundamental indicators for gauging the success of STPs (Lecluyse et al., 2019).

In this initial research phase, a novel methodology for calculating SV-SIEA is introduced, which presents innovations compared to original approach, namely the Polyhedral Model (Retolaza et al., 2016). Instead of relying on primary data obtained through interviews or consultations with stakeholders, the proposal suggests utilizing secondary data to quantify the SV generated by an organisation (GEAccounting, 2022). Specifically, primary data, such as company name, VAT number, and the number of on-site employees provided by the park management body, is considered foundational for the new proposed tool. Although these data are categorised as primary due to indirect access (researchers collect this data through collaboration with STP managers), they offer crucial details necessary for retrieving the required secondary data from specific databases like the ORBIS Platform, facilitating the autonomous reconstruction of SV-SIEA. It is important to acknowledge that this approach yields an approximation of SV-SIEA. To encompass the other two dimensions (non-market and emotional value), the traditional Polyhedral model must be employed (GEAccounting, 2022).

Subsequently, policy makers and practitioners can employ these results to gain insights into the value generated by STPs and how it is distributed among stakeholders. This information may inform internal management decisions and be shared with external stakeholders (Parmar et al., 2022).

In the adapted models, encompassing both the STP context and an experimental territorial context, secondary information available in databases such as ORBIS and World Bank's reports such as Doing Business are utilised to calculate SV-SIEA generated by four European STPs and its distribution among stakeholders. These STPs include the three STPs within the Basque Network of STPs (Basque Country, Spain) and Linköping Science Park (Östergötland, Sweden), all of which are members of the IASP. Comparing SV-SIEA per employee and per company in each of these four cases, it is observed that SV-SIEA per company is notably higher within STPs compared to their respective territories, while the results for SV-SIEA per employee vary.

The calculation of SV-SIEA within the realm of STPs, along with its subsequent territorial comparison employing this novel methodology, constitutes a noteworthy contribution to the academic discourse focused on gauging the social impact of STPs (Fulgencio, 2017; Lecluyse et al., 2019). After this assessment, SV-SIEA per employee and per company within each of the four cases underwent dual comparisons: first, within each STP, and second, within each of the four reference territories. The outcomes elucidate a conspicuous discrepancy in the SV-SIEA per company between the STPs and their corresponding territories, with the former consistently demonstrating higher values. However, the results exhibit greater variability when scrutinising the value SV-SIEA per employee. In this context, the value surpasses the reference territory's value in only one of the four STPs.

Compared to the traditional methodology, which relies on compiling primary data, the use of secondary data allows for the measurement of SV-SIEA across a larger number of institutions with fewer initial resource requirements for data collection. Thus, SV-SIEA calculations in these four STPs are conducted using secondary data.

By pursuing this path, the objectives of this study have been successfully achieved. Firstly, a novel methodology for quantifying SV, predominantly reliant on secondary data, has been introduced. Secondly, this innovative methodology has been applied to four STPs, each comprising numerous corporations and institutions. Furthermore, the assessment of SV-SIEA extends not only to individual corporations and STPs but also encompasses subnational territorial entities, including the three provinces of the Basque Autonomous Community and one region in Sweden. This approach to calculating SV-SIEA for territorial entities or extensive corporate collectives, such as clusters, sectors, would have been nearly unattainable through conventional primary data-driven methods. Nevertheless, the utilization of secondary data empowers the measurement of SV across substantial corporate aggregates and even within broader geographical and political entities, such as countries or the European Union.

While this methodology offers numerous advantages, certain limitations must be acknowledged. One key limitation relates to data obsolescence within databases. However, by working with data spanning three years instead of a single accounting year, this issue is mitigated, ensuring reasonable results. In cases where secondary data is unavailable or of poor quality, the accuracy of SV-SIEA calculations would be compromised. Moreover, it is crucial to recognize that international databases, such as the ORBIS Platform, may be subject to the influence of national legislation and accounting standards, which can introduce complexities when making comparisons.

Nevertheless, databases originating from multinational institutions such as the Organisation for Economic Co-operation and Development (OECD), World Bank, International Monetary Fund (IMF), United Nations, and European Union present auspicious initial resources for employing this secondary data-driven methodology.

Future research endeavours may expand upon this methodology to encompass a broader regional scope, spanning the entire European Union and the United Kingdom. This expansion aims to scrutinize the generation and allocation of SV-SIEA by STPs at a European scale, offering insights into their performance concerning regional benchmarks. Additionally, a subsequent study may be conducted, focusing on the same STPs, or potentially a single STP, utilizing primary data directly collected from constituent companies. Such an inquiry would facilitate a comparative analysis between primary and secondary data utilisation, encompassing not only SV-SIEA estimation but also the calculation of the other two dimensions of SV analysis: non-market and emotional value. Despite these intriguing avenues for research, the current phase of further development, as outlined in the methodology (see Chapter 3.3), entails extending the study to a broader sample of STPs at the European level.

4.1.3 Discussion and overall conclusion

In line with the introductory remarks of this chapter and following the five-step research methodology, the initial phase of the study aimed to address the primary research question. The focus was on the development and validation of a methodology capable of accurately measuring the SV generated by STPs. This methodology predominantly relies on secondary data, providing a reliable and accessible resource for key users interested in evaluating the impact of these technological hubs.

As detailed in *Chapter 4.1*, the methodology was successfully developed and validated in collaboration with partners, namely the GEAccounting association and the Basque Network of STPs (Spain). Subsequently, a seminal experiment, as documented in *Chapter 4.1.1*, was conducted to assess its real-world applicability by comparing two national contexts with the involvement of Linköping Science Park (Sweden). During this phase, an adapted procedure for territorial analysis was also tested, as outlined in *Chapter 4.1.2.1*.

In the previous chapters, the development of both the procedure and the calculation of SV-SIEA was elaborated upon to yield the most accurate results possible within the constraints of a model primarily reliant on secondary data. Although there were challenges, itis important to note that experts in the field, including park managers, consider the reconstructed SV estimation believable. The methodology provides a relatively simple means of obtaining an initial overview of the SV generated and distributed by the community of organisations located within the STP. A balance between result accuracy and user-friendliness has been achieved, ensuring minimal disruption to the analysed organisations and expediting the application process. However, it is important to acknowledge that greater precision can only be attained through direct collaboration with the analysed organisations, obtaining information directly from them. An interesting aspect would have been to conduct a controlled experiment by analysing the same organisations with both the Polyhedral model and adapted methodology with primary data. Nonetheless, the opportunity for such an analysis has not yet arisen, as park managers are presently focused on presenting and discussing this methodology and its results with their stakeholders. For a control test, more demanding in terms of resources involving organisations for direct application of this model is let for future experimentation. Their current priority lies in implementing a systematic data collection system to facilitate regular periodic analyses, with the ambition of conducting annual assessments.

Regarding the constraints and challenges encountered during the tool's development, particularly in the context of sub-research questions, several issues emerged. Specifically, challenges were evident during the phase dedicated to understanding STP contexts, particularly concerning the collection of primary data. As previously discussed, this aspect had a slight influence on the research objectives, especially those related to testing the tool as a performance monitoring system. Furthermore, limitations arose when extracting data from the ORBIS platform. Overcoming these challenges required meticulous efforts to identify suitable data repositories and fields, primarily focusing on addressing issues related to data completeness for specific data fields.

In any case, concerning the accessibility of essential data required for performing the SV calculation, the effectiveness of the ORBIS platform has been confirmed. By identifying the correct data fields from which to extract information, favourable rates have been achieved in identifying suitable organisations for analysis. Simultaneously, adjustments have been made to the calculation process to accommodate the available data, and proxies have been introduced for the reconstruction of specific values. For instance, techniques have been developed for reconstructing “Added Value” information and calculating SV-SIEA for suppliers (see *Chapter 4.1.1*). When applying these identified adjustments to the analysed organisations, reliable results have been obtained. It is important to note that precision can only be attained through the utilisation of primary data. Nevertheless, the data obtained from the platform remains reliable, thus ensuring the reliability of the results derived from it.

Concerning the second aspect, which entails standardising the tool for both the utilisation of secondary data and adaptation to specific national contexts, substantial efforts have been dedicated to refining the procedure for calculating SV-SIEA. Initially, the calculations were adjusted to align with the type of accounting information that could be extracted from ORBIS. With the aid of specific proxies, values have been successfully reconstructed for both the six primary stakeholders and the retained within organisations. Consequently, the objective of creating a stakeholder-centric tool has been realised. In terms of standardisation, both a standardised procedure and calculation method have been developed, both of which possess the potential for adaptation to any country. As for data accessibility and collection, this aspect is contingent upon the performance of the ORBIS platform in each country, closely tied to local legislation governing the disclosure of economic and financial information by organisations. Regarding the calculation process, the tool has been structured to accommodate specific national taxation information, utilizing data from Doing Business Reports. This approach has been tested in a seminal experiment conducted in Spain and Sweden, yielding positive results and opening avenues for potential European-level testing, as detailed in *Chapter 4.2*.

In terms of the methodology's functionality as a monitoring system, it can be confidently stated that it serves this purpose effectively as originally envisioned. However, it is important to acknowledge that due to the challenges associated with obtaining primary data related to organisations and their employees within the park on an annual basis, as previously detailed, conducting observations over a specific, well-defined timeframe has proven to be a complex endeavour. Nevertheless, the methodology's applicability remains undisputed, representing a significant area for future research. Notably, an intriguing possibility lies in the potential for annual replication of this analysis to assess performance trends, mirroring the approach employed in stakeholder accounting using the polyhedral model. This information, when considered alongside an analysis of the STP's context and specific annual events, could serve as a valuable source of insights for managers as they engage in strategic and organisational reflections. Importantly, it is essential to clarify that this does not imply an obligatory annual application of the methodology by park managers to yield meaningful results; even a one-time application can offer valuable insights and an initial understanding of the park's SV performance.

Concerning the utilisation of non-specific data, it is recognised that this tool comes with inherent limitations. However, within the scope of this initial experimentation, it can be asserted that the ultimate objective of this analysis aligns with the means employed. The primary purpose of this methodology is to provide an initial estimation of the SV generated and distributed by organisations situated within the STP. Consequently, the pursuit of precise and specific values is not the primary aim; rather, the use of secondary data is considered suitable for achieving this particular objective. As previously mentioned, the results have been validated by park managers, signifying that while variations in data accuracy may exist, it remains well-suited for its intended purpose. It is essential to highlight that the methodology's design places a premium on user-friendliness and manageability for potential end-users, such as park managers or third-party entities like public bodies. In practical terms, the methodology operates efficiently without necessitating direct involvement from the individual organisations under analysis, relying instead on secondary data sources. The level of accuracy in the analyses is deemed satisfactory, particularly when considering the methodology's streamlined application process and the availability of easily accessible data for analysis.

Regarding the methodology's functionality and its effectiveness in the initial study phase, positive outcomes were observed during the seminal experiment. This encouraged the extension of its application to validate its utility and effectiveness more comprehensively. To achieve this validation, the scope was broadened by analysing a greater number of STPs. This expansion allowed for the verification of the methodology's adaptability to the national context, encompassing both calculation and data accessibility aspects, whether primary (sourced from park managers' lists) or secondary (available in the ORBIS Platform).

In terms of practitioner field interest, the methodology received approval, and discussions regarding utility and applicative effectiveness within the specific context of STPs and individual nations yielded favourable outcomes. It is noteworthy that the publication of results from the initial project phase has significantly facilitated the advancement of research efforts. This progress encompasses the broader application and validation of the methodology, as well as the compilation of data related to the analysis of SV generated by organisations located within STPs. This data has played a crucial role in establishing two databases utilised for exploratory statistical analyses (refer to *Chapters 3.4-3.5* for methodology and *Chapters 4.3.1 - 4.3.2* for results).

In summary, while essential elements have been gathered to provide a preliminary response to the research question, it was necessary to extend the study to solidify these components and formulate a conclusive response regarding the methodology's convenience for key potential users. Additionally, the aim was to ensure the methodology's reliability in terms of the quality of the analysis it offers.

In the context of this initial research phase, a significant contribution to both academic and practitioner understanding of the methodology's adaptability and versatility has been observed, thereby enhancing its practical utility. As highlighted by the scientific community in the field of SV analysis, it is necessary to promote the experimentation of this approach in various contexts and involving different types of organisations in order to gain knowledge and effectively enhance the model (Aguado et al., 2019, 2021; Retolaza et al., 2016). In this regard, a preliminary contribution is believed to have been made.

This contribution includes the development of a methodology primarily reliant on secondary data, which enables the simultaneous analysis of numerous organisations, as well as the creation of a tool adaptable to various national contexts. Throughout this process, the maintenance of stringent analytical quality standards has remained paramount. It is important to note that these aspects have been tested in two countries to date, with the expectation that broader application will yield more substantial evidence.

Within the scope of this applied experiment and the reconstruction of SV within the community of STP enterprises, additional evidence emerges: the methodology's relevance extends to various organisational archetypes. Specifically, in this initial experimentation, the reconstruction of SV-SIAE has been accomplished for approximately 350 organisations within STPs and about 30,000 organisations located in their respective territories. This involved engaging organisations with different structures and operating in various sectors. Analysing this aspect could be intriguing to validate the methodology's reliability in reconstructing value from secondary data based on the type of organisation (data accessibility in ORBIS) and value creation according to the sector of activity and corporate structure. These research avenues are being retained for future analysis.

Regarding future trajectories, this study unquestionably contributes by testing specific proxies for secondary data application, furthering the standardisation and systematisation of SV monetisation procedures by providing precise and contextualised evidence (Retolaza et al., 2016, 2022). This contribution aligns with the principles of the New Business Narrative, driving the advancement of methodologies and techniques for effectively quantifying value generation and distribution among diverse stakeholders of an organisation (Freeman, Retolaza et al., 2020; Hörisch et al., 2020). In this instance, managers of STPs are provided with a novel methodology for estimating and evaluating the value generated and distributed to stakeholders by economic activities. This equips them with new insights to share with their own stakeholders and may lead to a fresh perspective, prompting them to consider new factors in their strategic and operational decision-making (Cadorin et al., 2021; Freeman et al., 2021; Germain et al., 2022; Parmar et al., 2022).

In alignment with this perspective, the introduction of a novel application domain, namely STPs, into the realm of SV analysis contributes substantively to bridging an existing gap, as identified by Lecluyse et al. (2019), characterised by a scarcity of empirical evidence (cf. Fulgencio, 2017), and Torres-Pruñonosa et al., 2020).

Concretely, this study offers an experimental tool designed to gauge the societal impact of STPs by estimating the SV-SIEA for primary stakeholders within these organisations. This facet contributes significantly to both the assessment of STP performance (Albahari et al., 2013; Bigliardi et al., 2006; Gwebu et al., 2019), enriching it with a SV dimension, and the consideration of stakeholders in STP analysis, spanning ecosystem-wide and individual organisational levels (Germain et al., 2022; Nieth & Benneworth, 2020). Consequently, the application of this methodology not only produces valuable results but also stimulates the development of stakeholder engagement frameworks within STPs, as suggested by extant literature (Germain et al., 2022; Lecluyse et al., 2019). Simultaneously, the information generated by this methodology proves instrumental in policy impact assessments, notably regarding innovation and technology transfer policies, enabling the measurement of indirect effects by evaluating the SV-SIEA generated by the collective of resident organisations.

In conclusion, these aspects were addressed in the second phase of the study, in direct consultation with the key stakeholders, namely the STP managers, who are also potential users of the newly introduced methodology. Further details on this discussion can be found in the following chapter (refer to *Chapter 4.2*).

4.2 Widening the use of the Methodology: a European Level analysis

In this chapter, the focus shifts towards the results obtained during the second phase of the research, which involved the expansion of the study to a European level. As previously discussed, the adaptation, validation, and successful publication of the model for the SV analysis, specifically the SV-SIEA, within the context of STPs marked the achievement of the first phase. This success paved the way for the research to proceed, following the methodological steps outlined in this second phase. Specifically, as elaborated in the research methodology chapter (refer to *Chapter 3.3*), the research unfolds in a three-step procedure.

The first step involved the creation of a community of analysable STPs and the collection of primary data necessary for applying the model. The second step focused on tailoring the calculation procedure to the specific national context and subsequently applying the model to the pool of STPs. Finally, in the third and last step, the attention shifted towards the validation of the obtained results. As outlined in the methodology, the validation process unfolded in two stages: initial validation with each individual STP and subsequent analysis and discussion conducted within the group during a workshop.

Therefore, the objective in this phase was to confirm the validity and applicability of the methodology in the European STP landscape. By creating an initial community of fourteen STPs interested and eligible for experimentation, the model was tested in other four national contexts (i.e., Italy, Portugal, Denmark, and England), in addition to the two already tested in the first phase (i.e., Spain and Sweden). The number of STPs analysed varied for each country; there were six in Spain, three in Italy, two in Portugal, and one each in Sweden, Denmark, and England. This sample was assembled through voluntary participation call (refer to *Chapter 3.3*), constituting a convenience sample but deemed justified for the purposes of this research phase, aimed at extending the model's application.

For each of these STPs, the methodology outlined in chapter 3.3 was applied. It involved two key components: conducting an SV analysis using the model and reconstructing the STP's profile. This profile reconstruction was based on a validated questionnaire, and the process was overseen in collaboration with the STP managers. The primary research focus was centred on determining the model's applicability to each STP within the sample and assessing the reliability of the resulting outcomes. These specific activities have yielded the results outlined in the subsequent sections.

Upon completing the procedure, results of the SV-SIEA analysis, combined with an initial reconstruction of the STP's profile, were obtained for each of the fourteen STPs. To ensure a more accurate interpretation of the analysis outcomes, it is imperative to consider the profile and characteristics of each park, along with the contextual factors of the surrounding territory and institutional framework. Therefore, conducting in-depth case analyses for individual STPs emerges as the most suitable approach. It is important to note, however, that this objective falls beyond the scope of the present research but is strongly recommended for future developments. Currently, this possibility is being evaluated in collaboration with IASP and the respective STPs.

For the purposes of this research, profiling was employed to provide an initial contextualisation, understanding, and interpretation of the results of STPs. This process was substantiated by insights from the respective STP managers. Given the experimental nature of this research, there is significant room for further exploration. Caution must be exercised as these results represent a first-time occurrence, and therefore, the path to comparing the STPs performance without a thorough contextual analysis is not yet feasible nor sufficiently robust. What is plausible and followed, however, is the individual reflection that each STP manager can undertake with the results of the SV analysis. Within the scope of this research, a preliminary comparison among STP managers was conducted during the concluding workshop.

The data collected from this extension of the model's application to fourteen STPs have enabled the creation of databases, as outlined in the research methodology, to support the subsequent phase, namely, exploratory statistical analyses. In one instance, the results of the SV-SIEA analyses conducted on the 799 organisations affiliated with the fourteen STPs facilitated the development of cluster analysis on value distribution among stakeholders (refer to *Chapter 4.3.1*). Meanwhile, STP profiling, in conjunction with its SV analysis results, was instrumental in the statistical analysis pertaining to the multilevel model of performance, with a focus on one stakeholder: the employee (refer to *Chapter 4.3.2*).

By the end, it is essential to emphasise that the successful execution of this procedure and the subsequent presentation of the results were reliant on key collaborations established during this phase. These collaborations were established with the IASP and the University of Insubria (refer to *Chapter 3.3*). On one hand, they facilitated a comprehensive understanding of the European STP landscape, while on the other hand, they provided invaluable methodological support for this phase of the study.

Thanks to these collaborative efforts, several promising avenues for future research have emerged throughout the study. These include exploring the nuanced interpretation of specific data reconstructed through SV analysis and conducting a comprehensive analysis of how governance and management systems impact performance metrics, particularly in terms of SV creation and distribution. From a practical standpoint, with

IASP there is an ongoing evaluation of the potential development of a specialised service or even an automated tool. Such resources would empower other STPs interested in conducting similar analyses, either independently or with assisted guidance. While these discussions are ongoing, they underscore the positive implications of the work conducted.

In a broader context, this phase of the research has played a multifaceted role in its development. Beyond confirming the validity of the adapted model for STP analysis, it has introduced the concept of SV analysis into practical applications. Furthermore, it has raised awareness among key actors in the field of STP (i.e. STP managers and the IASP itself) and established a foundation for potential future research initiatives.

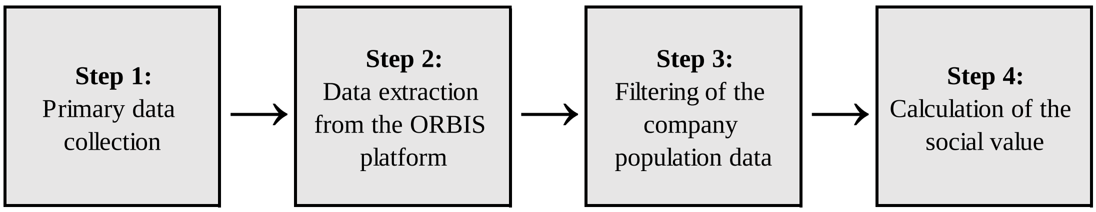
Adhering to the systematic approach of presenting research findings throughout different phases, the forthcoming sections provide an in-depth exposition and examination of the procedural steps implemented and the results attained during this phase. The chapter concludes with an extensive discussion of the findings resulting from this expansion of the study to the European context, followed by a conclusion and the identification of emerging research directions.

4.2.1 Implementation of the Methodology at the European level

As previously mentioned, in this project phase, the objective was to validate within the European context the methodology developed in the first phase. This validation involved an empirical application process, as detailed in methodological *Chapter 3.3*. Consistently, the complete four-step procedure was executed, as outlined in *Chapter 4.1.1*, and can be visualized in *Figure 3*.

Figure 3: Social Value (SV) Monetisation Procedure in the context of STPs - European Level

Figure 3 : Social Value (SV) Monetisation Procedure in the context of STPs - European Level



Notes:

- Step 1: Primary data collection
Data needed: 1) Name of each company at the STP, 2) European VAT identification number, 3) Number of employees at the company's workplace at the STP.

- Step 3: Filtering of company population data
Criteria: 1) State of company activities, 2) Data availability, 3) Obsolete data, 4) Availability of total of employees and nr. of workers at the STP, 5) Completeness of accounting data, 6) Data distortion.

Source: Own elaboration based on Blazquez et al. (2020)

Therefore, the process commenced following the procedure, with the initial step focused on collecting primary data. During this phase, it is important to clarify that the project began from scratch, separate and independently from the experimentation conducted in 2020. Consequently, the data from the seminal experiment conducted in 2020 were not utilized in this second phase, which aimed to validate the model. However, an open call was extended to all STPs affiliated with the IASP European division, providing an opportunity for all eligible STPs, including those from the initial study, to participate in this new experiment. Notably, as detailed below (see *Table 9*)[6], the selected STPs for analysis encompassed two from the initial study: Linköping Science Park in Sweden and the Parque Científico y Tecnológico de Bizkaia, a member of the Basque Network of STPs in Spain. Therefore, like all other candidates, they were required to submit their lists of primary data to the designated intermediary to gain access to the study. As per the methodology, during this phase, the IASP, represented by Laura Monasterio, IASP Knowledge & Project Manager, acted as the primary intermediary with potential candidates both before and after the selection process with participating STPs.

Table 9: European STPs - Selection of Eligible STPs

Table 9: European STPs - Selection of Eligible STPs

STP Name	Country
UC3M Science Park - LEGANÉS TECNOLÓGICO	Spain
Parque Científico y Tecnológico de Tenerife	Spain
Parque Científico y Tecnológico de Bizkaia	Spain
Parque Científico Tecnológico de Gijón	Spain
Parque Tecnolóxico de Galicia	Spain
Ciudad Politécnica de la Innovación (Valencia)	Spain
OpenZone	Italy
ComoNExT	Italy
KilometroRosso	Italy
Madan Parque de Ciencia	Portugal
TECMAIA Perque de Ciencia e Tecnologia de Maia	Portugal
Linköping Science Park	Sweden
NOVI	Denmark
University of Warwick Science Park	United Kingdom

Source: Own elaboration.

[6] STPs listed randomly and grouped by country of origin.

As outlined in the methodology, all expressions of interest and formal applications were submitted directly to IASP in the spring of 2021. IASP, which subsequently shared this information with the research team. The call for participation yielded a reasonable response, resulting in 14 eligible candidates for analysis from a total of 86 STPs affiliated to the European division of IASP. Notably, some STPs expressed interest without submitting formal applications but requested to stay informed about the research's progress (known to IASP). Three additional formal applications from STPs in United Kingdom, Italy, and Spain were received but not accepted due to incomplete primary data (known to the researchers), particularly the absence of information concerning the number of employees within the companies located in the park premises.

Several parks took the initiative to collect and complement this missing information after their initial application, and as a result, they were admitted to the study. For instance, Ciudad Politécnica de la Innovación (Valencia, Spain) and ComoNExT (Lomazzo, Italy) fall into this category. Their proactive efforts were highly appreciated, underscoring the genuine interest of the actors involved.

These highlighted aspects reaffirm the challenges associated with obtaining such primary data, as initially recognised during the development of the adapted methodology and in the implementation of the seminal experiment. Consequently, in this extended experiment as well, the possibility of testing the methodology as a monitoring system was limited. Also in this testing, the estimation of SV-SIEA relies on accounting data from a specific period.

At the conclusion of the selection process for the initial community of STPs for experimentation, which was finalised upon receipt of all primary information lists, the last submissions were received in January 2022. This procedure, characterized by its timeconsuming nature, ultimately yielded a pool of 14 analysable STPs. Indeed, given the method of group formation, this collective displayed considerable heterogeneity, as illustrated in the table provided below (*Table 10*). Having such a diverse sample offers several advantages. This diversity allows testing the methodology on a wide range of STPs, including those with significant differences in historical background, governance structure, and size (see *Table 10*)[7]. Additionally, it highlights the interest of various types of parks in exploring this analytical approach to assess the SV impact of their activities.

Notably, as explained earlier, the diversity among STPs and their respective contexts makes it challenging to establish direct and straightforward comparability based solely on the results of the analyses. However, park managers, with their in-depth knowledge of the European park ecosystem and the individual STPs involved, may indeed find value in making such comparisons.

[7] In the following series of 4 tables (*Tables 10 - 13*) profiling the STPs in the sample, a concise summary of the information provided in the specific questionnaire employed during this project phase is presented. The original questionnaires, complemented and validated during bilateral meetings for result presentations, are held by the researchers, while the questionnaire used can be found in Annex 1 for reference.

Table 10: STP Community Overview[8]

Table 10: STP Community Overview

STP Name	Establishment Year	Governance Type	Size - Nr.of Tenants
UC3M - LEGANÉS (ES)	2000	Public	Medium-Large
PCyT de Tenerife (ES)	2006	Public	Small
PCyT de Bizkaia (ES)	1985	Public	Large
PCyT de Gijón (ES)	2000	Public	Medium-Large
PT de Galicia (ES)	1992	Mixed	Medium
CPI - UPV (ES)	2002	Public	Small
OpenZone (IT)	2001	Private	Small
ComoNExT (IT)	2010	Mixed	Medium
KilometroRosso (IT)	2004	Private	Medium
Madan (PT)	2000	Mixed	Medium
TECMAIA (PT)	1999	Mixed	Small
Linköping SP (SE)	1984	Public	Very Large
NOVI (DK)	1988	Private	Large
UWSP (UK	1984	Private	Medium-Large

Source: Own elaboration based on data obtained from questionnaires and interviews.

As previously discussed in *Chapter 2.2.1* and as supported by the existing literature, STPs can exhibit a wide range of distinct characteristics (Meseguer-Martinez et al., 2020). In the research sample, this diversity becomes observable, as highlighted in the *Table 10*. The STPs in the study encompass a spectrum of historical backgrounds, ranging from those established in the 1980s to much newer ones with just over a decade of operational history. Moreover, the sample reflects the three primary governance typologies (Lund et al., 2020), comprising six public, four private, and four mixed-ownership STPs. Additionally, variations in size are observed, covering five categories based on the number of organisations typically situated within the STP[9]: four STPs categorised as

[8] National Abbreviations: Spain (ES), Italy (IT), Portugal (PT), Sweden (SE), Denmark (DK), United Kingdom (UK)
[9] The categorization was adapted from scales used by IASP in their data collection efforts among their associates. (IASP - International Association of Science Parks and Areas of Innovation, 2018)

small (with fewer than 50 organisations), four classified as medium-sized (ranging from 50 to 100), three as medium-large (spanning from 101 to 200), two as large (encompassing 201 to 400), and one as very large (comprising over 401 organisations).

In terms of management, significant variation exists among the STPs. Some parks operate with a relatively small management team, while others employ as many as 25 individuals (Full Time Equivalent), as indicated in Table XY below. It is crucial to contextualise this data by taking into account the size of the STP, specifically the number of hosted organisations, and the scope and quality of services offered, as discussed in *Chapter 2.2.2*. (Albahari et al., 2018; Gower et al., 1996). Furthermore, it is worth noting that a common trend across all the parks is their engagement with STP ownership (Cadorin et al., 2021; Chou, 2007; Liberati et al., 2016). More than a third of the STPs actively involve owners in STP management, while another third maintains passive involvement, typically at the board of director's level. Regarding the community of resident organisations (Mora-Valentín et al., 2018), only five parks have an association that links these entities, and active participation in management activities is a rarity, observed in just one park.

In general, and as reflected in the questionnaire responses, it is observed that all STPs conduct regular meetings with their resident organisations. While some adhere to a structured and frequent meeting schedule, others organise meetings as per specific requirements. This pattern also extends to those entities identified as the primary stakeholders of the park. Within this category, certain STPs even involve these stakeholders directly in active STP management and, consequently, in decision-making processes. Notably, university partners often play a pivotal role among these stakeholders (Polat, 2022; Urbinati et al., 2020) (Kosmol & Kotra, 2013).

Table 11: STP Community - Management Staff, Ownership Participation, and Business Associations

Table 11: STP Community - Management Staff, Ownership Participation, and Business Associations

STP Name	STP Management Staff (FTE)	Owners involved in STP Management	STP Business Association
UC3M - LEGANÉS (ES)	18	Active	Yes
PCyT de Tenerife (ES)	17	Active	Yes
PCyT de Bizkaia (ES)	19	Active	No
PCyT de Gijón (ES)	22	Active	Yes
PT de Galicia (ES)	12	Active	No
CPI - UPV (ES)	10	Passive	No
OpenZone (IT)	20	Passive	No
ComoNExT (IT)	27	Passive	Yes
KilometroRosso (IT)	13	Active	No
Madan (PT)	4	Passive	No
TECMAIA (PT)	6	Active	No
Linköping SP (SE)	11	Active	No
NOVI (DK)	18	Active	Yes
UWSP (UK	25	Active	No

Source: Own elaboration based on data obtained from questionnaires and interviews.

In terms of the interactions with universities, as illustrated in *Table 11*, it becomes apparent that twelve STPs have established formalised and well-structured partnerships with universities located in their respective regions. In contrast, the remaining two STPs, although lacking a formalised arrangement, engage in collaborative efforts with universities on specific project-based initiatives. This highlights the pivotal role of universities within the context of STPs (Bigliardi et al., 2006; Cadorin et al., 2017, 2021; Löfsten et al., 2020; Theeranattapong et al., 2020).

In close alignment with the university engagement aspect, the provision of incubation and acceleration services for entrepreneurial activities stands as a pivotal developmental feature within STPs (Chan & Lau, 2005; Schmidt & Balestrin, 2015). Among the surveyed STPs, nine offer both incubation and acceleration services, two exclusively provide incubation support, one solely focuses on acceleration services, while two do not incorporate these services into their offerings. It is noteworthy that these services are frequently conducted in collaboration with universities, either within structured partnerships or as part of specific technology transfer projects (Phongthiya et al., 2022; Steruska et al., 2019; Theeranattapong et al., 2020).

Table 12: STP Community - Establishment Criteria, Incubation/Acceleration, and University Partnerships

Table 12: STP Community - Establishment Criteria, Incubation/Acceleration, and University Partnerships

STP Name	Establishment Criteria	Incubator / Accelerator Presence	Formalised University Partnership
UC3M - LEGANÉS (ES)	Yes	Both	Yes
PCyT de Tenerife (ES)	Yes	Incubator	Yes
PCyT de Bizkaia (ES)	No	Both	No
PCyT de Gijón (ES)	Yes	Both	Yes
PT de Galicia (ES)	Yes	Both	Yes
CPI - UPV (ES)	Yes	Both	Yes
OpenZone (IT)	Yes	Accelerator	Yes
ComoNExT (IT)	Yes	Both	Yes
KilometroRosso (IT)	Yes	-	Yes
Madan (PT)	Yes	Both	Yes
TECMAIA (PT)	Yes	-	Yes
Linköping SP (SE)	No	Both	No
NOVI (DK)	No	Incubator	Yes
UWSP (UK	Yes	Both	Yes

Source: Own elaboration based on data obtained from questionnaires and interviews.

Regarding business support (Meseguer-Martinez et al., 2020), it is noteworthy that all STPs in the sample have confirmed the provision of this service to the organisations they host. Furthermore, they actively engage in networking activities and event coordination, consistent with the literature’s emphasis on these practices as foundational for fostering both internal and external collaborations within the STP ecosystem, including research networks and institutions (Corrocher et al., 2019; Gwebu et al., 2019; Löfsten & Lindelöf, 2005). In the context of STPs, another essential feature is the provision of shared spaces (Chandra & Chao, 2016; Liberati et al., 2016). According to responses gathered in the questionnaire, all STPs, except one, affirmed their practice of making these spaces accessible to the organisations they host. These shared spaces encompass a diverse range, including meeting rooms, dining facilities, leisure amenities, and laboratories (Robinson & Stubberud, 2014). In some instances, specific areas are even accessible to the public or external organisations.

Instead, concerning the criteria governing the establishment of organisations within STPs, as indicated in *Table 12*, eleven of these parks require adherence to specific placement criteria. Typically, entrepreneurial entities seeking residency within these STPs are required to submit applications and undergo a selection process. These criteria often revolve around the innovative and research activities of the organisation or may be aligned with the STP's specific focus and mission, where applicable. Depending on the type and stage of development of the entrepreneurial activity or concept, these criteria can also be associated with the presence of incubators and/or accelerators within the park. These factors subsequently shape the composition of the organisational population that constitutes the STP community. As depicted in *Table 13*, the business community's composition within the sampled STPs exhibits substantial diversity, characterised by variations in the proportions among the four specified categories: startups, small and medium-sized enterprises (SMEs), large enterprises (LEs), and research and development (R&D) centres. Understanding this population structure is crucial for interpreting the filtering process outcomes (step 3 of the adapted methodology's procedure) and, subsequently, the final analysis results.

Table 13: STP Community - Organisation Community Structure

Table 13: STP Community - Organisation Community Structure

STP Name	Start-ups	SMEs	LEs	R&D Centres
UC3M - LEGANÉS (ES)	34%	63%	2%	1%
PCyT de Tenerife (ES)	39%	53%	-	8%
PCyT de Bizkaia (ES)	42%	43%	14%	1%
PCyT de Gijón (ES)	34%	60%	4%	2%
PT de Galicia (ES)	5%	89%	1%	5%
CPI - UPV (ES)	38%	16%	1%	45%
OpenZone (IT)	14%	72%	9%	6%
ComoNExT (IT)	30%	70%	-	-
KilometroRosso (IT)	5%	45%	25%	25%
Madan (PT)	75%	10%	-	15%
TECMAIA (PT)	1%	69%	30%	-
Linköping SP (SE)	16%	82%	2%	-
NOVI (DK)	56%	45%	-	1%
UWSP (UK	25%	73%	1%	1%

Source: Own elaboration based on data obtained from questionnaires and interviews.

In this sample, significant heterogeneity is observed within the organisational community's structure. Various STPs are oriented towards hosting R&D centres, encompassing both public and private entities. Conversely, other STPs focus primarily on startups and new entrepreneurial ventures, while some prioritise SMEs. To correctly interpret these data, it is essential to examine each case individually and cross-reference them with the previously presented STP's information, as they are all closely interconnected. Understanding the STP's profile becomes pivotal in comprehending the results of the adapted methodology for STPs.

It is justified to claim that, with this self-volunteering pool of STPs, a comprehensive overview of various park types is gained, featuring interesting combinations for analysis. Undoubtedly, this aspect will be noteworthy for future research endeavours. For this current study, it was functional to possess, at the very least, a general understanding of the analysed sample to avoid premature conclusions. For the readers of this doctoral dissertation, this overview provides an essential foundation for approaching and interpreting the results presented in the upcoming sub-chapter with a more informed perspective.

Continuing the procedure, following the collection of primary data, the second step involved the extraction of organisational data from the ORBIS platform. This step was carried out for each individual STP, serving as the basis for calculating the SV-SIEA estimate. Subsequently, in the third step, the selection of organisations eligible for analysis was conducted, in accordance with the established procedure. This step applied six specific selection criteria:

1. Company Activity Status
2. Data Availability
3. Currency of Data
4. Employee Information, encompassing both the number of employees within the STP (provided by the STP manager) and the overall workforce count of the organisation (derived from ORBIS)
5. Data Integrity
6. Data Consistency

The following *Tables (14 and 15)* display the outcomes of the organisation selection procedure. In the upper section of each table, completeness characterizes the primary data provided by STP managers, encompassing details such as organisation names, VAT identification numbers, and the count of employees situated within the STP. Meanwhile, the lower section illustrates the selection process involving the application of criteria one through six, which subsequently led to a reduction in the sample size of analysable organisations.

Table 14: STP database creation - Identification of analysable organisations - Part I

Table 14: STP database creation - Identification of analysable organisations - Part I

Data source: Orbis Platform	**UC3M - LEGANÉS (Spain)**			**PCyT de Tenerife (Spain)**			**PCyT de Bizkaia (Spain)**		
	No. Firms	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**	**No. Firms**	*%*	**No. Workers**
Organisations Names	101	*100%*		29	*100%*		275	*100%*	
Organisations with VAT No.	101	*100%*		29	*100%*		264	*96%*	
Organisations with No. Workers	101	*100%*	3’232	27	*93%*	436	224	*80%*	11’994
ORBIS - VAT No. Searched	101	*100%*		29	*100%*		264	*100%*	
ORBIS - VAT No. Found	101	*100%*		29	*100%*		252	*95%*	
Active organisations	100	*99%*		28	*97%*		228	*86%*	
Data up-to-date	84	*83%*		20	*69%*		182	*69%*	
Orgs. with No. Workers	**75**	*74%*	**2’615**	**16**	*55%*	**142**	**168**	*64%*	**9’518**
Complete accounting data	73	*72%*		16	*55%*		161	*61%*	
Data without distortion	**65**	*64%*	**2’563**	**15**	*52%*	**138**	**154**	*58%*	**9’253**
	PCyT de Gijón (Spain)			**PT de Galicia (Spain)**			**CPI - UPV (Spain)**		
Organisations Names	165	*100%*		84	*100%*		37	*100%*	
Organisations with VAT No.	163	*101%*		84	*100%*		37	*100%*	
Organisations with No. Workers	143	*87%*	4’359	56	*67%*	1’207	33	*89%*	527
ORBIS - VAT No. Searched	163	*100%*		84	*100%*		37	*100%*	
ORBIS - VAT No. Found	142	*87%*		80	*95%*		37	*100%*	
Active organisations	141	*87%*		78	*93%*		37	*100%*	
Data up-to-date	118	*72%*		58	*69%*		24	*65%*	
Orgs. with No. Workers	**99**	*61%*	**3’587**	**49**	*58%*	**1’091**	**22**	*59%*	**516**
Complete accounting data	98	*60%*		48	*57%*		20	*54%*	
Data without distortion	**87**	*53%*	**3’549**	**45**	*54%*	**1’082**	**18**	*49%*	**493**
	OpenZone (Italy)			**ComoNExT (Italy)**			**Kilometro Rosso (Italy)**		
Organisations Names	32	*100%*		76	*100%*		64	*100%*	
Organisations with VAT No.	32	*100%*		70	*92%*		62	*97%*	
Organisations with No. Workers	32	*100%*	819	67	*88%*	596	64	*100%*	1’821
ORBIS - VAT No. Searched	32	*100%*		70	*100%*		62	*100%*	
ORBIS - VAT No. Found	31	*97%*		68	*97%*		46	*74%*	
Active organisations	30	*94%*		66	*94%*		44	*71%*	
Data up-to-date	29	*91%*		66	*94%*		43	*69%*	
Orgs. with No. Workers	**27**	*84%*	**766**	**55**	*79%*	**452**	**36**	*58%*	**1’524**
Complete accounting data	24	*75%*		52	*74%*		33	*53%*	
Data without distortion	**23**	*72%*	**731**	**52**	*74%*	**447**	**33**	*53%*	**1’520**

Source: Own elaboration.

Table 15: STP database creation - Identification of analysable organisations - Part II

Table 15: STP database creation - Identification of analysable organisations - Part II

Data source: Orbis Platform	Madan (Portugal) No. Firms	Madan (Portugal) %	Madan (Portugal) No. Workers	TECMAIA (Portugal) No. Firms	TECMAIA (Portugal) %	TECMAIA (Portugal) No. Workers	Linköping SP (Sweden) No. Firms	Linköping SP (Sweden) %	Linköping SP (Sweden) No. Workers
Organisations Names	58	*100%*		43	*100%*		366	*100%*	
Organisations with VAT No.	58	*100%*		43	*100%*		351	*104%*	
Organisations with No. Workers	58	*100%*	350	43	*100%*	2'054	340	*93%*	6'298
ORBIS - VAT No. Searched	58	*100%*		43	*100%*		351	*100%*	
ORBIS - VAT No. Found	58	*100%*		40	*93%*		351	*100%*	
Active organisations	58	*100%*		39	*91%*		311	*89%*	
Data up-to-date	56	*97%*		37	*86%*		307	*87%*	
Orgs. with No. Workers	**51**	*88%*	**252**	**36**	*84%*	**1'474**	**219**	*62%*	**5'795**
Complete accounting data	48	*83%*		36	*84%*		200	*57%*	
Data without distortion	**48**	*83%*	**246**	**36**	*84%*	**1'474**	**196**	*56%*	**4'108**

	NOVI (Denmark) No. Firms	NOVI (Denmark) %	NOVI (Denmark) No. Workers	UWSP (England) No. Firms	UWSP (England) %	UWSP (England) No. Workers
Organisations Names	137	*100%*		103	*100%*	
Organisations with VAT No.	133	*97%*		102	*99%*	
Organisations with No. Workers	116	*85%*	2'700	66	*64%*	1'130
ORBIS - VAT No. Searched	133	*100%*		102	*100%*	
ORBIS - VAT No. Found	129	*97%*		100	*98%*	
Active organisations	129	*97%*		96	*94%*	
Data up-to-date	121	*91%*		95	*93%*	
Orgs. with No. Workers	**101**	*76%*		**53**	*52%*	**609**
Complete accounting data	16	*12%*		12	*12%*	
Data without distortion	**15**	*11%*	**505**	**12**	*12%*	**408**

Source: Own elaboration.

It is noteworthy that, in most cases, more than 50% of analysable entities could be obtained from organisations extractable via the ORBIS platform using their VAT Numbers at the end of the selection process. This outcome represents a promising preliminary result for the study. However, variations were observed, with some countries, like Portugal, achieving the highest values in the sample, exceeding 80% of eligible organisations, while others, such as Denmark and England, recorded the lowest values, with less than 15% of companies deemed analysable. These discrepancies are primarily attributed to challenges related to data accessibility and collection, which are closely associated with the ORBIS platform's performance in each country and influenced by local regulations governing the disclosure of economic and financial information by organisations (refer to *Chapter 4.1.1*).

Some other significant factors have been identified during this selection process, exerting a notable influence on the determination of eligible organisations. The composition of the STP's organisational community, for instance, plays a pivotal role. In STPs characterized by a substantial presence of startups and R&D centres, a higher exclusion rate of organisations in the selection process may be observed. This phenomenon is primarily attributable to certain factors. For instance, newly established entrepreneurial ventures of a very recent nature may not have yet generated financial documentation, rendering it inaccessible via ORBIS Platform. Furthermore, in the case of R&D centres registered as foundations or associations in specific countries, they may be exempt from mandatory financial statement disclosures, thus curtailing the retrieval of such information from secondary sources.

Based on the outcomes observed in the implementation of step 3 at the European level, it can be concluded that the ORBIS platform is well-suited for utilisation within the developed methodology, despite certain encountered limitations. While its performance may vary among countries, the overall results prove satisfactory for this initial exploration. It is observed that across the six countries considered in this extended preliminary study, the adapted methodology can be effectively applied. This provides an opportunity for further exploration and research development in the near future, as discussed with the STP managers in the sample.

To proceed with the final step of the procedure, involving the calculation of the SV-SIEA generated and distributed to various stakeholders, two critical operations were executed, as per the outlined methodology. The first operation entailed the transformation of economic and financial data of organisations based on the proportion of personnel located within the STP. The second operation involved the adaptation of the calculation process for the six countries covered in the study: Denmark, England, Italy, Portugal, Spain, and Sweden, following specific tax information. These adaptations relied on data from the Doing Business Reports (World Bank Group, 2020c, 2020a, 2020d, 2020b, 2020e, 2020f), and the country-specific adjustments are detailed in *Annex 2*.

With these adjustments in place, precise calculations were executed to yield results for each STP, which are subsequently presented and discussed in the forthcoming subchapter.

4.2.2 Results of the analysis at the European level

In this subsection, the results concerning the SV-SIEA generated and distributed to the primary stakeholders are presented. These outcomes have been derived through the final step of the methodology designed for the analysis of SV in STPs, involving the application of the final calculation to determine the SV-SIEA. Consequently, in the following five Tables (see *Tables 16-20*)[10], distributed across separate pages, the results of the analyses conducted on the fourteen STPs involved in this study are displayed.

For this study, it is important to note that the analysis period selected encompasses the data from the years 2017 to 2019. This choice was made based on the methodology, which considers financial data within this timeframe as reliable (refer to *Chapter 4.1.1*). This decision was made to avoid any potential impact from the COVID-19 pandemic, which emerged in 2020.

The tables offer a concise overview of the results for all the analysed STPs. In the upper section of each table, information regarding the SV, as measured by SV-SIEA generated collectively by the analysed organisations within the park, is presented. This includes the number of these organisations and their respective employee count within the park. Subsequently, per-organisation and per-employee values are provided (which involve arithmetically dividing the total value by the number of organisations on one hand and by the number of employees on the other). As discussed in *Chapter 4.1.1*, these values could potentially serve as indicators in a hypothetical preliminary comparison between STPs, provided that contextual comparability is ensured.

[10] STPs listed randomly and grouped by country of origin.

While continuing to examine the table, the central section displays the distribution of this value among the key stakeholders, encompassing clients, suppliers, employees, public administration, shareholders, and financial institutions. Furthermore, it includes the portion of value retained within the organisation. This data is presented in both absolute Euro figures and as a percentage of distribution.

In the table's lower section, it can be seen information regarding the fiscal year of the data extracted from the ORBIS Platform, which was used for the analyses of individual organisation. Consequently, it is possible to observe the frequency with which the fiscal years 2019, 2018, and 2017 were respectively employed across all the organisations analysed in each park.

As outlined in the study's methodology (refer to *Chapter 3.3*), the data presented in this chapter have undergone validation through bilateral meetings with individual STP managers. In *Annex 3*, it is possible to consult the values approved by representatives of the STPs. Detailed data and analyses of individual organisations[11] are securely stored on researchers' servers to safeguard privacy.

[11] These specific values have not been exposed to the STP managers, to preserve the organisations.

Table 16: European STPs SV-SIEA Generation and Distribution - Part I

Table 16: European STPs SV-SIEA Generation and Distribution - Part I

Data source: Orbis Platform	**UC3M - LEGANÉS (Spain)**	**PCyT de Tenerife (Spain)**	**PCyT de Bizkaia (Spain)**
Aggregated Social Value	€ 706’573’154	€ 64’160’638	€ 4’359’249’743
Number of Organisations	65	15	154
Number of Workers	2’563	138	9’253
Social Value per Organisation	€ 10’870’356	€ 4’277’376	€ 28’306’817
Social Value per Worker	€ 275’682	€ 464’932	€ 471’117
Distribution in value:			
Customers	€ 363’736’738	€ 30’962’368	€ 2’328’254’980
Suppliers	€ 77’017’481	€ 3’873’666	€ 625’466’213
Workers	€ 49’278’582	€ 1’774’934	€ 227’394’313
Public Administration	€ 151’221’550	€ 8’701’625	€ 796’453’157
Company's Retained	€ 27’830’748	€ 1’225’924	€ 223’319’002
Shareholders	€ 30’482’220	€ 17’171’530	€ 79’699’581
Financial Entities	€ 7’005’836	€ 450’591	€ 78’662’497
Distribution in percentages:			
Customers	52%	48%	54%
Suppliers	11%	6%	14%
Workers	7%	3%	5%
Public Administration	21%	13%	18%
Company's Retained	4%	2%	5%
Shareholders	4%	27%	2%
Financial Entities	1%	1%	2%
Accounting data year:			
No. Org. data 2019	*57*	*14*	*140*
No. Org. data 2018	*7*	*1*	*9*
No. Org. data 2017	*1*		*5*

Source: Own elaboration based on data source ORBIS Platform and World Bank Group (2020d).

Table 17: European STPs SV-SIEA Generation and Distribution - Part II

Table 17: European STPs SV-SIEA Generation and Distribution - Part II			
Data source: Orbis Platform	**PCyT de Gijón (Spain)**	**PT de Galicia (Spain)**	**CPI - UPV (Spain)**
Aggregated Social Value	€ 2’422’686’869	€ 296’477’592	€ 121’782’509
Number of Organisations	87	45	18
Number of Workers	3’549	1’082	493
Social Value per Organization	€ 27’846’976	€ 6’588’391	€ 6’765’695
Social Value per Worker	€ 682’639	€ 274’009	€ 247’023
Distribution in value:			
Customers	€ 1’321’478’268	€ 163’315’024	€ 62’499’646
Suppliers	€ 423’127’379	€ 51’563’739	€ 12’687’039
Workers	€ 92’831’258	€ 14’520’684	€ 11’228’760
Public Administration	€ 395’644’476	€ 52’993’058	€ 27’552’927
Company's Retained	€ 73’739’934	€ 4’416’081	€ 4’022’430
Shareholders	€ 20’992’730	€ 5’929’336	€ 3’269’378
Financial Entities	€ 94’872’825	€ 3’739’669	€ 522’328
Distribution in percentages:			
Customers	55%	55%	51%
Suppliers	17%	17%	10%
Workers	4%	5%	9%
Public Administration	16%	18%	23%
Company's Retained	3%	2%	3%
Shareholders	1%	2%	3%
Financial Entities	4%	1%	1%
Accounting data year:			
No. Org. data 2019	*81*	*41*	*17*
No. Org. data 2018	*5*	*3*	*1*
No. Org. data 2017	*1*	*1*	

Source: Own elaboration based on data source ORBIS Platform and World Bank Group (2020d).

Table 18: European STPs SV-SIEA Generation and Distribution - Part III

Table 18: European STPs SV-SIEA Generation and Distribution - Part III

Data source: Orbis Platform	**OpenZone (Italy)**	**ComoNExT (Italy)**	**Kilometro Rosso (Italy)**
Aggregated Social Value	€ 323’326’408	€ 115’993’944	€ 770’354’735
Number of Organisations	23	52	33
Number of Workers	731	447	1’520
Social Value per Organization	€ 14’057’670	€ 2’230’653	€ 23’344’083
Social Value per Worker	€ 442’307	€ 259’494	€ 506’812
Distribution in value:			
Customers	€ 173’349’432	€ 62’558’719	€ 405’164’915
Suppliers	€ 46’751’311	€ 17’574’624	€ 100’526’661
Workers	€ 26’149’644	€ 11’088’947	€ 44’060’328
Public Administration	€ 65’515’979	€ 24’249’078	€ 136’925’727
Company's Retained	€ 7’689’868	€ 4’119’065	€ 31’437’906
Shareholders	€ 2’498’177	€ -4’232’465	€ 41’207’192
Financial Entities	€ 1’371’996	€ 635’977	€ 11’032’007
Distribution in percentages:			
Customers	54%	54%	53%
Suppliers	14%	15%	13%
Workers	8%	9%	6%
Public Administration	20%	21%	18%
Company's Retained	2%	4%	4%
Shareholders	1%	-4%	5%
Financial Entities	1%	1%	1%
Accounting data year:			
No. Org. data 2019	*23*	*52*	*33*
No. Org. data 2018			
No. Org. data 2017			

Source: Own elaboration based on data source ORBIS Platform and World Bank Group (2020b).

Table 19: European STPs SV-SIEA Generation and Distribution - Part IV

Table 19: European STPs SV-SIEA Generation and Distribution - Part IV

Data source: Orbis Platform	**Madan (Portugal)**	**TECMAIA (Portugal)**	**Linköping SP (Sweden)**
Aggregated Social Value	€ 28’996’036	€ 247’161’121	€ 1’844’164’627
Number of Organisations	48	36	196
Number of Workers	246	1’474	4’108
Social Value per Organization	€ 604’084	€ 6’865’587	€ 9’409’003
Social Value per Worker	€ 117’870	€ 167’681	€ 448’920
Distribution in value:			
Customers	€ 14’466’788	€ 120’225’140	€ 945’638’981
Suppliers	€ 2’474’892	€ 17’115’114	€ 258’114’020
Workers	€ 4’520’593	€ 43’960’746	€ 178’391’492
Public Administration	€ 6’130’621	€ 52’795’190	€ 354’060’753
Company's Retained	€ 361’914	€ 3’725’800	€ 58’086’239
Shareholders	€ 996’290	€ 8’003’299	€ -13’098’089
Financial Entities	€ 44’939	€ 1’335’831	€ 62’971’231
Distribution in percentages:			
Customers	50%	49%	51%
Suppliers	9%	7%	14%
Workers	16%	18%	10%
Public Administration	21%	21%	19%
Company's Retained	1%	1%	4%
Shareholders	3%	3%	-1%
Financial Entities	0%	1%	3%
Accounting data year:			
No. Org. data 2019	*46*	*35*	*196*
No. Org. data 2018	*2*	*1*	
No. Org. data 2017			

Source: Own elaboration based on data source ORBIS Platform and World Bank Group (2020c) (2020c).

Table 20: European STPs SV-SIEA Generation and Distribution - Part V

Table 20: European STPs SV-SIEA Generation and Distribution - Part V

Data source: Orbis Platform	**NOVI (Denmark)**	**UWSP (England)**
Aggregated Social Value	€ 396’634’326	€ 219’686’494
Number of Organisations	15	12
Number of Workers	505	408
Social Value per Organization	€ 26’442’288	€ 18’307’208
Social Value per Worker	€ 785’415	€ 538’447
Distribution in value:		
Customers	€ 191’915’393	€ 118’292’677
Suppliers	€ 31’721’217	€ 40’215’929
Workers	€ 47’193’944	€ 19’056’822
Public Administration	€ 56’869’590	€ 27’739’983
Company's Retained	€ 51’180’034	€ 7’143’879
Shareholders	€ 9’959’136	€ -6’364’959
Financial Entities	€ 7’795’010	€ 13’602’163
Distribution in percentages:		
Customers	48%	54%
Suppliers	8%	18%
Workers	12%	9%
Public Administration	14%	13%
Company's Retained	13%	3%
Shareholders	3%	-3%
Financial Entities	2%	6%
Accounting data year:		
No. Org. data 2019	*15*	*11*
No. Org. data 2018		*1*
No. Org. data 2017		

Source: Own elaboration based on data source ORBIS Platform and World Bank Group (2020f) (2020a).

As previously mentioned, these data were presented, discussed, and subsequently validated with the STP management. The managers, possessing an in-depth understanding of their respective STPs, the community of organisations within them, and the contextual factors, efficiently comprehended, interpreted, and validated the data. Indeed, their familiarity with the STP ecosystem facilitated their interpretation of the information provided through this methodology. With complete transparency, and as a confirmation of the earlier statement, one STP had to undergo a reanalysis process due to inaccuracies in a portion of the primary data provided at the onset of the study. During the validation meeting, the CEO noticed implausible data and expressed doubts. Real-time verification revealed that the error originated from the initial list, specifically in the count of employees within the companies situated in the STP. By supplying the corrected data, new results were promptly generated and validated on the same day. This validation process is consistent with the methodology detailed in *Chapter 3.3*, where managers had the opportunity to review the data before the meetings, allowing them to come prepared with any clarifications or specific requests for further information.

In this final scenario, some STPs requested specific analyses to gain a deeper understanding of their park's SV generation and distribution performance. They expressed a particular interest in acquiring more detailed insights into value generation by specific groups within their respective parks. These requests took two primary forms:

1. Isolating the value generated by organisations located in specific areas of the STP, such as within the park's incubator.
2. Isolating the value generated by specific groups of organisations, such as the category known as flagship companies within the STP.

These requests could be accommodated only for the STPs[12] that had supplied the essential key information in the primary dataset (such as the list of organisations within the incubator). It is worth noting that although these analyses were also initially conducted in an exploratory manner before the meetings to gain deeper insights into the results, they were shared exclusively with the STPs that had raised the respective themes during the meetings and explicitly requested these analyses.

Additionally, one STP sought detailed information on value generation for the public administration. This included both the absolute Euro value and the percentage of value contributed by each component to the total SV-SIEA for the public administration.

These requests highlight the interest in both the methodology and the resultant findings. They also highlight the considerable potential for conducting specific analyses on individual STPs. This potential is likely to be further explored after the conclusion of the current research project. The detailed analyses provided to park managers have added significant value in terms of information gathering, existing substantial room for further investigation. The database created through the methodology's application allows for numerous analyses, a potential that managers have duly recognised. This avenue of research offers an interesting opportunity to gain deeper insights into their community of organisations and its societal impact. Indeed, some managers have expressed a desire, during individual meetings, to continue these in-depth analyses of their respective parks. They plan to begin by expanding the initial primary dataset, with the goal of analysing

[12] Due to the highly sensitive nature of the analyses, they are not included in this doctoral thesis, as well as the reference to the STPs that make the specific request. However, they are securely held by the researchers involved in the study, along with all other study information and analyses.

the entire population of STP organisations and implementing an ongoing monitoring function, achievable through annual application of the methodology.

Certainly, these managers previously lacked access to such comprehensive information about their respective parks, making the acquisition of this data a noteworthy initial achievement. There is a clear enthusiasm among them to delve deeper into understanding the methodology and exploring its potential applications. Almost all of them expressed a desire to engage with other study participants, specifically to review their peers' results. Since all participants provided formal consent for sharing results within the research community, this request was honoured by organising the concluding workshop on March 13, 2023, as part of this research endeavour.

While some STPs were unable to attend the workshop, both absent and present participants received the materials presented and discussed during the event, along with its recording. It is noteworthy that there was limited discussion during the event, which is entirely understandable. The presence of IASP representatives and researchers during the workshop potentially influenced participation, particularly in terms of discussion engagement. However, this influence was minimal, as the prevailing atmosphere within the STP community emphasised complete transparency and the extensive sharing of information, grounded in collective intelligence. On this occasion, STP representatives primarily assumed observer roles, focusing on information acquisition. The moderator's prompts, though well-intentioned, did not significantly stimulate substantive debate or discussion. In contrast, individual meetings proved to be highly interactive and dynamic.

This is a novel and sensitive topic for them, and this initial step served as an introduction to the subject. Individuals must gain familiarity with the methodology before more in-depth discussions can take place, perhaps after they have had the opportunity to independently experiment with the methodology.

Concerning the utilization of this information, all STPs were granted permission to employ the results related to their respective parks, both for internal and external purposes. However, it was emphasised that this should always be done with the necessary precautions, methodological transparency, and rigor in presentation or dissemination. Indeed, during individual meetings, many of the STPs expressed their intent to share these results with their stakeholders. Their approach involved an initial internal sharing of the information within their management teams, followed by dissemination to their STP boards, and subsequently with institutional stakeholders. Finally, the results were extended to a broader external audience beyond the STP, addressing the relevant territory and reaching out to the community affected by the park's activities, which encompasses society at large (Lazcano et.al, 2020). In specific cases, some managers also expressed their desire to disseminate these results, providing comprehensive explanations of both the methodology employed and the resulting outcomes, to the community of organisations situated within the STP.

What captivated their interest universally was the concept of SV monetisation, as it introduces a common and easily comprehensible language for communication. This approach empowers them to engage more effectively and potentially negotiate with specific stakeholders in their managerial capacities. The importance of effectively communicating this sensitive and complex subject matter was emphasised with the managers (Harrison et al., 2020; Hörisch et al., 2020). The results of the SV analysis, quantified as SV-SIEA in Euros, require contextualisation for proper interpretation. It was reiterated on multiple occasions that merely publishing the data could lead to misleading interpretations. Therefore, it is of utmost importance to consistently provide context, both in terms of how the data was generated and what it implies.

In general, concerning the results, no evaluative judgments were made regarding the performance of STPs in terms of SV generation at any moment. However, a consistent request emerged during individual validation meetings: participants sought feedback on their own performance compared to other study participants. In fact, as expected, it appears that in this context (the analysis of SV and its impact on society), they are actively or indirectly seeking a benchmark, although it is still premature to develop this practice given the current limited evidence in the field.

The focus of this research phase was not primarily on making comparisons between STPs, but rather on assessing the methodology's applicability at the European level and its potential utility for end-users. These objectives have been successfully met.

Regarding the results of the analyses, after the selection process for analysable organisations, the SV-SIEA calculation was applied to a total of 799 organisations. These organisations are situated in fourteen different STPs across six distinct countries and collectively employ over 26,000 individuals within these parks.

Regarding the hypothetical indicators, the analysis of the sample reveals per-organisation values ranging from a minimum of approximately 600,000 euros to a maximum exceeding 28 million euros, with an average slightly above 13 million euros. In terms of per-employee values, they range from a minimum slightly above 100,000 euros to a maximum near 800,000 euros, with an average hovering slightly above 400,000 euros. These data are summarized and may appear somewhat "sterile" unless properly contextualised. As previously discussed, their true value emerges when interpreted effectively by individuals familiar with the underlying context.

In the context of distributing SV-SIEA among stakeholders, promising research avenues emerge. These preliminary findings affirm the development of an exploratory cluster analysis methodology, which seeks to explore the potential utility of SV-SIEA distribution among stakeholders in creating a meaningful taxonomy of organisations (see next *Chapter 4.3*).

Within this sample, the distribution to various stakeholders yields the following ranges: customers receiving between 48% and 55%, suppliers receiving between 6% and 18%, and workers' SV-SIEA ranging from 3% to 18%. It is noteworthy that, as outlined in the methodology (Blazquez et al., 2020), the value attributed to workers represents the net value, accounting for contributions and social charges, which are calculated and attributed to the public administration stakeholder. Consequently, the value generated and allocated to the public administration falls within the range of 13% to 23%. Concerning the value retained within companies, it spans from 2% to 4% of the total SV-SIEA generated. Shareholders receive SV-SIEA ranging from -4% to 27%, with an average of 3%. These values highlight the impact of the types of organisations present in the STP (new entrepreneurial ventures versus established companies). In cases where there is a significant concentration of start-ups, the value allocated to shareholders tends to be lower.

Lastly, when considering SV-SIEA generated for financial entities, a consistent distribution around 2% is observed, with occasional fluctuations. As previously mentioned, to interpret these data effectively, it is crucial to contextualise them within the specific profile of the individual STP, as detailed in Chapter 4.2.1. The composition of the community of organisations within the STP often exerts a notable influence on these figures, as extensively discussed in this chapter.

4.2.3 Discussion and overall conclusions

Consistent with the introductory statements presented in this chapter and following the prescribed three-step research procedure, the second phase of this study aimed to validate and confirm the suitability of the adapted methodology within the European STP context. As described in the previous chapter, this objective has been successfully achieved. The methodology was efficiently applied and tested on a sample of fourteen STPs situated in six different nations. This analysis encompassed 799 organisations employing over 26,000 individuals within the STPs. The results of the analyses were subsequently validated by the respective STP managements. STP managers, on one hand, serve as the most authoritative voices for assessing and substantiating the validity of the results. On the other hand, they represent the potential and most suitable users of this methodology. Indeed, their collaboration played a pivotal role in this phase, along with the partnership with IASP and the University of Insubria, as outlined in the research methodology (refer to chapter 3.3).

At the conclusion of this phase, through the empirical application process, the insights emerging from the initial phase are substantiated. It can be asserted that the adaptation of the Polyhedral model for SV analysis to the STP context can indeed be considered a suitable methodology for assessing SV in terms of the SV-SIEA. This approach proves to be convenient for the potential end-user, specifically STP managers, while maintaining a reliable standard of analysis quality.

In terms of the quality of the analysis results, the methodological framework for SV analysis was initially validated in the first phase of the project through collaboration with experts from the GEAccounting association. Furthermore, the reliability and quality of the results in the practical context received preliminary validation from four STPs during the initial project phase. In this second phase, this validation has been extended to a new European-level sample, confirming the methodology's suitability for assessing SV-SIEA and its appropriateness for the potential end-users.

Considerations regarding the quality of the analysis results should always be related to the characteristics of the developed methodology, particularly its suitability for working with secondary data, instead of with primary data compared to the original methodology. Moreover, the ultimate objective of this methodology is linked to the estimation, rather than focusing on the precise calculation of value, of SV-SIEA for the primary stakeholders, following a stakeholder-centric approach. This is the "*conditio sine qua non"* for working with secondary data in this new methodological approach.

Finally, regarding the achieved results and conducted analyses, it can cautiously be stated that they represent a unique and innovative contribution within the realm of STPs (to the best of the researchers' knowledge). At present, sixteen[13] STPs have undergone this analysis, and they exclusively stand to gain from this additional valuable information for their strategic reflections, serving as a bedrock for responsible and informed decision-making.

In any case, these additional confirmations, while acknowledging the limitations identified and discussed in this chapter, instil confidence in the continued application, development, and ongoing improvement of this new methodology. Two key aspects have emerged from this phase, holding significance for future research development. First, the methodology operates effectively and appears to offer benefits to the end-user. Second, it

[13] Fourteen STPs participated in the European-level experimentation, along with the two affiliated with the Basque Network of STPs, which were involved solely in the seminal experiment in the first phase of the research project.

has garnered interest at multiple levels within the STP field, encompassing the umbrella association (IASP) and individual STPs. his includes the fourteen STPs analysed in this study, as well as others that expressed interest in the topic and the methodology but did not participate in this European study.

Regarding the responses to the individual sub-research questions, based on the evidence and insights gathered in this second research phase, the following can be confirmed.

Concerning the accessibility of secondary data, upon which the entire SV-SIEA calculation methodology relies, the validity of the ORBIS platform is confirmed. In this extended European-level experiment involving platform utilization, varying performance levels were observed among different nations, as discussed in subchapter 4.2.1. Specifically, Denmark and the United Kingdom exhibited reduced accessibility to financial information from companies. However, as previously discussed, this aspect is influenced by local regulations governing the disclosure of economic and financial information by organisations. Potential solutions[14] to address these challenges in specific countries can be investigated, and some STP managers are open to collaborating on future research endeavours. They are keen on completing the analyses for their respective parks. On the other hand, regarding the selection of data fields for information extraction from the ORBIS platform, they are fully validated. This effectively affirms the calculation procedure developed in step four of the methodology. Thus, the successful confirmation of data integration, along with its extraction process, within the adapted methodology is established.

[14] Some of the ideas proposed by STP managers involve partnering with companies specialised in reconstruct this information in the country under investigation.

Regarding the standardisation of the methodology, it is affirmed, as validated by the European experiment, that it effectively accommodates the use of secondary data collected from various countries. Additionally, it is confirmed that the methodology's adaptability to individual countries functions smoothly. In this application, the calculation is adapted for each nation (refer to *Annex 2*) in a relatively straightforward and intuitive manner, following the standard procedures outlined by the methodology itself, which rely on data from the Doing Business Reports (refer to *Chapter 4.1.1*). It is further affirmed that for all stakeholders, the reconstruction of their SV-SIEA was achievable without the need for modification in the calculation process for any country. In the future progression of the research, expanding this practical implementation to a wider array of European countries is a compelling prospect. Moreover, the possibility of extending this approach to other divisions of IASP on a global scale, especially those well-supported by the ORBIS Platform, should be explored. Alternatively, an equally high-performance platform tailored to specific countries or continents should be identified.

Concerning the collection of initial primary data, which is fundamental for initiating the methodology's prescribed procedure, the challenges identified in the seminal experiment are once again confirmed. As extensively discussed in Chapter 4.2.1, difficulties arose during the application process in which STP managers were expected to provide these three key pieces of information. These challenges, as discussed, led to the non-selection of certain STPs for this study. However, some STPs managed to address this gap by conducting direct data collection, particularly regarding information about the organisations personnel located within the STP – crucial data for applying SV-SIEA calculations to organisations not fully established within the STP. Consequently, like the seminal experiment, the methodology could not be tested as a monitoring system. In the absence of experienced pilot tests at the park level for this aspect of the methodology, a small experiment within the experiment was conducted. Specifically, within one STP, a historical company was identified, and its generated and distributed value over a nine-year period was reconstructed (see *Annex 4*). The resulting data were presented to the organisation's CEO, who was able to recognise their own company based on the reported data. This validation serves to confirm the accuracy of the results obtained using secondary data. Finally, on a positive note, some STPs have already taken steps to reconstruct time series of this data, with the aim of potentially conducting a customised application for their park in the future.

Given that the methodology relies on non-specific data to calculate SV-SIEA, its suitability for the analysis remains confirmed. STP managers have endorsed the reconstructed estimates as reasonably accurate values, acknowledging the presented data's alignment with the methodology's convenience for key potential users, as previously discussed (refer to *Chapter 4.1.3*).

Concerning the methodology's utility for STP managers, it can be affirmed that it holds value for their park management endeavours, especially within the domain of strategic management (Cadorin et al., 2021; Freeman et al., 2021; Germain et al., 2022; Parmar et al., 2022). As previously discussed, they have already begun incorporating this information into their internal and external STP-related workflows, which serves as indicative evidence of the analyses' practicality. This kind of analysis is undeniably advantageous for them as it provides an initial perspective and awareness of the value they generate through the activities of the organisations they host and support, particularly for the stakeholders for whom SV-SIEA has been reconstructed. The methodology, coupled with its generated data, offers ample scope for numerous specific analyses.

Furthermore, if employed regularly, it can serve as a tool for monitoring the impacts of specific actions or choices undertaken, both by the STP and the territorial institutional and political system within which it operates. Access to this knowledge would empower various stakeholders, extending beyond STP managers alone (including policy makers, local and regional institutions, funders, etc.), to engage in profound strategic contemplations and facilitate more informed decision-making processes. Negotiations and evaluations concerning STPs could embrace this novel category of information, adopting a stakeholder-oriented perspective. Lastly, it is noteworthy to mention the straightforward utility of utilising this information for external communication, particularly in portraying the estimated impact that the STP generates in society.

At the conclusion of this second phase, which involved the application of the methodology on a European scale, two databases have been created. The first database contains the analyses conducted on the 799 organisations under examination, while the second database collects all the information acquired through questionnaires related to the profiling of the 14 STPs. Utilising the data from the latter, as detailed in the research methodology (refer to *Chapters 3.4-3.5*), an initial valuation attempt has been made, involving preliminary exploratory statistical analyses (i.e. hierarchical cluster analysis on stakeholder value distribution and a multilevel modelling on employee value generation). The results of these analyses are presented in the following chapter (see *Chapter 4.3*).

4.3 Exploratory statistical analysis

In this chapter, attention is directed towards the results obtained in the third phase of the research, where additional exploratory statistical analyses were conducted. During this phase, two primary objectives were pursued. Firstly, an attempt was made to further enhance the data generated in the second phase, encompassing the outcomes of applying the methodology at the European level and the information collected through the questionnaires completed by the fourteen STPs. Secondly, an exploratory analysis was made regarding the potential for pursuing these research avenues in the future. These avenues include analysing the distribution of SV-SIEA among stakeholders and exploring models that elucidate value creation for specific stakeholders, particularly employees in this first exploratory analysis.

The results presented in this chapter were obtained by following the procedures outlined in the dedicated methodology chapters (see *Chapters 3.4* and *3.5*). In order to develop the two objectives mentioned in the beginning of this *Chapter 4.3* (see previous paragraph), two statistical analyses have been carried out: a cluster analysis and a multilevel modelling.

In the first place, a hierarchical cluster analysis was conducted following a three-step procedure, as detailed in *Chapter 3.4*. The initial step focused on data, including data collection (performed during phase two of the study) and data preparation for cluster analysis. The second step involved implementing the hierarchical cluster analysis algorithm, which also determined the optimal number of clusters. Finally, in the third step, attention was directed towards interpreting and analysing the preliminary results.

Regarding multilevel modelling, a similar three-step procedure was adopted, as explained in *Chapter 3.5*. The initial step centred on data, encompassing data collection, preparation for model development, and the execution of preliminary exploratory data analyses. Moving to the subsequent step, the multilevel hierarchical model was operationalized, including model estimation. Ultimately, the third step focused on model validation, involving diagnostic assessments and result interpretation.

For this exploratory statistical analysis, the R statistical software served as the primary tool. The results outlined in this chapter are of exploratory nature, and they provide a basis to consider further exploration in additional enquires.

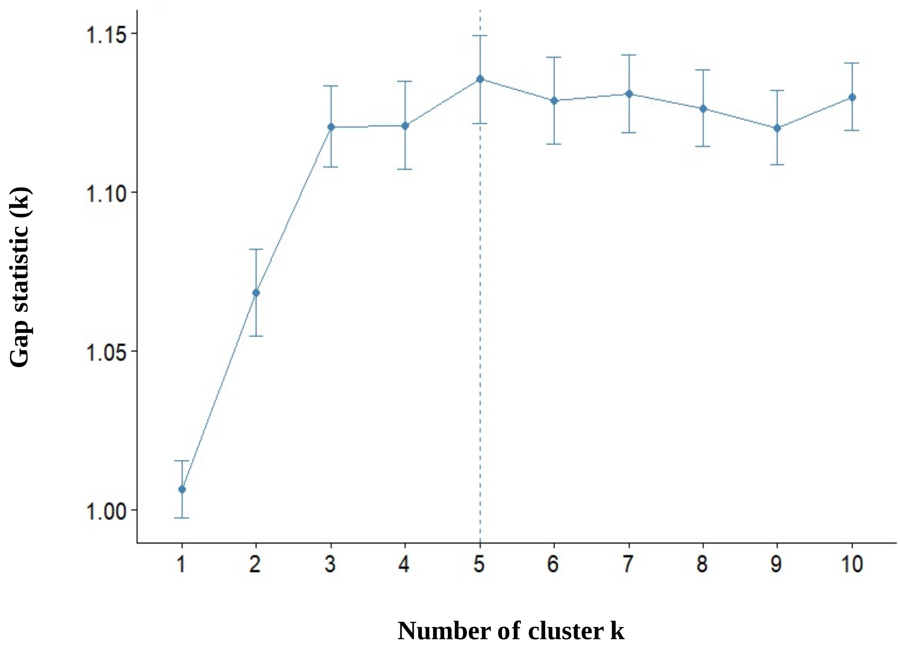
Following the systematic approach of presenting research findings across various phases, the upcoming sub-chapters will present the results derived from the hierarchical cluster analysis, followed by the outcomes of the multilevel modelling. The chapter will conclude with a brief discussion of the findings from this exploratory statistical analysis, ultimately ending with a conclusion and the identification of emerging research directions.

4.3.1 Results of the Hierarchical Cluster Analysis

In this subchapter, the preliminary results of the exploratory cluster analysis are presented. As previously explained in the methodology chapter (refer *Chapter 3.4*), this analysis was conducted following a three-step procedure, which enabled particular data treatment. This careful data processing subsequently allowed for the execution of the cluster analysis on a refined sample comprising 718 organisations. Collectively, these methodological considerations and empirical insights converged on the determination that a five-cluster solution was the most appropriate choice for representing the inherent data structure, as illustrated in *Graph 1*.

Graph 1: Exploratory Cluster Analysis - Optimal Number of Clusters

Exploratory Cluster Analysis - Optimal Number of Clusters

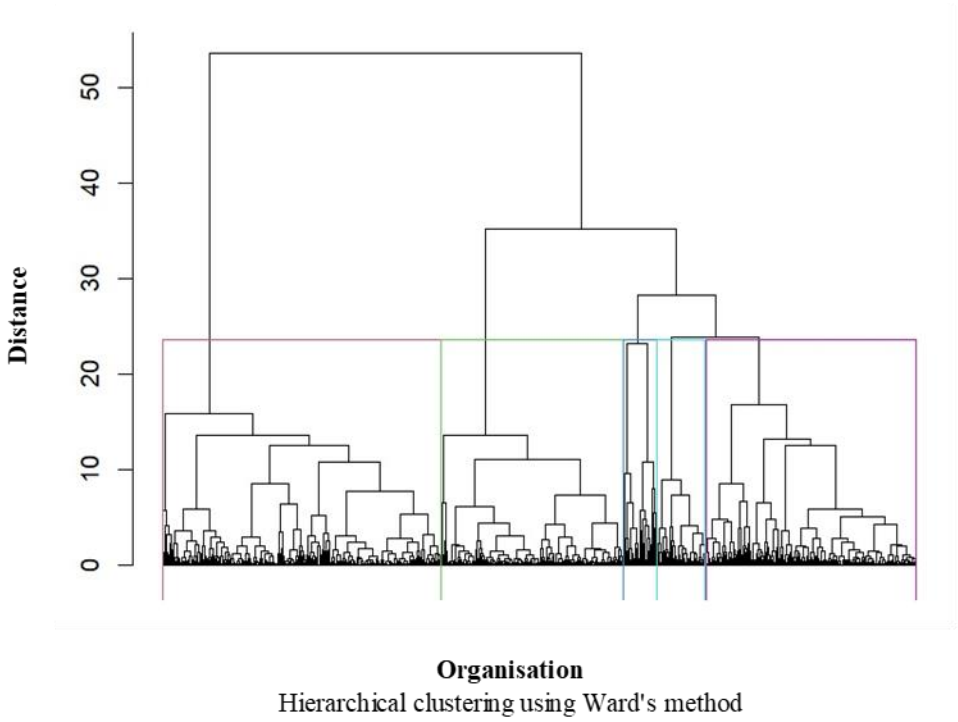


Source: Own elaboration.

The clustering of the sample has revealed the presence of five distinct clusters, as evidenced by the dendrogram in *Grap 2*. These clusters exhibit noticeable differences in size, with two large clusters encompassing over 200 organisations each, one medium-large cluster comprising more than 150 organisations, and finally, two smaller clusters, each containing fewer than 50 organisations.

Graph 2: Dendrogram of SV-SIEA Distribution to Stakeholders

Dendrogram of SV-SIEA Distribution to Stakeholders

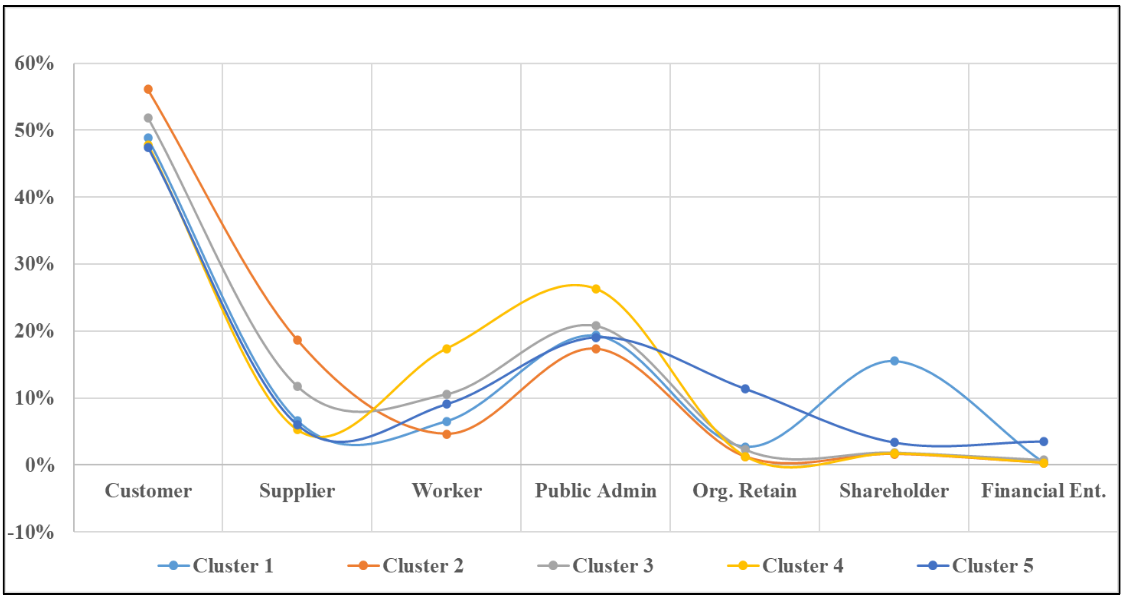


Source: Own elaboration.

The identified clusters display distinct distributions of SV-SIEA among primary stakeholders, such as consumers, suppliers, employees, public administration, shareholders, financial entities, and retained value within the organisation. These distinctive distributions are visualised in the following *Graph 3*.

Graph 3: Average Distribution of SV-SIEA to Stakeholders Across the 5 Clusters

Graph 3: Average Distribution of SV-SIEA to Stakeholders Across the 5 Clusters



Source: Own elaboration.

In *Graph 3*, the average distributions towards stakeholders for each identified cluster are depicted. To gain a more profound insight into these distributions, it is essential to consider not only the average values but also the extremes represented by the maximum and minimum values, along with the central tendency indicated by the median distribution for each stakeholder category. These specific details are comprehensively presented in the following table (refer to *Table 21*) for an initial overview. However, to facilitate a more comprehensive understanding of the cluster descriptions that will be presented in the subsequent sections, it is crucial to consider various contextual pieces of information that characterise the examined sample.

Table 21: Cluster SV-SIEA Distribution among Stakeholders (Mean, Median, Minimum, Maximum)

Cluster SV-SIEA Distribution among Stakeholders (Mean, Median, Minimum, Maximum)

MEAN	Costumer	Supplier	Worker	P. Adimin	Reteined	Sherholder	F. Entities
Cluster 1	49%	7%	7%	19%	3%	16%	0%
Cluster 2	56%	19%	5%	17%	1%	2%	0%
Cluster 3	52%	12%	11%	21%	2%	2%	1%
Cluster 4	48%	5%	17%	26%	1%	2%	0%
Cluster 5	47%	6%	9%	19%	11%	3%	4%

MEDIAN	Costumer	Supplier	Worker	P. Adimin	Reteined	Sherholder	F. Entities
Cluster 1	49%	7%	6%	20%	1%	14%	0%
Cluster 2	56%	19%	4%	17%	1%	1%	0%
Cluster 3	52%	12%	10%	21%	1%	2%	0%
Cluster 4	48%	5%	17%	26%	0%	2%	0%
Cluster 5	47%	6%	9%	19%	11%	3%	3%

MIN	Costumer	Supplier	Worker	P. Adimin	Reteined	Sherholder	F. Entities
Cluster 1	45%	0%	1%	11%	0%	9%	0%
Cluster 2	52%	13%	0%	13%	0%	-23%	0%
Cluster 3	46%	3%	1%	13%	0%	-14%	0%
Cluster 4	40%	0%	9%	19%	0%	-26%	0%
Cluster 5	43%	0%	2%	14%	0%	-8%	0%

MAX	Costumer	Supplier	Worker	P. Adimin	Reteined	Sherholder	F. Entities
Cluster 1	53%	13%	11%	24%	13%	34%	2%
Cluster 2	64%	31%	10%	22%	13%	14%	2%
Cluster 3	59%	26%	31%	26%	16%	10%	6%
Cluster 4	53%	15%	29%	42%	11%	16%	4%
Cluster 5	53%	17%	20%	26%	41%	23%	11%

Note: Percentages are rounded for clarity.

Source: Own elaboration.

The data presented in *Table 21* and subsequent *Tables 22-25* serve as the foundation for comprehensive descriptions of the ensuing five clusters. These descriptions will outline the unique profiles and distinctive characteristics of each cluster. Prior to delving into these profiles, relevant contextual insights are provided to frame the analysis results.

A total of 718 organisations are considered in the analysis, distributed across STPs located in six countries: Spain, Italy, Portugal, Sweden, Denmark, and the United Kingdom.

Regarding the distribution of organizations (see *Table 22* below):

- Spanish STPs contribute the largest share, accounting for 49% of the sample, encompassing 352 organisations.
- Italian STPs follow, representing 13% of the sample, with 93 organisations.
- Portuguese STPs contribute 75 organisations, making up 11% of the sample.
- Swedish STPs, with 173 organisations (24% of the sample), constitute a significant segment.
- Smaller contributions come from a Danish STP (13 organisations) and a UK STP (11 organisations).

It is noteworthy that the substantial presence of Spanish and Swedish organisations is unsurprising, given their larger representation in the sample. However, as the cluster descriptions unfold, cases such as Cluster 4 will reveal notable representations of both Spanish and Swedish STP organisations.

Table 22: Cluster Composition by Country of STP

Table 22: Cluster Composition by Country of STP

	Spain	Italy	Portugal	Sweden	Denmark	United Kingdom
Cluster 1	54%	9%	13%	20%	2%	2%
Cluster 2	51%	21%	13%	12%	1%	2%
Cluster 3	53%	15%	7%	17%	4%	3%
Cluster 4	43%	7%	11%	38%	0%	0%
Cluster 5	53%	9%	9%	22%	6%	0%
cf. Total Sample	*49%*	*13%*	*11%*	*24%*	*2%*	*2%*

Note: Percentages are rounded for clarity.

Source: Own elaboration.

The ensuing cluster descriptions provide a comprehensive overview of the unique profiles and characteristics within each cluster. These profiles have been constructed by considering not only the distribution of SV to stakeholders but also factors related to the organisations themselves, such as size, as well as aspects concerning the hosting STPs, including their size, governance, and country of establishment (as see just before in *Table 20*).

In terms of STP governance, the study includes six STPs with public governance, four with private governance, and an additional four with mixed governance. Within the analysed sample for clustering, this prevalence of organisations affiliated with specific STPs becomes clear (see *Table 23* below). To be specific, 482 organisations, constituting 67% of the sample, fall under the umbrella of public governance STPs. Consequently, it explains the fact that clusters are generally characterised by a strong presence of organisations located in public STPs. Following this, there are organisations within STPs featuring mixed governance, totalling 164 or 23% of the sample, and lastly, businesses located in private STPs, numbering 72 and representing 10% of the sample.

Table 23: Cluster Composition by STP Governance Typology

Table 23: Cluster Composition by STP Governance Typology

	Mixed	Private	Public
Cluster 1	20%	9%	72%
Cluster 2	34%	11%	55%
Cluster 3	22%	17%	61%
Cluster 4	18%	4%	78%
Cluster 5	13%	13%	75%
cf. Total Sample	*23%*	*10%*	*67%*

Note: Percentages are rounded for clarity.

Source: Own elaboration.

Concerning the distribution of the cluster analysis sample concerning the size of the STPs, a notably consistent distribution is observed across various size categories, ranging from “Medium” to “Very Large” (see *Table 24* below). All of these categories represent a substantial portion of the sample, ranging from 21% (151 organisations) to 24% (173 organisations). However, it is worth noting that the category of Small STPs has a lower representation, comprising only 11% (76 organizations) of the sample. This lower presence aligns with the characteristics of “Small” STPs, typically hosting fewer than 50 organisations.

Table 24: Cluster Composition by STP Size

Table 24: Cluster Composition by STP Size

	Very Large	Large	Medium-Large	Medium	Small
Cluster 1	20%	20%	28%	20%	13%
Cluster 2	12%	26%	18%	31%	13%
Cluster 3	17%	22%	25%	24%	11%
Cluster 4	38%	17%	18%	17%	9%
Cluster 5	22%	28%	31%	16%	3%
cf. Total Sample	*24%*	*22%*	*21%*	*23%*	*11%*

Note: Percentages are rounded for clarity.

Source: Own elaboration.

In conclusion, the last aspect to consider relates to organisational size. Within the cluster analysis sample, a notable prevalence of micro-organisations is observed, totalling 301 organisations, accounting for 42% of the sample (see *Table 25* below)[15]. Following closely are small organisations, comprising 26% or 186 organisations. Additionally, medium-sized enterprises constitute 18% of the sample, with 131 organisations in this category, while large enterprises represent 14% of the sample, totalling 100 organisations.

[15] Categories: “Micro” (<10 employees), “Small” (10-49), “Medium” (50-249), “Large” (>249) adapted from Aguado (2007)

This distribution is consistent with the typical composition found within STPs, especially those accommodating incubators and accelerators, which is the case for the majority of STPs participating in this study. Given these data, it is understandable why the clusters exhibit a substantial presence of micro-organisations.

Table 25: Cluster Composition by Organization Size

Table 25: Cluster Composition by Organisation Size

	Large	Medium	Small	Micro
Cluster 1	9%	11%	11%	70%
Cluster 2	13%	16%	23%	48%
Cluster 3	14%	22%	28%	35%
Cluster 4	14%	19%	28%	39%
Cluster 5	19%	16%	34%	31%
cf. Total Sample	*14%*	*18%*	*26%*	*42%*

Note: Percentages are rounded for clarity.

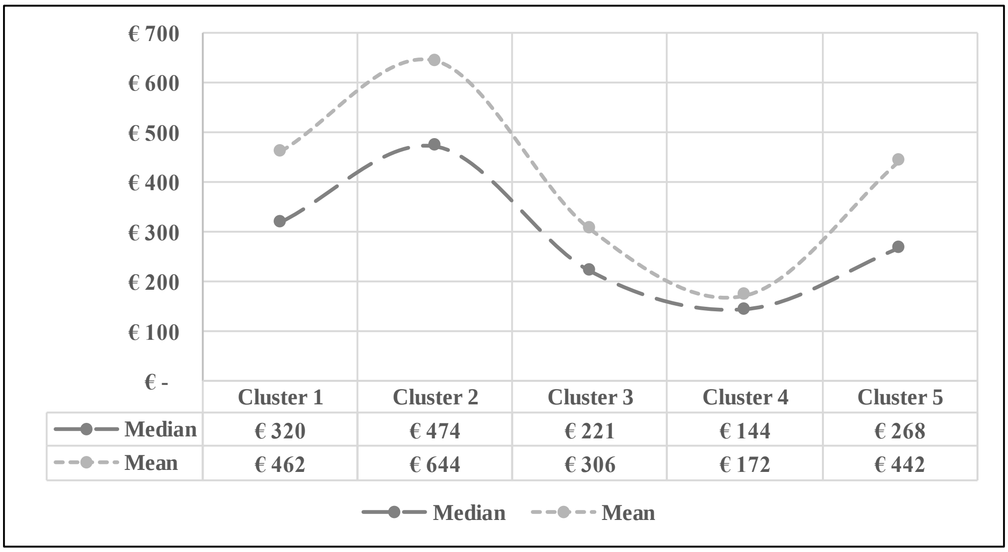
Source: Own elaboration.

In this analysis, these elements have been utilised to profile and characterise the clusters. It is important to note that additional elements can be employed, and further details regarding specific elements can be cross-referenced. The extensive European-level database created for this study is well-suited for such analytical pursuits and provides room for continued exploration of cluster profiling in a subsequent phase.

Before delving into the profiling of individual clusters, it is worth noting the per-capita value generation for employees by organisations within these clusters, as illustrated in *Graph 4*. The graph reveals that one cluster, namely Cluster 2, displays higher values in comparison to the others, while another cluster, Cluster 4, exhibits lower values. The remaining three clusters fall within the intermediate range with their respective values.

Graph 4: SV-SIEA Distribution per Capita by Employee Aross the 5 Clusters

Graph 4: SV-SIEA Distribution per Capita by Employee Aross the 5 Clusters



Note: Values in thousands of euros.

Source: Own elaboration.

Following this brief contextualisation, enriched with supplementary elements to enhance the understanding and interpretation of the clusters' unique characteristics, concise descriptions have emerged for each of the five clusters, each distinguished by a distinct label. Each description is accompanied by a graph depicting the distribution of SV-SIEA among various stakeholders, illustrating the range of distribution with its extremes (maximum and minimum), mean value, and median.

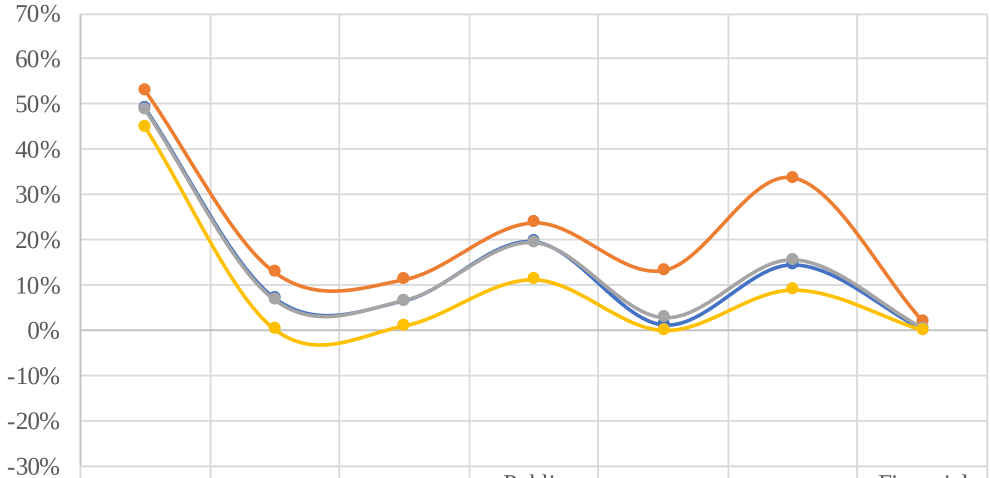
Cluster 1: Organisations focused on customers and shareholders

Profile: Cluster 1 encompasses 46 organisations distributed across thirteen STPs in the six countries under investigation (see *Graph 5*). In terms of SV-SIEA distribution, the organisations within this cluster allocate a significant portion of their value to "Customers" (approximately 49%) and a substantial share to the "Public Administration" (about 19%) and especially to "Shareholders" (approximately 16%). The majority of organisations in this cluster are located in STPs from Spain (approximately 54%). Concerning the size of the STPs where these organisations are located, there is a nearly even distribution among "Very Large", "Large", "Medium-Large", and "Medium" categories. The governance structure of these STPs is predominantly public (approximately 72%). In terms of organisational size, a significant portion falls into the "Micro" category (around 70%). The SV-SIEA generated per-employee varies considerably, with a median of approximately 320,000 Euros.

Characterisation: Cluster 1 is primarily composed of small-sized organisations situated predominantly in STPs with a public governance structure. There is a noticeable distribution of SV-SIEA towards customers and shareholders. The majority of organisations in this cluster originate from STPs Spain (six over fourteen STP are locate in Spain), and they exhibit a fairly even distribution across various STP sizes.

Graph 5: SV-SIEA Distribution Cluster 1

Graph 5: SV-SIEA Distribution Cluster 1



	Customer	Supplier	Worker	Public Admin	Org. Retain	Shareholder	Financial Ent.
Median	49%	7%	6%	20%	1%	14%	0%
Max	53%	13%	11%	24%	13%	34%	2%
Mean	49%	7%	7%	19%	3%	16%	0%
Min	45%	0%	1%	11%	0%	9%	0%

Note: 46 organisations - 13 STP - 6 Countries

Source: Own elaboration.

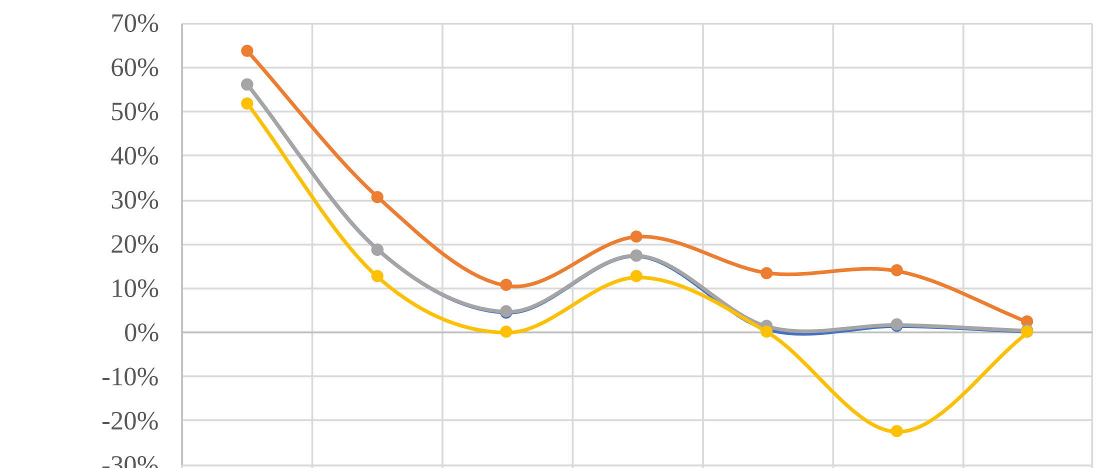
Cluster 2: Organisations focused on customers and suppliers

<u>Profile:</u> Cluster 2 comprises 176 organisations spanning fourteen STPs across six countries (see *Graph 6*). This cluster exhibits a high percentage of SV-SIEA allocated to "Customers" (approximately 56%) and "Suppliers" (about 19%). These organizations have a significant presence in both Spanish and Italian STPs. Concerning STP size, there is a prevalence of "Medium-sized" parks (around 31%). The governance structure of the STPs in this cluster is predominantly public, followed by mixed governance. Organizational sizes vary, with a balanced distribution among "Micro", "Small", and "Medium". SV-SIEA generated per employee is high, with a median of around 474,000 Euros.

Characterisation: Cluster 2 demonstrates a strong inclination towards distributing SV-SIEA to customers and suppliers. Organizations in this cluster tend to be of medium size and are predominantly located in public governance STPs. There is a substantial representation of organisations from Spanish and Italian STPs.

Graph 6: SV-SIEA Distribution Cluster 2

Graph 6: SV-SIEA Distribution Cluster 2



	Customer	Supplier	Worker	Public Admin	Org. Retain	Shareholder	Financial Ent.
Median	56%	19%	4%	17%	1%	1%	0%
Max	64%	31%	10%	22%	13%	14%	2%
Mean	56%	19%	5%	17%	1%	2%	0%
Min	52%	13%	0%	13%	0%	-23%	0%

Note: 174 organisations - 14 STP - 6 Countries

Source: Own elaboration.

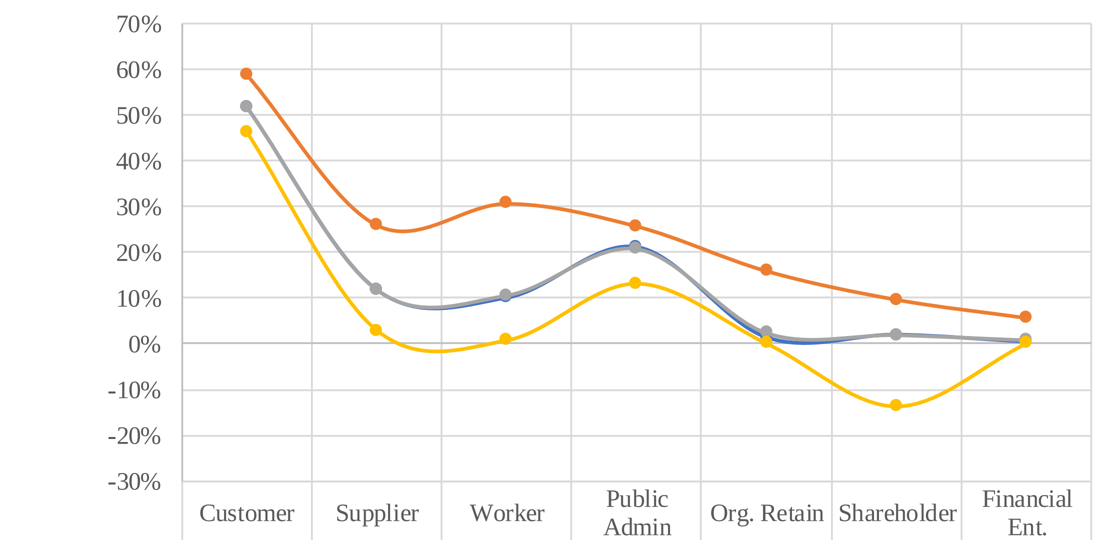
Cluster 3: Organisations with a balanced distribution

Profile: Cluster 3 consists of 210 organisations distributed across fourteen STPs in six countries (see *Graph 7*). The distribution of SV-SIEA within this cluster is well-balanced, allocating approximately 52% to “Customers” and about 21% to the “Public Administration”. The majority of these organizations originate from Spanish STPs, comprising approximately 53%. Concerning the size of the STPs where these organisations are located, there is a uniform distribution across different STP sizes. The governance structure of these STPs is predominantly public, accounting for around 61%. The organisations vary in size, with a balanced distribution among “Micro”, “Small” and “Medium”. SV-SIEA generated per employee is lower compared to other clusters, with a median of approximately 221,000 Euros.

<u>Characterisation:</u> Cluster 3 demonstrates a well-balanced distribution of SV-SIEA, with a slight preference for customers and public administration. Organisations in this cluster exhibit variations in size and are predominantly situated in STPs governed by the public sector. The majority of organizations in this cluster originate from Spanish STPs.

Graph 7: SV-SIEA Distribution Cluster 3

Graph 7: SV-SIEA Distribution Cluster 3



	Customer	Supplier	Worker	Public Admin	Org. Retain	Shareholder	Financial Ent.
Median	52%	12%	10%	21%	1%	2%	0%
Max	59%	26%	31%	26%	16%	10%	6%
Mean	52%	12%	11%	21%	2%	2%	1%
Min	46%	3%	1%	13%	0%	-14%	0%

Note: 210 organisations - 14 STP - 6 Countries

Source: Own elaboration.

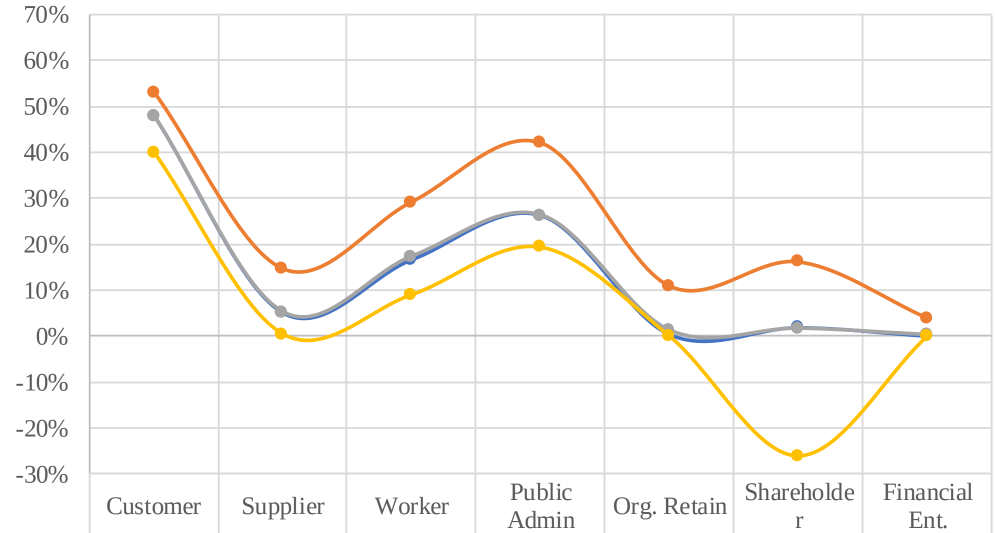
Cluster 4: Organisations focused on employees and public administration

Profile: Cluster 4 comprises 265 organisations distributed across eleven STPs in four countries (see *Graph 8*). This cluster allocates a significant portion of its value to “Workers” (about 17%) and the “Public Administration” (around 26%). The majority of organisations in this cluster originate from STPs located in Spain and Sweden. Many organizations in this cluster are categorized as “Very Large” (approximately 38% from the Swedish STP) in terms of STP size. The governance structure of the STPs in this cluster is predominantly public (about 78%). The organisations vary in size, with a balanced distribution among “Micro”, “Small”, and “Medium”. The SV-SIEA generated per employee is relatively low, with a median of approximately 144,000 Euros.

Characterisation: Cluster 4 is marked by a significant allocation of SV-SIEA to workers and public administration. Organisations in this cluster are predominantly large in size and are primarily situated within STPs governed by public entities. There is a noteworthy presence of organisations from Spain. In this cluster, in comparison to the others, there is a significant presence of organisations located in Swedish STP.

Graph 8: SV-SIEA Distribution Cluster 4

Graph 8: SV-SIEA Distribution Cluster 4



	Customer	Supplier	Worker	Public Admin	Org. Retain	Shareholder	Financial Ent.
Median	48%	5%	17%	26%	0%	2%	0%
Max	53%	15%	29%	42%	11%	16%	4%
Mean	48%	5%	17%	26%	1%	2%	0%
Min	40%	0%	9%	19%	0%	-26%	0%

Note: 265 organisations - 11 STP - 4 Countries

Source: Own elaboration.

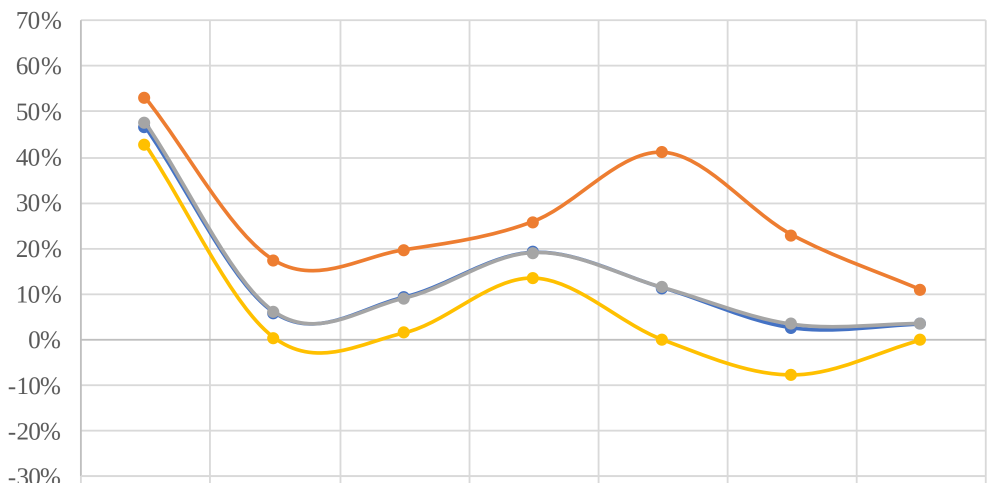
Cluster 5: Organisations focused on building shareholders' equity

Profile: Cluster 5 encompasses 32 organisations situated across nine STPs in five countries (see *Graph 9*). Within this cluster, the distribution of SV-SIEA is notably balanced, with a significant allocation to the "Public Administration" (approximately 19%) and a substantial retained share (approximately 11%). The majority of these organisations originate from STPs in Spain and Sweden. Concerning STP size, "Medium-Large" parks prevail (around 31%). The governance structure of STPs in this cluster predominantly follows a public model (75%). Organisation size varies, with a well-distributed mix of "Micro", "Small", and "Medium" entities. SV-SIEA generated per employee exhibits a median value of approximately 268,000 Euros.

Characterisation: Cluster 5 demonstrates a significant propensity for SV-SIEA retention and an equitable allocation of value to public administration. Public governance in STPs is the prevailing model, with a notable representation of organisations located in "Medium-Large" STPs. The majority of organisations in this cluster originate from STPs in Spain and Sweden.

Graph 9: SV-SIEA Distribution Cluster 5

Graph 9: SV-SIEA Distribution Cluster 5



	Customer	Supplier	Worker	Public Admin	Org. Retain	Shareholder	Financial Ent.
Median	47%	6%	9%	19%	11%	3%	3%
Max	53%	17%	20%	26%	41%	23%	11%
Mean	47%	6%	9%	19%	11%	3%	4%
Min	43%	0%	2%	14%	0%	-8%	0%

Note: 32 organisations - 9 STP - 5 Countries

Source: Own elaboration.

Within the scope of this research, the results obtained through this exploratory cluster analysis bearing in mind the limitations of the utilised sample, offer substantial support for the continuation of research efforts in this field. It is prudent to delve deeper into this area to unravel the intricate dynamics of SV-SIEA distribution among stakeholders within organisations operating within STPs. Additionally, there is a compelling rationale for further inquiry into how these distribution patterns correlate with the distinct characteristics of the hosting STPs. By doing so, a comprehensive understanding of the intricate interplay between organisations and their stakeholders can be gained, along with insights into the influential factors tied to the STP environment.

4.3.2 Results of the Multilevel analysis

In this section, the results of the multilevel modelling approach are presented. These findings are derived from the application of the three-step procedure outlined in the corresponding methodology chapter (see Chapter 3.5). They constitute an exploration to assess the potential for further analysis in this direction. A multilevel model has been outlined, and it will be further elaborated upon in the following sections.

Model Variables

The model considers the following variables:

- Dependent Variable (Response): SV_work_capita - This represents the SV-SIEA generated for stakeholders, specifically employees, per capita.

Organizational-Level Predictors:

- log_Employees: The logarithmically transformed number of employees, indirectly indicating organizational size.
- Assets_Inmat_Cat_2: Categorized variable representing an organization's intangible assets.
- Ebitda_cub: Earnings before Interest, Taxes, Depreciation, and Amortization (EBITDA) subjected to cubic transformation to enhance model fit.

STP-Level Predictors:

- P_Cat_PCyT_collapsed: Categorised variable denoting the type of STP governance, with "Mixed" and "Public" categories merged.
- P_Dimension_3_f: Categorised variable representing STP size, categorised as large, medium, or small.

In chapter 3.5. there is a comprehensive explanation of this methodology. Additional information can be found in *Annex 5.*

Mathematical Model

The following model is employed to analyse the relationship between these variables:

$$Yij = \beta_0 + \beta_1(log\_Employees_{ij}) + \beta2(P\_Cat\_PCyT\_collapsedPrivado_{ij}) + \beta_3(P\_Dimension\_3\_f2_{ij}) + \beta_4(P\_Dimension\_3\_f3_{ij}) + \beta5(Ebitda\_cub_{ij}) + \beta6(Assets\_Inmat\_Cat\_22_{ij}) + u_{0j} + u_{1j}(Ebitda\_cub_{ij}) + e_{ij}$$

A summary of the model components is provided below:

- Yij: The dependent variable, SV_work_capita, for observation i in group j.
- Intercept (β0): Represents the baseline level of SV_work_capita when all other variables are zero (13.2459).
- Coefficients (β1 to β6): Reflect the relationships between the respective variables and SV_work_capita.
- Random Intercept (u0j): Captures variability between different STPs (ID_2) with an estimated standard deviation of 6.1960.
- Random Slope (u1j): Models the variation in the relationship between Ebitda_cub and SV_work_capita across different STP, with an estimated standard deviation of 0.3889.
- Residual Error (eij): Represents unexplained variability for each observation.

This model provides valuable insights into the relationship between the selected variables and SV_work_capita, as depicted in *Table 26* below. While the preliminary analysis is subject to sample limitations, significant findings regarding these relationships will be discussed in below. Firstly, a model fit assessment will be briefly presented, followed by fixed effects interpretation and random effects analysis. Subsequently, a general conclusion about this exploratory model will be reached.

Table 26: Multilevel Model Analysis of SV-SIEA for Stakeholder: Employee

Table 26: Multilevel Model Analysis of SV-SIEA for Stakeholder: Employee

```
Random effects:
 Groups   Name        Variance Std.Dev. Corr
 ID_2     (Intercept) 38.3909  6.1960
          Ebitda_cub   0.1513  0.3889   0.43
 Residual             94.5930  9.7259
Number of obs: 708, groups:  ID_2, 14

Fixed effects:
                            Estimate Std. Error       df t value Pr(>|t|)
(Intercept)                  13.2459     2.5907  10.7727   5.113  0.00036 ***
log_Employees                 0.9984     0.2090 688.2530   4.777 2.17e-06 ***
P_Cat_PCyT_collapsedPrivado   8.4976     4.2874  13.0846   1.982  0.06889 .
P_Dimension_3_f2              5.0844     4.4072  10.2913   1.154  0.27473
P_Dimension_3_f3             13.1680     4.5515   8.8906   2.893  0.01802 *
Ebitda_cub                    0.4069     0.1425   5.5732   2.857  0.03142 *
Assets_Inmat_Cat_22           2.9538     1.4245 692.5678   2.074  0.03849 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Source: Own elaboration.

Model Fit Assessment

An analysis of the results highlights the model's satisfactory fit, as indicated by a Restricted Maximum Likelihood (REML) criterion of 5258 (refer to *Annex 5*). This criterion signifies that the model effectively captures the nuances present in the observed data.

Fixed Effects Interpretation

1. **Intercept**: The intercept term, quantified at 13.2459 ($p < 0.001$), plays a central role in the model. It represents the expected value of SV_work_capita when all other variables are held at null values, defining the fundamental level of SV_work_capita independently of log_Employees, P_Cat_PCyT_collapsed, P_Dimension_3_f, Ebitda_cub, and Assets_Inmat_Cat_2.

2. **log_Employees**: This variable exhibits a substantial impact, with a unit increase corresponding to a 0.9984 unit escalation in SV_work_capita ($p < 0.001$), confirming a positive correlation between log_Employees and SV_work_capita.
3. **P_Cat_PCyT_collapsedPrivado**: With a coefficient of 8.4976 ($p = 0.06889$), this variable suggests a favourable association with SV_work_capita. However, it does not achieve statistical significance at the conventional 0.05 threshold, warranting further exploration of its implications for SV_work_capita.
4. **P_Dimension_3_f2 and P_Dimension_3_f3**: These variables, characterized by coefficients of 5.0844 and 13.1680 respectively ($p < 0.05$), exhibit statistically significant positive relationships with SV_work_capita. This implies that organizations aligned with these categories generally demonstrate superior SV_work_capita compared to the reference category.
5. **Ebitda_cub:** With a coefficient of 0.4069 ($p = 0.03142$), this variable signifies a positive association with SV_work_capita, indicating that a unit increase in Ebitda_cub corresponds to an approximately 0.4069 unit increase in SV_work_capita.
6. **Assets_Inmat_Cat_22**: Characterised by a coefficient of 2.9538 ($p = 0.03849$), this variable demonstrates a statistically significant positive relationship with SV_work_capita, suggesting that enterprises falling under the Assets_Inmat_Cat_22 classification tend to exhibit higher levels of SV_work_capita compared to the reference category.

Random Effects Analysis

Turning to the Random Effects incorporated into the model, these are governed by the grouping variable ID_2, quantifying the variability among different STPs, thereby encapsulating inherent heterogeneity.

- **ID_2 (Intercept)**: This component quantifies the variability in SV_work_capita across diverse STPs, with the estimated standard deviation registered at 6.1960, indicating considerable diversity among the STPs.
- **ID_2 Ebitda_cub:** This aspect reflects the variability in the relationship between Ebitda_cub and SV_work_capita across different STPs, with a standard deviation of 0.3889, highlighting moderate variation in the relationship across distinct STPs.

In conclusion, the model provides valuable insights into the dynamics between the explanatory variables and SV-SIEA generated per employee. The significant fixed effects coefficients, particularly related to organisational size ("log_Employees"), STP size ("P_Dimension_3_f2" and "P_Dimension_3_f3"), organisational performance in terms of EBITDA ("Ebitda_cub"), and investment in intangible assets ("Assets_Inmat_Cat_22"), underline their pivotal roles in explaining the variability in SV-SIEA generated per employee. The influence of STP governance appears to be less pronounced. Furthermore, the random effects analysis highlights the existing variability among distinct STPs, emphasising the necessity of incorporating this heterogeneity into any subsequent analysis regarding SV-SIEA generated per employee.

In essence, in this initial exploration employing a multilevel model, three organisational variables have surfaced as positively influencing the per capita generation of SV-SIEA for the employee stakeholder. These variables encompass the organization's size, quantified in terms of the total number of employees, the company's performance, indicated by the EBITDA, and the investments in intangible assets.

At the organisational level, these factors have consistently demonstrated a positive impact on SV-SIEA generation per capita for the employee stakeholder. As the organization's size increases, as evidenced by a higher total number of employees, there is a corresponding elevation in SV-SIEA generated for the employee stakeholder. This relationship aligns logically with expectations.

Similarly, the model reveals that enhanced company performance, measured through a larger EBITDA, results in an increased value generated for the employee stakeholder. This association reflects the intuitive notion that improved overall financial performance contributes to higher value for employees.

Moreover, the analysis introduces the variable of total investments in intangible assets. Findings indicate that greater investments in intangible assets by organisations tend to have a positive impact on the generation of value for the employee stakeholder. This highlights the importance of intangible asset development within the context of SV-SIEA generation, especially for organisations locate in STPs.

At the STP level, certain variables assume significance. Specifically, the size of the STP plays a substantial role in influencing SV-SIEA generation for organisations within it. Organisations situated in medium to large-sized STPs exhibit a positive impact on the generation of value for the employee stakeholder.

Furthermore, the governance structure of the park appears to be a crucial factor. Organisations within privately-managed STPs demonstrate a more pronounced and positive effect on SV-SIEA generation for the employee stakeholder. Nevertheless, it is essential to note that this aspect necessitates further comprehensive exploration.

In conclusion, this initial exploration provides valuable insights into the factors influencing SV-SIEA generation. These findings can guide future research endeavours, shedding light on how organisations within STPs contribute to value generation for their employee stakeholders. The interplay between these factors at both organisational and STP levels offers promising avenues for deeper investigation and understanding within this field.

4.3.3 Conclusions

In this research's third phase, exploratory statistical analyses were employed to uncover potential avenues for future research. Both analyses have yielded results that warrant further investigation into these research directions.

To begin with, an inquiry was initiated into the distribution of SV-SIEA among stakeholders by utilising hierarchical cluster analysis on the sample of organisations examined in this research. This sample encompasses 718 organisations situated in fourteen STPs across six European countries. This analysis successfully grouped organisations based on their patterns of generating and distributing value among stakeholders, resulting in the identification of five distinct clusters, each characterised by unique distributions of SV-SIEA among various stakeholders.

In this study, these five distinct clusters have been discerned, with each cluster featuring a specific label. These labels effectively represent the stakeholders towards whom the organisations within each cluster generate higher value in comparison to the distributions observed in other clusters. Therefore, the clusters and their distinctive characteristics can be identified by the following labels:

- *Cluster 1: Organizations focused on customers and shareholders*
- *Cluster 2: Organizations focused on customers and suppliers*
- *Cluster 3: Organizations with a balanced distribution*
- *Cluster 4: Organizations focused on employees and public administration*
- *Cluster 5: Organizations focused on building shareholders' equity*

It is noteworthy that within the context of STPs, no clusters exclusively consisted of organizations from a single STP or a single country.

Future research should delve deeper into the relationship between the organisations constituting these clusters and the characteristics of the STPs in which they are located. This will require expanding the sample size and balancing the number of organisations analysed per STP. One limitation of the current study is the uneven representation of parks, with some extensively analysed and others minimally. Additionally, some countries have a significant number of STPs analysed, while others have only one park with few organizations suitable for SV-SIEA analysis.

In conclusion, this analysis of SV-SIEA distribution holds promise for further exploration. It can contribute to the development of SV analysis models and prove valuable within the context of STPs by providing insights into how SV-SIEA is distributed by the hosted community of organisations. Additionally, examining and analysing these clustered distributions in relation to STPs and their contexts will be instrumental in advancing understanding in this field.

In the context of multilevel analysis and model development, additional avenues for research emerge. Exploring the determinants of value generation for specific stakeholders is a promising area within the field of SV analysis. Furthermore, it holds relevance within the context of STPs as it allows for an investigation of park-level components that may exert significant influence on SV-SIEA creation for particular stakeholders. In this study, the focus has primarily been on analysing “employee” stakeholders. However, future research could consider shifting the perspective to examine the dynamics involving other stakeholders.

In this exploratory investigation using a multilevel model, three organizational factors have been identified as positively affecting per capita generation of SV-SIEA for employee stakeholders. These factors include organisational size, measured by the total employee count, company performance indicated by EBITDA, and investments in intangible assets. At the organizational level, these factors consistently demonstrate a positive impact on SV-SIEA generation per capita for employee stakeholders. As organisational size increases, reflected in a higher number of employees, there is a corresponding increase in SV-SIEA generated for employees, aligning with expectations. Similarly, improved company performance, measured by a higher EBITDA, leads to increased value generated for employee stakeholders. This connection is intuitively logical, as better financial performance benefits employees. Furthermore, greater investments in intangible assets by organisations tend to positively influence SV-SIEA generation for employee stakeholders, emphasising the importance of developing intangible assets, particularly for organisations in STPs.

At the STP level, two key variables come into play. The size of the STP significantly affects SV-SIEA generation for organisations within it, with medium to large-sized STPs positively impacting employee stakeholder value generation. Additionally, the governance structure of the park is a crucial factor, with organisations in privately-managed STPs demonstrating a more pronounced and positive effect on SV-SIEA generation for employee stakeholders. However, further in-depth exploration of this aspect is warranted.

In summary, this exploratory investigation provides valuable insights into the factors influencing SV-SIEA generation. These findings can guide future research, illuminating how organisations within STPs contribute to value generation for their employee stakeholders. The interaction between these factors at both organisational and STP levels presents promising avenues for deeper exploration and understanding in this field.

It is worth noting that both analyses conducted in this study are exploratory in nature. The databases utilised in this study could serve as a robust foundation for subsequent investigations, facilitating the evolution of analytical approaches.

5. Conclusions

This chapter is the final section of the doctoral research journey, where the findings have been meticulously presented and discussed in a logical sequence. The exploration encompassed three distinct research phases: firstly, the development of a methodology adapted to the unique context of STPs; secondly, the expansion of our study to a European scale; and finally, the execution of exploratory statistical analyses on the data gathered during the research. This analytical and reflective journey allowed for the gradual assembly of the necessary elements and evidence to address the core research question: "*How can a measurement tool based on secondary data be developed to assess the SV generated by STPs in a way that is both convenient for the key potential users and also reliable in terms of quality of analysis?"*

From the comprehensive content of this doctoral dissertation, it becomes evident that the answer to this question is affirmative. It has been demonstrated that it is indeed possible to devise a tool for measuring SV generated by STPs that is both user-friendly and based on secondary data, all while maintaining the quality of the analysis. The foundation for such a tool is showcased in this work, which is rooted in our stakeholder-centric methodology for SV analysis, developed using the Polyhedral Model.

At the conclusion of this journey, a methodology tailored for application within STPs has been successfully crafted. This methodology underwent rigorous testing and validation involving potential end-users, particularly STP managers, and experts well-versed in the original methodology (GEAccounting Association). This adapted methodology equips STPs with the means to estimate SV, expressed in terms of the Social Impact of Economic Activity (SIEA), generated and distributed among principal stakeholders (including employees, suppliers, customers, shareholders, financial entities, public administration, and the retained value within the organisation) by the community of organisations within the STP. Through the utilisation of secondary data analysis, direct engagement with the organizations themselves becomes unnecessary. By leveraging secondary data related to these organizations, we approximate the Social Impact of Economic Activity (SIEA) they generate toward society in monetary terms. In this context, society is represented by the stakeholders for whom this value can be approximated.

It can be asserted that the results derived from this thesis showcase innovation in both research domains: Stakeholder Accounting, where the emphasis lies on analysing SV generated by organizations, and the realm of STPs. Our work extends the application of SV analysis into a new field, specifically STPs, and simultaneously introduces a fresh perspective within STPs - the analysis of SV concerning stakeholders. The methodology, as conceived, offers significant flexibility, including its potential application in territorial analysis, as outlined in *Chapter 4.1.2.1*.

To arrive at these assertions, a systematic exploration of all five sub-research questions was conducted, aligning them with the five primary objectives crucial for addressing the overarching research question. Achieving these objectives was made possible through substantial collaborations established during this doctoral research, as detailed in the methodology chapter (Chapter 3). Key among these collaborations were partnerships with representatives from both research domains: GEAccounting, which provided methodological support for adapting the methodology, and IASP, which offered substantial assistance in practical applications within the STP ecosystem. Collaborations with the STPs themselves, the primary focus of this methodology's application, were instrumental. These collaborations not only added depth and complexity to the research but also facilitated a stepwise validation process for the developments presented in this work.

Certainly, it can be asserted that the publication of the developed methodology in a peer-reviewed journal (Blazquez et al., 2020) has played a pivotal role in this research. This publication significantly bolstered the credibility and robustness of the methodology, enabling its expansion to a broader European study. This extension allowed for the validation of the methodology using a more extensive sample of STPs, encompassing 14 STPs across six different nations, and consequently, a larger pool of organizations (i.e., 799 organizations employing 26,000 individuals within the STPs). This final crucial step has enabled both the validation of the methodology's suitability for its original purpose, which involves estimating SV-SIEA based on secondary data. This aspect constitutes one of its distinctive feature. Additionally, it has brought to light any potential critical aspects, whether related to the methodology's conceptualisation or its application context. These aspects must be taken into consideration when interpreting the obtained results and when applying this stakeholder-centric methodology within specific contexts, such as European STPs.

In summary, exploration was conducted to develop a valid and satisfactory response to the five sub-research questions, thereby achieving the functional objectives to address the principal research question: the development of a valid stakeholder-centric methodology for assessing the SV impact in society of STPs.

Let us revisit the first sub-question: *"How can essential data be accessed and integrated into the adapted model to ensure accurate analysis and evaluation of STPs?"* In this case, the entire methodology was developed, both in terms of procedure and SV-SIEA calculation, to ensure the functional reconstruction of value for identified key stakeholders (including employees, suppliers, customers, shareholders, financial entities, public administration, and the retained value within the organization). On the other hand, the ORBIS platform was identified as a valid database for extracting financial accounting information from organizations, which can then be used to reconstruct SV-SIEA through the calculations specified in the methodology. Through an iterative testing process, the right balance was found between data accessibility and their integration into the calculation. Given the analysis's objective, which is to reconstruct a value estimate, a reasonable equilibrium has been reached between the use of secondary data and the accuracy of the analysis's results. This balance has been tested and validated multiple times during the research process, involving research in methodology (methodological-procedural validity) and the application context (results validity).

Regarding the second question: *"How can the adapted model be standardised to effectively utilize secondary data while remaining adaptable to specific national contexts?"* In this case, considering the objectives and constraints posed by the first question, standardisation efforts were made on the methodology, both in its implementation procedure and SV-SIEA calculations. This standardisation aimed to make it adaptable for use with secondary data from the ORBIS platform, while allowing for data retrieval from various European countries. Using a similar approach, calculations were developed that could be tailored to each country's specific context. To achieve this, the World Bank's "Doing Business Reports" was identified as a valuable tool for adapting calculations based on each country's tax regulations. This aspect was particularly validated through the methodology's application at the European level. The experimentation yielded positive results, as standardisation was highly adaptable. However, some challenges arose in certain countries due to legal regulations related to the publication of corporate accounts, making data retrieval difficult (e.g., in Denmark and the United Kingdom).

Regarding the fourth question: *"How can the use of non-specific data maintain a high degree of accuracy in the analysis of STP performance using the adapted model?"* In this case, extensive work was undertaken. Firstly, the ORBIS database was thoroughly explored to identify accounting entries that were well-suited for reconstructing SV-SIEA. These entries were chosen based on their proximity to the specific values used in the original methodology (the Polyhedral Model) and the completeness of data provided by organizations (in terms of the amount of available data – meaning fewer missing data). Secondly, proxies were utilized to reconstruct values that couldn't be directly extracted from ORBIS (e.g., SV-SIEA for suppliers). In this sense, a reasonable compromise has been reached in this regard to ensure the results are as accurate as possible, even though they remain estimations. The validation of the results obtained using this methodology by the managers of the European STPs participating in the study endorses this conclusion.

Regarding the analysis of STP performance as a community of organisations, certain challenges were encountered when attempting to analyse the entire population of resident organizations. On one hand, the challenge was related to obtaining comprehensive lists with primary data (organizations name, VAT number, number of employees established in STP organizations facilities), and on the other, there were difficulties in retrieving data from the ORBIS platform in some countries. These issues can be overcome, as STP managers can establish more efficient systems for primary data retrieval, and alternative country-specific databases can be explored for data extraction. However, as discussed in previous *Chapters 4.1* and *4.2*, it should be noted that for certain categories of organizations (e.g., startups, new entrepreneurial initiatives, foundations, and associations), it remains challenging to obtain data. Despite these difficulties, the methodology allowed for the reconstruction of SV-SIEA for over 80% of the population in some STPs.

Concerning the fifth and final question: *"How can the adapted model be validated with potential users to ensure its usefulness and effectiveness as an analytical tool for STPs?"* Given the inherently practical nature of this research, extensive discussions took place with the principal stakeholders throughout the methodology's development, testing, and validation phases. These key stakeholders are the STP managers, and they were actively engaged from the outset of the development phase, displaying early interest in a methodology capable of illustrating the societal impact of their STPs.

During the evaluation stages of the methodology, particularly when expanding the study to a European scale, there were further opportunities for interaction with STP managers. As elucidated in Chapter 4.2.2, their enthusiasm for the potential utility of implementing the methodology became manifest. As outlined in Chapter 2, the environments in which they operate increasingly require them to furnish information regarding their social contributions to various stakeholders (e.g., local institutions, public and private funding entities, etc.). The methodology developed in this thesis is primed to transform into a practical tool for STP managers, backed by both intent and solid scientific foundations for its adoption.

In conclusion, it can be asserted that the developed methodology is well-poised to evolve into a valuable tool for STP managers. The intentions of some project partners to embark on this journey align with the necessary scientific prerequisites. It is sincerely hoped that this research will continue to progress in multiple directions, encompassing both academic and practical domains regarding STPs' management and social value generation.

References

Aguado, R. (2007). *Economía y política de la innovación empresarial. El caso de la Red Vasca de Parques Tecnológicos*.

Aguado, R., Alcañiz, L., & Retolaza, J. L. (2015). A new role for the firm incorporating sustainability and human dignity. Conceptualization and measurement. *Human Systems Management*, *34*(1), 43–56. https://doi.org/10.3233/HSM-150829

Aguado, R., & Eizaguirre, A. (2020). Virtuous Cycles in Humanistic Management. In *Contributions to Management Science*. https://doi.org/10.1007/978-3-030-29426-7

Aguado, R., & Retolaza, J. L. (2020). Humanistic management in the corporation: From self-interest to dignity and well-being. In *Contributions to Management Science* (pp. 151–161). Springer. https://doi.org/10.1007/978-3-030-29426-7_9

Aguado, R., Retolaza, J.-L., & Alcañiz, L. (2019). Action Research Training Experience (ARTE) para la formación de directivos. In A. Eizaguirre, B. María José, A. Arantza, & N. Sáenz Bilbao (Eds.), *Espacios de aprendizaje en Educación Superior* (pp. 187–198). https://dialnet.unirioja.es/servlet/articulo?codigo=7180593

Aguado, R., Retolaza, J.-L., & Alcañiz, L. (2021). Social accounting in organizations of the social economy: The ARTE program applied to the CLADE Group | Contabilidad social en organizaciones de la economía social: El programa ARTE aplicado al Grupo CLADE. *REVESCO Revista de Estudios Cooperativos*, *138*(138), 1–13.

Albahari, A., Barge-Gil, A., Pérez-Canto, S., & Landoni, P. (2022). The effect of science and technology parks on tenant firms: a literature review. In *The Journal of Technology Transfer* (Issue 0123456789). Springer US. https://doi.org/10.1007/s10961-022-09949-7

Albahari, A., Barge-Gil, A., Pérez-Canto, S., & Modrego, A. (2018). The influence of Science and Technology Park characteristics on firms' innovation results. *Papers in Regional Science*, *97*(2), 253–279. https://doi.org/10.1111/pirs.12253

Albahari, A., Catalano, G., & Landoni, P. (2013). Evaluation of national science park systems: a theoretical framework and its application to the Italian and Spanish systems. *Technology Analysis and Strategic Management*, *25*(5), 599–614. https://doi.org/10.1080/09537325.2013.785508

Albahari, A., Klofsten, M., & Rubio-Romero, J. C. (2019). Science and Technology Parks: a study of value creation for park tenants. *Journal of Technology Transfer*, *44*(4), 1256–1272. https://doi.org/10.1007/s10961-018-9661-9

Alcaniz, L., Aguado, R., & Retolaza, J. L. (2020). New business models: Beyond the shareholder approach. In *Revista Brasileira de Gestao de Negocios* (Vol. 22, Issue 1, pp. 48–64). https://doi.org/10.7819/rbgn.v22i1.4035

Al-Kfairy, M., Khaddaj, S., & Mellor, R. B. (2020). Evaluating the effect of organizational architecture in developing science and technology parks under differing innovation environments. *Simulation Modelling Practice and Theory*, *100*(July 2019), 102036. https://doi.org/10.1016/j.simpat.2019.102036

Almeida, A., Afonso, Ó., & Silva, M. R. (2020). Panacea or Illusion: An Empirical Analysis of European Science Parks in the Case of Follower Regions. *Journal of Innovation Economics & Management*, *n° 31*(1), 155–194. https://doi.org/10.3917/jie.pr1.0060

Amaral, M. G., da Hora, A. L. F., & Schocair, M. M. (2022). Assessment of science, technology and innovation parks based on helices actors linkages. *International Journal of Innovation Science*. https://doi.org/10.1108/IJIS-11-2020-0254

Andrades Peña, J., & Jorge, M. L. (2019). Examining the amount of mandatory non-financial information disclosed by Spanish state-owned enterprises and its potential influential variables. *Meditari Accountancy Research*, *27*(4). https://doi.org/10.1108/MEDAR-05-2018-0343

Anunciação, P. F., Santos, J. R., & Rocha, F. R. (2011). The complete ethics chain of value: From social and ethical principles to the role of the official auditing and accounting revision entities. *International Journal of Management and Enterprise Development*, *10*(2–3). https://doi.org/10.1504/IJMED.2011.041551

Argandoña, A. (2012). Stakeholder Theory and Value Creation. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1947317

Austin, P. C. (2017). A tutorial on multilevel survival analysis: Methods, models and applications. *International Statistical Review*, *85*(2). https://doi.org/10.1111/insr.12214

Ayuso, S., Carbonell, X., & Serradell, L. (2022). Assessing universities' social sustainability: accounting for stakeholder value. *International Journal of Sustainability in Higher Education*, *23*(2). https://doi.org/10.1108/IJSHE-12-2020-0509

Ayuso, S., Sánchez, P., Retolaza, J. L., & Figueras-Maz, M. (2020). Social value analysis: the case of Pompeu Fabra University. *Sustainability Accounting, Management and Policy Journal*, *11*(1), 233–252. https://doi.org/10.1108/SAMPJ-11-2018-0307

Barba-Sánchez, V., Milán, B. C., Milán, M. J. C., & Rivera, G. S. (2021). Approach to the Social Value of a Rural Cluster School: the Case of RCS "Sierra de Alcaraz." *CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa*, *101*. https://doi.org/10.7203/CIRIEC-E.101.18098

Barba-Sánchez, V., Salinero, Y., & Estévez, P. J. (2021). Monetising the social value of inclusive entrepreneurship: the case of the Abono Café social economy enterprise. *CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa*, *101*. https://doi.org/10.7203/Ciriec-E.101.18158

Barraket, J., & Yousefpour, N. (2013). Evaluation and Social Impact Measurement Amongst Small to Medium Social Enterprises: Process, Purpose and Value. *Australian Journal of Public Administration*, *72*(4). https://doi.org/10.1111/1467-8500.12042

Bernal, R., San-Jose, L., & Retolaza, J. L. (2019). Improvement actions for a more social and sustainable public procurement: A Delphi analysis. *Sustainability (Switzerland)*, *11*(15). https://doi.org/10.3390/su11154069

Bigliardi, B., Dormio, A. I., Nosella, A., & Petroni, G. (2006). Assessing science parks' performances: Directions from selected Italian case studies. *Technovation*, *26*(4), 489–505. https://doi.org/10.1016/j.technovation.2005.01.002

Blázquez, V., Aguado, R., & Retolaza, J. L. (2020). Science and technology parks: measuring their contribution to society through social accounting. *CIRIEC-Es-Paña, Revista de Economía Pública, Social y Cooperativa*, *100*, 277–306. https://doi.org/10.7203/CIRIEC-E.100.18169

Bolton, P., & Dewatripont, M. (1994). The firm as a communication network. *Quarterly Journal of Economics*, *109*(4). https://doi.org/10.2307/2118349

Booth, W. C., Colomb, G. G., & Williams, J. M. (1997). The Craft of Research. *College Composition and Communication*, *48*(1). https://doi.org/10.2307/358777

Brown, R. (2004). Consideration of the origin of Herbert Simon's theory of "satisficing" (1933-1947). In *Management Decision* (Vol. 42, Issue 10). https://doi.org/10.1108/00251740410568944

Bruneel, J., Ratinho, T., Clarysse, B., & Groen, A. (2012). The evolution of Business incubators: Comparing demand and supply of business incubation services across different incubator generations. *Technovation*, *32*(2), 110–121. https://doi.org/10.1016/j.technovation.2011.11.003

Bryman, A., & Bell, E. (2015). Business research methods: Oxford University Press. *American Journal of Sociology*.

Cadorin, E., Johansson, S. G., & Klofsten, M. (2017). Future developments for science parks: Attracting and developing talent. *Industry and Higher Education*, *31*(3), 156–167. https://doi.org/10.1177/0950422217700995

Cadorin, E., Klofsten, M., & Löfsten, H. (2021). Science Parks, talent attraction and stakeholder involvement: an international study. *Journal of Technology Transfer*, *46*(1), 1–28. https://doi.org/10.1007/s10961-019-09753-w

Chandra, A., & Chao, C. A. (2016). Country context and university affiliation: A comparative study of business incubation in the United States and Brazil. *Journal of Technology Management and Innovation*, *11*(2). https://doi.org/10.4067/S0718-27242016000200004

Chou, T. L. (2007). The science park and the governance challenge of the movement of the high-tech urban region towards polycentricity: The Hsinchu science-based industrial park. *Environment and Planning A*, *39*(6). https://doi.org/10.1068/a38200

Coase, R. H. (1937). The Nature of the Firm. In *New Series* (Vol. 4, Issue 16).

Coase, R. H. (1960). The Problem of Social Cost. *The Journal of Law and Economics*, *3*. https://doi.org/10.1086/466560

Correia, A. M. M., Veiga, C. P. da, Senff, C. O., & Duclós, L. C. (2021). Analysis of the Maturity Level of Business Processes for Science and Technology Parks. *SAGE Open*, *11*(3). https://doi.org/10.1177/21582440211037303

Corrocher, N., Lamperti, F., & Mavilia, R. (2019). Do science parks sustain or trigger innovation? Empirical evidence from Italy. *Technological Forecasting and Social Change*, *147*(July), 140–151. https://doi.org/10.1016/j.techfore.2019.07.005

Corsaro, D., & Cantù, C. (2015). Actors' heterogeneity and the context of interaction in affecting innovation networks. *Journal of Business and Industrial Marketing*, *30*(3–4), 246–258. https://doi.org/10.1108/JBIM-12-2014-0249

Costas, A. (2017). *El final del desconcierto : un nuevo contrato social para que España funcione*. Ediciones Península.

De Leeuw, J., & Meijer, E. (2008). Handbook of multilevel analysis. In *Handbook of Multilevel Analysis*. https://doi.org/10.1007/978-0-387-73186-5

Diez-Vial, I., & Fernández-Olmos, M. (2017). The effect of science and technology parks on a firm's performance: a dynamic approach over time. *Journal of Evolutionary Economics*, *27*(3), 413–434. https://doi.org/10.1007/s00191-016-0481-5

Diez-Vial, I., & Montoro-Sanchez, A. (2017). Research evolution in science parks and incubators: foundations and new trends. *Scientometrics*, *110*, 1243–1272. https://doi.org/10.1007/s11192-016-2218-5

Echanove Franco, A. (2020). Reference framework for the integration of social accounting in the strategic management of social economy enterprises. *CIRIEC-ESPANA REVISTA DE ECONOMIA PUBLICA SOCIAL Y COOPERATIVA*, *100*.

Echevarria, J. (2020). Filosofía de la innovación y valores sociales en las empresas. *ArtefaCToS. Revista de Estudios Sobre La Ciencia y La Tecnología*, *9*(1), 77. https://doi.org/10.14201/art2020917799

Entringer, T. C., & Da Silva, L. L. (2020). Critical success factors in science and technology parks: a bibliographic review and analysis. *Independent Journal of Management & Production*, *11*(2). https://doi.org/10.14807/ijmp.v11i2.1050

Etxezarreta, E., Mendiguren a, J. C. P., Diaz, L., & Errasti, A. (2018). Social value of social cooperatives: Application of the Polyhedral Model to ZABALDUZ S.COOP. *CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa*, *93*, 155–180. https://doi.org/10.7203/CIRIEC-E.93.9953

Etzkowitz, H., & Zhou, C. (2017). Innovation incommensurability and the science park. *R&D Management*, *48*(1), 73–87. https://doi.org/10.1111/radm.12266

Everitt, B., & Hothorn, T. (2011). An Introduction to Applied Multivariate Analysis with R. In *An Introduction to Applied Multivariate Analysis with R*. https://doi.org/10.1007/978-1-4419-9650-3

Finch, W. H., Bolin, J. E., & Kelley, K. (2016). Multilevel Modeling Using R. In *Multilevel Modeling Using R*. https://doi.org/10.1080/00949655.2020.1805564

Freeman, E., & Liedtka, J. (1997). Stakeholder capitalism and the value chain. *European Management Journal*, *15*(3). https://doi.org/10.1016/S0263-2373(97)00008-X

Freeman, R. E. (1984). Strategic Management: A Stakeholder Approach. Pitman: London. In *Business Ethics Quarterly* (Vol. 4, Issue 4).

Freeman, R. E. (1999). Divergent stakeholder theory. *Academy of Management Review*, *24*(2). https://doi.org/10.5465/AMR.1999.1893932

Freeman, R. E., Fairchild, G. B., Venkataraman, S., Mead, J., & Chen, M.-J. (2021). Creating Value for Stakeholders. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1585673

Freeman, R. E., Harrison, J. S., & Wicks, A. C. (2007). Managing for stakeholders: Survival, reputation, and success. In *Managing for Stakeholders: Survival, Reputation, and Success*. https://doi.org/10.5860/choice.45-4474

Freeman, R. E., Martin, E. K., & Parmar, L. B. (2020). *The power of and : responsible business without trade-offs*. Columbia University Press.

Freeman, R. E., Retolaza, J. L., & San-Jose, L. (2020). Stakeholder Accounting: hacia un modelo ampliado de contabilidad. *CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa*, *100*, 89–114. https://doi.org/10.7203/CIRIEC-E.100.18962

Fukugawa, N. (2006). Science parks in Japan and their value-added contributions to new technology-based firms. *International Journal of Industrial Organization*, *24*(2). https://doi.org/10.1016/j.ijindorg.2005.07.005

Fulgencio, H. (2017). Social value of an innovation ecosystem: the case of Leiden Bioscience Park, The Netherlands. *International Journal of Innovation Science*, *9*(4), 355–373. https://doi.org/10.1108/IJIS-09-2017-0098

Fung, A., Graham, M., & Weil, D. (2007). Full disclosure: The perils and promise of transparency. In *Full Disclosure: The Perils and Promise of Transparency*. https://doi.org/10.1017/CBO9780511510533

Gartzia, L., & Retolaza, J. L. (2019). *Cuantificación en unidades monetarias del valor social del género en las organizaciones.*

GEAccounting. (2022). *Manual de contabilidad social - Cómo monetizar el valor social generado por una organización*. Alternativas Economica.

Gentle, J. E., Kaufman, L., & Rousseuw, P. J. (1991). Finding Groups in Data: An Introduction to Cluster Analysis. *Biometrics*, *47*(2). https://doi.org/10.2307/2532178

Germain, E., Klofsten, M., Löfsten, H., & Mian, S. (2022). Science parks as key players in entrepreneurial ecosystems. *R&D Management*. https://doi.org/10.1111/radm.12536

Gomes, S., Lopes, J. M., Ferreira, L., & Oliveira, J. (2022). Science and Technology Parks: Opening the Pandora's Box of Regional Development. *Journal of the Knowledge Economy*, *0123456789*. https://doi.org/10.1007/s13132-022-00995-y

Gonzalo, J. A., & Perez, J. (2017). Una propuesta de normalización relativa al valor añadido como medida alternativa de rendimiento empresarial. *Especial XIX Congreso Internacional AECA*, 35–39.

Gower, S. M., Harris, F. C., & Cooper, P. A. (1996). Assessing the management of science parks in the UK. *Property Management*, *14*(1). https://doi.org/10.1108/02637479610106738

Groth, J. C., Byers, S. S., & Bogert, J. D. (1996). Capital, economic returns and the creation of value. *Management Decision*, *34*(6). https://doi.org/10.1108/00251749610121452

Guadix, J., Carrillo-Castrillo, J., Onieva, L., & Navascués, J. (2016). Success variables in science and technology parks. *Journal of Business Research*. https://doi.org/10.1016/j.jbusres.2016.04.045

Gwebu, K. L., Sohl, J., & Wang, J. (2019). Differential performance of science park firms: an integrative model. *Small Business Economics*, *52*(1), 193–211. https://doi.org/10.1007/s11187-018-0025-5

Harrison, J. S., Phillips, R. A., & Freeman, R. E. (2020). On the 2019 Business Roundtable "Statement on the Purpose of a Corporation." *Journal of Management*, *46*(7), 1223–1237. https://doi.org/10.1177/0149206319892669

Hennig, C., Meila, M., Murtagh, F., & Rocci, R. (2015). Handbook of cluster analysis. In *Handbook of Cluster Analysis*. https://doi.org/10.1201/b19706

Henriques, I. C., Sobreiro, V. A., & Kimura, H. (2018). Science and technology park: Future challenges. *Technology in Society*, *53*, 144–160. https://doi.org/10.1016/j.techsoc.2018.01.009

Hobbs, K. G., Link, A. N., & Scott, J. T. (2017). Science and technology parks: an annotated and analytical literature review. *The Journal of Technology Transfer*, *42*(4), 957–976. https://doi.org/10.1007/s10961-016-9522-3

Hommen, L., Doloreux, D., & Larsson, E. (2006). Emergence and growth of Mjärdevi Science Park in Linköping, Sweden. *European Planning Studies*, *14*(10), 1331–1361. https://doi.org/10.1080/09654310600852555

Hörisch, J., Freeman, R. E., & Schaltegger, S. (2014). Applying Stakeholder Theory in Sustainability Management: Links, Similarities, Dissimilarities, and a Conceptual Framework. *Organization and Environment*, *27*(4), 328–346. https://doi.org/10.1177/1086026614535786

Hörisch, J., Schaltegger, S., & Freeman, R. E. (2020). Integrating stakeholder theory and sustainability accounting: A conceptual synthesis. *Journal of Cleaner Production*, *275*. https://doi.org/10.1016/j.jclepro.2020.124097

Hox, J. J. (2010). Multilevel analysis: Techniques and applications: Second edition. In *Multilevel Analysis: Techniques and Applications: Second Edition*. https://doi.org/10.4324/9780203852279

IASP - International Association of Science Parks and Areas of Innovation. (2018). *IASP - General Survey*.

IASP - International Association of Science Parks and Areas of Innovation. (2023). *Definitions - IASP*. https://www.iasp.ws/our-industry/definitions

Jensen, M. (2001). Value maximisation, stakeholder theory, and the corporate objective function. *European Financial Management*, *7*(3). https://doi.org/10.1111/1468-036X.00158

Jimenez-Zarco, A. I., Cerdan-Chiscano, M., & Torrent-Sellens, J. (2013). Challenges and Opportunities in the Management of Science Parks: design of a tool based on the analysis of resident companies. *Review of Business Management*. https://doi.org/10.7819/rbgn.v15i48.1503

Jones, T. M., & Wicks, A. C. (1999). Convergent stakeholder theory. *Academy of Management Review*, *24*(2). https://doi.org/10.5465/AMR.1999.1893929

Kassambara, A. (2017). Cluster Analysis in R - Unsupervised machine learning. *Statistical Tools for High-Throughput Data Analysis*.

Kim, H.-Y., & Jung, C. M. (2010). Does a Technology Incubator Work in the Regional Economy? Evidence from South Korea. *Journal of Urban Planning and Development*, *136*(3). https://doi.org/10.1061/(asce)up.1943-5444.0000019

Kosmol, J., & Kotra, J. (2013). Introduction to Science and Technology Park Activity - Case Study That Focuses on Complementary Support. *World Technopolis Review*, *1*(4). https://doi.org/10.7165/wtr2012.1.4.256

Lamperti, F., Mavilia, R., & Castellini, S. (2017). The role of Science Parks: a puzzle of growth, innovation and R&D investments. *Journal of Technology Transfer*, *42*(1), 158–183. https://doi.org/10.1007/s10961-015-9455-2

Latorre, P. M., Hermoso, R., & Rubio, M. A. (2017). A novel network-based analysis to measure efficiency in science and technology parks: the ISA framework approach. *Journal of Technology Transfer*, *42*(6), 1255–1275. https://doi.org/10.1007/s10961-017-9585-9

Lazcano, L., San-Jose, L., & Retolaza, J. L. (2019). Social Accounting in the Social Economy: A Case Study of Monetizing Social Value. In *Modernization and Accountability in the Social Economy Sector* (pp. 132–150). IGI Global. https://doi.org/10.4018/978-1-5225-8482-7.ch008

Lazkano, L., & Beraza, A. (2019). Social accounting for sustainability: A study in the social economy. *Sustainability (Switzerland)*, *11*(24). https://doi.org/10.3390/SU11246894

Lazkano, L., Beraza, A., & San-Jose, L. (2020). Determining success factors in the implementation of social accounting. *CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa*, *100*. https://doi.org/10.7203/CIRIEC-E.100.18195

Lazkano, L., & San José, L. (2020). Monetización del valor social: el caso Clade. *Gizarte Ekonomiaren Euskal Aldizkaria - Revista Vasca de Economía Social*, *16*, 103–127. https://doi.org/10.1387/reves.20903

Lecluyse, L., & Knockaert, M. (2020). Disentangling satisfaction of tenants on science parks: A multiple case study in Belgium. *Technovation*, *98*. https://doi.org/10.1016/j.technovation.2020.102156

Lecluyse, L., & Knockaert, M. (2021). Science parks in Europe: a comparison of science park characteristics and activities in Belgium, Spain and Denmark. In *Handbook of Research on Business and Technology Incubation and Acceleration*. https://doi.org/10.4337/9781788974783.00021

Lecluyse, L., Knockaert, M., & Spithoven, A. (2019). The contribution of science parks: a literature review and future research agenda. *Journal of Technology Transfer*, *44*(2), 559–595. https://doi.org/10.1007/s10961-018-09712-x

Leite, T. Q., Silva, A. L., Silva, J. R., & Silva, S. E. (2022). A Multilevel Analysis of the Interaction Between Science Parks and External Agents: a Study in Brazil and Portugal. In *Journal of the Knowledge Economy* (Issue 0123456789). Springer US. https://doi.org/10.1007/s13132-021-00867-x

Liberati, D., Marinucci, M., & Tanzi, G. M. (2016). Science and technology parks in Italy: main features and analysis of their effects on the firms hosted. *Journal of Technology Transfer*, *41*(4), 694–729. https://doi.org/10.1007/s10961-015-9397-8

Löfsten, H., Klofsten, M., & Cadorin, E. (2020). Science Parks and talent attraction management: university students as a strategic resource for innovation and entrepreneurship. *European Planning Studies*, *28*(12), 2465–2488. https://doi.org/10.1080/09654313.2020.1722986

Löfsten, H., & Lindelöf, P. (2002). Science Parks and the Growth of New Technology-Based Firms - Academic-industry links, innovation and markets. *Research Policy*, *30*(3), 143–154.

Löfsten, H., & Lindelöf, P. (2005). R&D networks and product innovation patterns - Academic and non-academic new technology-based firms on Science Parks. *Technovation*, *25*(9). https://doi.org/10.1016/j.technovation.2004.02.007

Lund, Ebba., Addarii, Filippo., Schmitz, Hardy., Kokorotsikos, Paris., & Bush, Robert. (2020). *Public-Private Partnerships for Science and Technology Parks : utilising PPPs and related models for the development and operation of STPs and innovation districts*. European Commission. Joint Research Centre. https://doi.org/10.2760/3057

Lyra, R. M. M., & Almeida, M. F. L. F. L. (2018). Measuring the performance of Science and Technology Parks: a proposal of a multidimensional model Related content Measuring the performance of Science and Technology Parks: a proposal of a multidimensional model. *Journal of Physics: Conf. Series 1044 (2018)*, 12042. https://doi.org/10.1088/1742-6596/1044/1/012042

Maguregui, M. L., Corral, J. L., & Elechiguerra, C. A. (2019). La identificación de los grupos de interés de las entidades sin fines de lucro en la emisión de información transparente. *REVESCO. Revista de Estudios Cooperativos*, *131*. https://doi.org/10.5209/reve.62814

Martínez-Cañas, R., & Ruíz-Palomino, P. (2011). 25 Years Of Science Parks In Spain: Towards A New Model Of Development. *Review of Business Information Systems*, *15*(5), 17–24.

Marx, K. (1844). *Economic and philosophical manuscripts* (Early Writings.).

Mathur, V. N., Price, A. D. F., & Austin, S. (2008). Conceptualizing stakeholder engagement in the context of sustainability and its assessment. *Construction Management and Economics*, *26*(6). https://doi.org/10.1080/01446190802061233

Mayer, C. (2021). The Future of the Corporation and the Economics of Purpose. *Journal of Management Studies*, *58*(3). https://doi.org/10.1111/joms.12660

Melé, D. (2012). The Firm as a “Community of Persons”: A Pillar of Humanistic Business Ethos. *Journal of Business Ethics*, *106*(1). https://doi.org/10.1007/s10551-011-1051-2

Mendizabal, X., & García, J. D. (2021). Social value measurement in basketball clubs: is it possible? *CIRIEC-Espana Revista de Economia Publica, Social y Cooperativa*, *101*. https://doi.org/10.7203/CIRIEC-E.101.18384

Mendizabal, X., San-Jose, L., & García, J. D. (2022). Monetizing social value in sports clubs. *Sport, Business and Management: An International Journal*, *12*(5), 560–579. https://doi.org/10.1108/SBM-09-2021-0107

Meseguer-Martinez, A., Popa, S., & Soto-Acosta, P. (2020). The instrumentation of science parks: an integrative framework of enabling factors. *Journal of Intellectual Capital*. https://doi.org/10.1108/JIC-11-2019-0264

Mineiro, A. A. da C., Arantes, R. de C., Vieira, K. C., Castro, C. C., Carvalho, E. G., & Amaral, M. G. do. (2023). Business practices for strengthening the quadruple and quintuple helix: a study using structural equation modeling. *International Journal of Innovation Science*, *15*(1). https://doi.org/10.1108/IJIS-02-2021-0049

Mitchell, R. K., Van Buren, H. J., Greenwood, M., & Freeman, R. E. (2015). Stakeholder Inclusion and Accounting for Stakeholders. *Journal of Management Studies*, *52*(7). https://doi.org/10.1111/joms.12151

Mitnick, B. M. (2000). Commitment, Revelation, and the Testaments of Belief: The Metrics of Measurement of Corporate Social Performance. *Business & Society*, *39*(4). https://doi.org/10.1177/000765030003900405

Mora-Valentín, E. M., Ortiz-de-Urbina-Criado, M., & Nájera-Sánchez, J. J. (2018). Mapping the conceptual structure of science and technology parks. *Journal of Technology Transfer*, *43*(5), 1410–1435. https://doi.org/10.1007/s10961-018-9654-8

Moyano-Fuentes, J., Rodríguez-Martínez, A., & Jiménez-Delgado, J. J. (2019). Territorial agglomerations and corporate social responsibility: The role of science and technology parks. *International Journal of Entrepreneurship and Innovation Management*, *23*(2). https://doi.org/10.1504/IJEIM.2019.098152

Murphy, R. O., & Ackermann, K. A. (2014). Social Value Orientation: Theoretical and Measurement Issues in the Study of Social Preferences. *Personality and Social Psychology Review*, *18*(1). https://doi.org/10.1177/1088868313501745

Ng, W. K. B., Appel-Meulenbroek, R., Cloodt, M., & Arentze, T. (2019). Towards a segmentation of science parks: A typology study on science parks in Europe. *Research Policy*, *48*(3), 719–732. https://doi.org/10.1016/j.respol.2018.11.004

Ng, W. K. B., Appel-Meulenbroek, R., Cloodt, M., & Arentze, T. (2021). Perceptual measures of science parks: Tenant firms' associations between science park attributes and benefits. *Technological Forecasting and Social Change*, *163*(September 2020), 120408. https://doi.org/10.1016/j.techfore.2020.120408

Ng, W. K. B., Appel-Meulenbroek, R., Cloodt, M., & Arentze, T. (2022). Exploring science park location choice: A stated choice experiment among Dutch technology-based firms. *Technological Forecasting and Social Change*, *182*. https://doi.org/10.1016/j.techfore.2022.121796

Ng, W. K. B., Junker, R., Appel-Meulenbroek, R., Cloodt, M., & Arentze, T. (2020). Perceived benefits of science park attributes among park tenants in the Netherlands. *Journal of Technology Transfer*, *45*(4), 1196–1227. https://doi.org/10.1007/s10961-019-09744-x

Nieth, L., & Benneworth, P. (2020). Challenges of knowledge combination in strategic regional innovation processes - the Creative Science Park in Aveiro. *European Planning Studies*, *28*(10), 1922–1940. https://doi.org/10.1080/09654313.2019.1699908

Parmar, B. L., Freeman, R. E., Harrison, J. S., Wicks, A. C., Purnell, L., de Colle, S., & Edward, R. (2010). Stakeholder Theory: The State of the Art. *Academy of Management Annals*, *4*(1), 403–445. https://doi.org/10.5465/19416520.2010.495581

Parmar, B., Wicks, A. C., & Freeman, R. E. (2022). Stakeholder Management & The Value of Human-Centred Corporate Objectives. *Journal of Management Studies*, *59*(2), 569–582. https://doi.org/10.1111/joms.12716

Polat, G. (2022). A dynamic business model for Turkish techno parks: looking through the lenses of service perspective and stakeholder theory. *Journal of Science and Technology Policy Management*, *13*(2), 238–266. https://doi.org/10.1108/JSTPM-12-2020-0170

Poonjan, A., & Tanner, A. N. (2020). The role of regional contextual factors for science and technology parks: a conceptual framework. *European Planning Studies*, *28*(2), 400–420. https://doi.org/10.1080/09654313.2019.1679093

Poonjan, A., Tanner, A. N., & Andersen, P. D. (2020). How regional factors influence the performance of science and technology parks: a comparative analysis of regional science parks in Thailand. *Asian Journal of Technology Innovation*, *0*(0), 1–23. https://doi.org/10.1080/19761597.2020.1858718

Reason, P., & Bradbury, H. (2006). Handbook of Action Research. *Participative Inquiry and Practice London*.

Retolaza, J. L., & San-Jose, L. (2011). *Social economy and stakeholder theory, an integrative framework for socialization of the capitalism*. www.ciriec.eswww.ciriec-revistaeconomia.es

Retolaza, J. L., & San-Jose, L. (2021). Understanding Social Accounting Based on Evidence. *SAGE Open*, *11*(2). https://doi.org/10.1177/21582440211003865

Retolaza, J. L., & San-Jose, L. (2022). Is It Possible to Monetarily Quantify the Emotional Value Transferred by Companies and Organizations ? An Emotional Accounting Proposal. *Frontiers in Psychology*, *12*(January), 1–10. https://doi.org/10.3389/fpsyg.2021.805920

Retolaza, J. L., San-Jose, L., & Aguado, R. (2016). The role of shapeholders as a link between a firm and non-stakeholders: The pursuit of an economy for the common good based on stakeholder theory. *Developments in Corporate Governance and Responsibility*, *10*. https://doi.org/10.1108/S2043-052320160000010003

Retolaza, J. L., San-Jose, L., & Ruiz-Roqueñi, M. (2014). Ontological Stakeholder View: An Innovative Proposition. *Global Business Review*, *15*(1), 25–36. https://doi.org/10.1177/0972150913515590

Retolaza, J. L., San-Jose, L., & Ruíz-Roqueñi, M. (2016a). *Polyhedral Model: Social Value Model for Stakeholders* (pp. 37–51). Springer, Cham. https://doi.org/10.1007/978-3-319-13377-5_6

Retolaza, J. L., San-Jose, L., & Ruíz-Roqueñi, M. (2016b). *Process Model Analysis and Calculation: Spoly*. https://doi.org/10.1007/978-3-319-13377-5_7

Retolaza, J. L., San-Jose, L., Ruiz-Roqueñi, M., Araujo, A., Aguado, R., Urionabarrenetxea, S., García-Merino, D., & Alcañiz González, L. (2015). *Incorporando el valor social en las licitaciones públicas: un modelo integral*. *85*, 55–82. www.ciriec.eswww.ciriec-revistaeconomia.es

Retolaza, J.-L., & San-Jose, L. (2018). Contabilidad Social para el Bien Común. *Revista de Responsabilidad Social de La Empresa*, *29*, 95–122. https://dialnet.unirioja.es/servlet/articulo?codigo=6527388

Retolaza, J.-L., San-Jose, L., & Freeman, R. E. (2022). How do organizations generate and distribute value? Stakeholder value as the aim of the new business narrative [NBN] and stakeholder accounting [SA] as an information tool. *Boletín De Estudios Económicos*, *76*(232), 37–50. https://doi.org/https://doi.org/10.18543/bee.2240

Retolaza, J.-L., San-Jose, L., & Ruiz-Roqueñi, M. (2015). Monetarizing the social value: theory and evidence. *CIRIEC-España, Revista de Economía Pública, Social y Cooperativa*, *83*, 43–62. www.ciriec.eswww.ciriec-revistaeconomia.es

Retolaza, J.-L., San-Jose, L., & Ruiz-Roqueñi, M. (2016). *Social Accounting for Sustainability: Monetizing the Social Value*. Springer New York LLC.

Ribeiro, J., Higuchi, A., Bronzo, M., Veiga, R., & De Faria, A. (2016). A framework for the strategic management of science & technology parks. *Journal of Technology Management and Innovation*, *11*(4). https://doi.org/10.4067/S0718-27242016000400011

Ribeiro, J., Ladeira, M., De Faria, A., & Barbosa, M. (2021). A reference model for science and technology parks strategic performance management: An emerging economy perspective. *Journal of Engineering and Technology Management*, *59*(November 2019), 101612. https://doi.org/10.1016/j.jengtecman.2021.101612

Ricardo Martínez-Cañas. (2011). A literature review of the effect of science and technology parks on firm performance: A new model of value creation through social capital. *AFRICAN JOURNAL OF BUSINESS MANAGEMENT*, *5*(30). https://doi.org/10.5897/ajbm11.768

Robinson, S., & Stubberud, H. A. (2014). Business incubators: What services do business owners really use? *International Journal of Entrepreneurship*, *18*.

Ruiz-Roqueni, M. (2020). Quantification of Emotional Value. The case of Union of Agricultural Cooperatives of Navarra (UCAN). *CIRIEC-ESPANA REVISTA DE ECONOMIA PUBLICA SOCIAL Y COOPERATIVA*, *100*.

Sampaio Filho, M. C., & Nascimento-Santos, J. (2017). Key features of governance in brazilian science and technology parks. *Revista Ibero-Americana de Estratégia*, *16*(3). https://doi.org/10.5585/ijsm.v16i3.2528

San-Jose, L., Garcia-Merino, J. D., & Retolaza, J. L. (2022). Social value in the orange economy: social accounting applied to museums. *Museum Management and Curatorship*, *38*(3), 231–253. https://doi.org/10.1080/09647775.2021.2023901

San-Jose, L., & Retolaza, J. L. (2012). Participation of stakeholders in corporate governance: Foundation ontological and methodological proposal. *Universitas Psychologica*, *11*(2). https://doi.org/10.11144/javeriana.upsy11-2.psgc

San-Jose, L., & Retolaza, J. L. (2022). *Monetizando el valor social en la economía naranja: El caso de los museos vascos.* (ESIC). ESIC.

San-Jose, L., Retolaza, J.-L., & Freeman, R. E. (2017). Stakeholder Engagement at Extanobe: A Case Study of the New Story of Business. In R. E. Freeman, J. Kujala, & S. Sachs (Eds.), *Stakeholder Engagement: Clinical Research Cases* (Vol. 46, pp. 339–367). Springer International Publishing AG. https://doi.org/10.1007/978-3-319-62785-4

Schmidt, S., & Balestrin, A. (2015). Brazilian incubators and science parks' resources and R&D collaboration. *Journal of Technology Management and Innovation*, *10*(3). https://doi.org/10.4067/S0718-27242015000300004

Schneider, T., & Sachs, S. (2017). The Impact of Stakeholder Identities on Value Creation in Issue-Based Stakeholder Networks. *Journal of Business Ethics*, *144*(1). https://doi.org/10.1007/s10551-015-2845-4

Serafeim, G. (2020). Social-impact efforts that create real value. *Harvard Business Review*.

Skowron-Grabowska, B. (2020). Management of science and technology parks in terms of innovative aspects. *Management and Production Engineering Review*, *11*(4), 56–67. https://doi.org/10.24425/mper.2020.136120

Smith, A. (1776). An inquiry into the wealth of nations. *Strahan and Cadell, London*.

Soenarso, W. S., Nugraha, D., & Listyaningrum, E. (2013). Development of Science and Technology Park (STP) in Indonesia to Support Innovation-Based Regional Economy: Concept and Early Stage Development. *World Technopolis Review*, *2*(1). https://doi.org/10.7165/wtr2013.2.1.32

Somsuk, N., & Laosirihongthong, T. (2014). A fuzzy AHP to prioritize enabling factors for strategic management of university business incubators: Resource-based view. *Technological Forecasting and Social Change*, *85*. https://doi.org/10.1016/j.techfore.2013.08.007

Staszków, M., Puślecki, Ł., & Trapczyński, P. (2017). Development of Science and Technology Parks in Poland: Opportunities for New Modes of Cooperation in the Biopharmaceutical Industry. *Managing Global Transitions*, *15*(1). https://doi.org/10.26493/1854-6935.15.23-41

Steruska, J., Simkova, N., & Pitner, T. (2019). Do science and technology parks improve technology transfer? *Technology in Society*, *59*(April), 101127. https://doi.org/10.1016/j.techsoc.2019.04.003

Strand, R., & Freeman, R. E. (2015). Scandinavian Cooperative Advantage: The Theory and Practice of Stakeholder Engagement in Scandinavia. *Journal of Business Ethics*, *127*(1). https://doi.org/10.1007/s10551-013-1792-1

Sudiana, K., & Hendayani, R. (2020). Performance Management Practices in Science Technology Parks: Case Study of Bandung Techno Park. *Jurnal Manajemen Indonesia*, *20*(1). https://doi.org/10.25124/jmi.v20i1.2797

Tantalo, C., & Priem, R. L. (2016). Value creation through stakeholder synergy. *Strategic Management Journal*, *37*(2). https://doi.org/10.1002/smj.2337

Theeranattapong, T., Pickernell, · D, Simms, · C, & Simms, C. (2020). Systematic literature review paper: the regional innovation system-university-science park nexus. *The Journal of Technology Transfer*. https://doi.org/10.1007/s10961-020-09837-y

Torres-Pruñonosa, J., Raya, J. M., & Dopeso-Fernández, R. (2020). The Economic and Social Value of Science and Technology Parks. The Case of Tecnocampus. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.632600

Ubeda, F., Ortiz-de-Urbina-Criado, M., & Mora-Valentín, E. M. (2019). Do firms located in science and technology parks enhance innovation performance? The effect of absorptive capacity. *Journal of Technology Transfer*, *44*(1), 21–48. https://doi.org/10.1007/s10961-018-9686-0

Urbinati, A., Landoni, P., Cococcioni, F., & De Giudici, L. (2020). Stakeholder management in open innovation projects: a multiple case study analysis. *European Journal of Innovation Management*, *24*(5), 1595–1624. https://doi.org/10.1108/EJIM-03-2020-0076

Vanclay, F., & Esteves, A. M. (2011). New directions in social impact assessment: Conceptual and methodological advances. In *New Directions in Social Impact Assessment: Conceptual and Methodological Advances*. https://doi.org/10.1080/14615517.2012.669330

Vasquez-Urriago, A. R., Barge-Gil, A., & Modrego Rico, A. (2016a). Science and Technology Parks and cooperation for innovation: Empirical evidence from Spain. *Research Policy*, *45*(1), 137–147. https://doi.org/10.1016/j.respol.2015.07.006

Vasquez-Urriago, A. R., Barge-Gil, A., & Modrego Rico, A. (2016b). Which firms benefit more from being located in a Science and Technology Park? Empirical evidence for Spain. *Research Evaluation*, *25*(1), 107–117. https://doi.org/10.1093/reseval/rvv033

Warwick Enterprise Limited, & IASP – International Association of Science Parks and Areas of Innovation. (2017). *THE OWNERSHIP, GOVERNANCE AND MANAGEMENT OF SCIENCE AND TECHNOLOGY PARKS*.

Wood, D. J. (1991). Corporate Social Performance Revisited. In *Source: The Academy of Management Review* (Vol. 16, Issue 4). http://www.jstor.orgURL:http://www.jstor.org/stable/258977http://www.jstor.org/stable/258977?seq=1&cid=pdf-reference#references_tab_contents

World Bank Group. (2020a). *Doing Business 2020 - Economy Profile of Denmark*.

World Bank Group. (2020b). *Doing Business 2020 - Economy Profile of Italy*. 1–69.

World Bank Group. (2020c). *Doing Business 2020 - Economy Profile of Portugal*.

World Bank Group. (2020d). *Doing Business 2020 - Economy Profile of Spain*.

World Bank Group. (2020e). *Doing Business 2020 - Economy Profile of Sweden*.

World Bank Group. (2020f). *Doing Business 2020 - Economy Profile of United Kingdom*.

Xie, K., Song, Y., Zhang, W., Hao, J., Liu, Z., & Chen, Y. (2018). Technological entrepreneurship in science parks: A case study of Wuhan Donghu High-Tech Zone. *Technological Forecasting and Social Change*, *135*. https://doi.org/10.1016/j.techfore.2018.01.021

Yan, M. R., Chien, K. M., Hong, L. Y., & Yang, T. N. (2018). Evaluating the collaborative ecosystem for an innovation-driven economy: A systems analysis and case study of science parks. *Sustainability (Switzerland)*, *10*(3). https://doi.org/10.3390/su10030887

Zhang, Y. (2004). Critical factors for science park management: the North American and European experience. *International Journal of Entrepreneurship and Innovation Management*, *4*(6). https://doi.org/10.1504/IJEIM.2004.005849

Annex 1 – Questionnaire for European STP Analysis

PROJECT – "MONETISING THE SOCIAL VALUE GENERATED BY STPS/AOIS"

INTERVIEW/QUESTIONNAIRE WITH SCIENCE AND TECHNOLOGY PARK MANAGERS

INITIAL NOTES:
- All questions require a short answer.
- Fields marked with * are not compulsory, this space is available for clarification.

SECTION 1 - GENERAL

1. Name of the science and technology park (STP): Click or tap here to enter text.

2. Name and role of the person answering the questionnaire: Click or tap here to enter text.

3. STP year of foundation: Click or tap here to enter text.
   - * Short description of the STP: Click or tap here to enter text.

4. STP size - estimated surface in hectares or square metres:
   - Hectares (for very large STPs): Click or tap here to enter text.
   - Square metres (for STPs located in few buildings): Click or tap here to enter text.

5. STP structure of Business Community (collective of companies and organisations established in the STP) - estimated distribution in percentage:
   - Start-ups or new business initiatives: Click or tap here to enter text.
   - Small and medium-sized enterprises (SMEs): Click or tap here to enter text.
   - Large enterprises (250 employees or more): Click or tap here to enter text.
   - Research & Development Centres: Click or tap here to enter text.

SECTION 2 - GOVERNANCE AND MANAGEMENT SYSTEM

1. STP category: Select an element.
   - * Short description or comment: Click or tap here to enter text.

2. Do the owners of the STP mainly have an active or passive role in its management? Select an element.
   - * Short description, specification or comment: Click or tap here to enter text.

3. STP management staff – number in full-time equivalent: Click or tap here to enter text.
   - * Short description of the main activities carried out: Click or tap here to enter text.

4. How and when (frequency) the STP strategy is usually defined? Which stakeholders are mainly involved? – only short answer is required. Click or tap here to enter text.

5. As STP, do you have any reference model for defining your strategies and setting up your management system / approach? Click or tap here to enter text.

SECTION 3 - STAKEHOLDER MANAGEMENT AND INVOLVEMENT

1. Please list the STP main stakeholders: Click or tap here to enter text.

2. Please list the stakeholders who are actively or "passively" involved in the STP management:
   - Actively involved in activities or decision-making processes: Click or tap here to enter text.
   - Passively involved, i.e. considered but not directly engaged: Click or tap here to enter text.

3. Are there usually regular meetings with key stakeholders? Select an element.
   - * Short description, specification or comment: Click or tap here to enter text.

4. Are there usually regular meetings whit the STP's business community? Select an element.
   - * Short description, specification or comment: Click or tap here to enter text.

5. Is there an association of STP's business community? Select an element.
   - * Short description, specification or comment: Click or tap here to enter text.

6. Does the STP have a formalised relationship with a university? Select an element.
   - * Short description or comment: Click or tap here to enter text.

SECTION 4 -SERVICES TO ESTABLISHED ENTERPRISES/ORGANISATIONS

1. Are there any establishment criteria for companies or organisations? Select an element.
   - Short description: Click or tap here to enter text.

2. Select possible modes of establishment in the STP:
   - Office rental — Select an element.
   - Buildings rental — Select an element.
   - Buying building land — Select an element.
   - Buying offices — Select an element.
   - Buying buildings — Select an element.
   - Other options: — Click or tap here to enter text.
   - * Short description, specification or comment: — Click or tap here to enter text.

3. Is there an incubator or a business accelerator in the STP? Select an element.
   - * Short description, specification or comment: Click or tap here to enter text.

4. For its own business community, does the STP offer shared space (e.g. laboratories, meeting rooms, conference rooms, etc.)? Select an element.
   - Short description, specification or comment: Click or tap here to enter text.

5. For its own business community, does the STP offer business support services? Select an element.
   - Short description, specification or comment: Click or tap here to enter text.

6. For its own business community, does the STP offer training courses? Select an element.
   - Short description, specification or comment: Click or tap here to enter text.

7. Does the STP organise networking events for its business community? Select an element.
   - * Short description, specification or comment: Click or tap here to enter text.

8. Other relevant services provided to business community: Click or tap here to enter text.

9. What are the main reasons for companies/organisations to settle in your STP? Click or tap here to enter text.

Annex 2 – Doing Business Reports – Data for Calculation Adjustments

The necessary information regarding Value Added Tax (VAT) has been sourced from these reports. Additionally, data related to social security and pension contributions, both contributed by employees and by the organisations themselves based on gross salaries, has also been extracted. In cases where specific percentages or exact amounts were available, these were directly applied. However, when dealing with percentage ranges, average values were utilised, as it is not feasible to precisely reconstruct salary-scale-based contribution details for individual employees using the data extracted from ORBIS.

Spain

- Employer paid - Social security contributions: (29.9%) Gross Salary
- Employee paid - Social security contributions: (6.35%) Gross Salary
- Value added tax (VAT): (21%)

Data source:(World Bank Group, 2020d)

Italy

- Employer paid - Social security contributions: (26.56%-31.38%) Gross Salary → Used (28.97%)
- Employer paid – Mandatory contribution for work termination (TFR): (7.61%-7.81%) Gross Salary → Used (7.71%)
- Employee paid - Social security contributions: (9.39%-9.49%) Gross Salary → Used (9.44%)
- Value added tax (VAT): 22%

Data source:(World Bank Group, 2020b)

Denmark

- Payroll tax, paid by employer (Other public social security schemes): Fixed amount (DKK 5,300 per employee) → Converted in Euros
- Other taxes and mandatory social contributions paid by employer (fixed amount (DKK 5,950 per employee) → Converted in Euros
- Employer paid - Social Security Contributions (ATP): Fixed amount (DKK 2,272 per employee) → Converted in Euros
- Social security contributions on employees: (DKK 1,136 fixed amount) → Converted in Euros
- Social pension contributions on employees: (8%) Gross Salary
- Value added tax (VAT) 25%

Data source:(World Bank Group, 2020a)

Portugal

- Withheld contributions: (11%) Gross salary
- Social security contributions: (23.75%) Gross salary
- Value added tax (VAT): (23%)

Data source:(World Bank Group, 2020c)

Sweden

- Payroll tax: (31.42%) Gross Salary
- Employee paid - Labor tax: (7%) Gross Salary
- Value added tax (VAT): (25%)

Data source:(World Bank Group, 2020e)

Annex 3 – European STPs – Results Validation

The following validated results, organised in random order and categorised by country, are presented in sequence:

- UC3M Science Park - LEGANÉS TECNOLÓGICO (Spain)
- Parque Científico y Tecnológico de Tenerife (Spain)
- Parque Científico y Tecnológico de Bizkaia (Spain)
- Parque Científico Tecnológico de Gijón (Spain)
- Parque Tecnolóxico de Galicia (Spain)
- Ciudad Politécnica de la Innovación (Valencia) (Spain)
- OpenZone (Italy)
- ComoNExT (Italy)
- KilometroRosso (Italy)
- Madan Parque de Ciencia (Portugal)
- TECMAIA Perque de Ciencia e Tecnologia de Maia (Portugal)
- Linköping Science Park (Sweden)
- NOVI (Denmark)
- University of Warwick Science Park (United Kingdom)

Methodological Notes: All meetings were recorded with the explicit consent of all participants and are retained for future research purposes. The materials have been shared with all participants. he researchers securely store specific data used for analysis, as well as recordings of meetings and related materials, on university servers. The specific analyses conducted for individual STPs upon request are not included in this current annex.

UC3M Science Park - LEGANÉS TECNOLÓGICO (Spain) - January 28, 2022

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

uc3m Universidad Carlos III de Madrid

LEGANÉS TECNOLÓGICO

Preliminary results: Parque Cientifico UC3M & Parque Tecnológico de Leganés

28/01/2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 11

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

PC UC3M Leganés Tecnológico – Data for Social Value (SV) Calculation

PC UC3M Leganés Tecnológico			
Period of analysis (ORBIS Data): 2017-2019 *STP list of companies: 2021*	Nr. Firms	%	Nr. Workers
Companies Names	101	*100%*	
Companies with VAT Numbers	101	*100%*	
Companies with Nr. Workers	101	*100%*	3'232
ORBIS - VAT Numbers Searched	101	*100%*	
ORBIS - VAT Numbers Found	101	*100%*	
Active companies	100	*99%*	
Data up-to-date	84	*83%*	
Companies with Nr. Workers	75	*74%*	2'615
Complete accountig data	73	*72%*	
Data without distortion	65	*64%*	2'563

(Source: Elaboration by authors)

28/01/2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | University of Applied Sciences and Arts of Southern Switzerland SUPSI

PC UC3M Leganés Tecnológico – Social Value Generation & Distribution

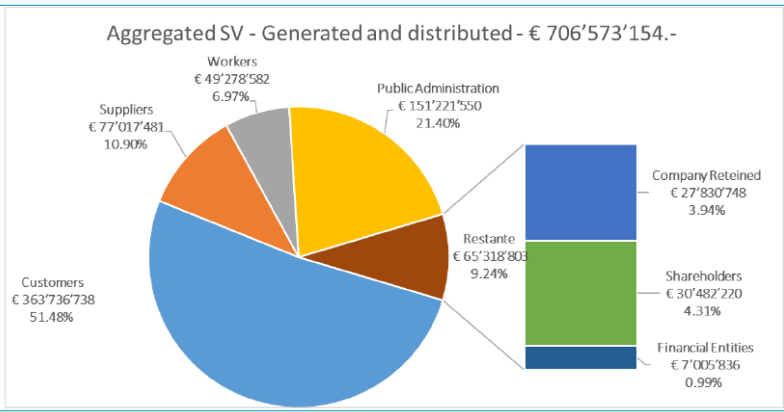
Period of analysis (data source): 2017-2019		PC UC3M Leganés Tecnológico	
Aggregated Social Value		€ 706'573'154	
Number of Companies		65	
Number of Workers		2'563	
Social Value per Worker		€ 275'682	
Social Value per Company		€ 10'870'356	
Distibution		In value:	In percentage:
	Customers	€ 363'736'738	51.48%
	Suppliers	€ 77'017'481	10.90%
	Workers	€ 49'278'582	6.97%
	Public Administration	€ 151'221'550	21.40%
	Company Reteined	€ 27'830'748	3.94%
	Shareholder	€ 30'482'220	4.31%
	Financial Entities	€ 7'005'836	0.99%

(Source: Elaboration by authors)

28/01/2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | University of Applied Sciences and Arts of Southern Switzerland SUPSI

PC UC3M Leganés Tecnológico – Social Value Stakeholder Distribution



(Source: Elaboration by authors)

28/01/2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 14

Parque Científico y Tecnológico de Tenerife (Spain) – March 2, 2022

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

in tech Tenerife

Preliminary results: Parque Científico y Tecnológico de Tenerife

February 2022

Project - "Monetising the social value generated by STPs/AOIs"
Blazquez V., Aguado R., Retolaza JL.

10

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

PCyT de Tenerife – Data for Social Value (SV) Calculation

PCyT de Tenerife			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	29	*100%*	
Companies with VAT Numbers	29	*100%*	
Companies with Nr. Workers	27	*93%*	436
ORBIS - VAT Numbers Searched	29	*100%*	
ORBIS - VAT Numbers Found	29	*100%*	
Active companies	28	*97%*	
Data up-to-date	20	*69%*	
Companies with Nr. Workers	16	*55%*	142
Complete accountig data	16	*55%*	
Data without distortion	15	*52%*	138

(Source: Elaboration by authors)

February 2022

Project - "Monetising the social value generated by STPs/AOIs"
Blazquez V., Aguado R., Retolaza JL.

11

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

PCyT de Tenerife – SV Generation & Distribution

Data source: Orbis Platform
Accounting data year: 1 (2018) 14 (2019)

		PCyT de Tenerife	
Aggregated Social Value		€ 64'160'638	
Number of Companies		15	
Number of Workers		138	
Social Value per Company		€ 4'277'376	
Social Value per Worker		€ 464'932	
Distibution		In value:	In percentage:
	Customers	€ 30'962'368	48%
	Suppliers	€ 3'873'666	6%
	Workers	€ 1'774'934	3%
	Public Administration	€ 8'701'625	13%
	Company Reteined	€ 1'225'924	2%
	Shareholder	€ 17'171'530	27%
	Financial Entities	€ 450'591	1%

(Source: Elaboration by authors)

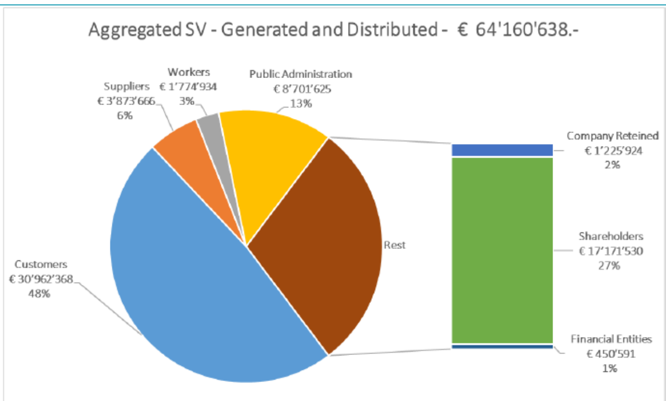
February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

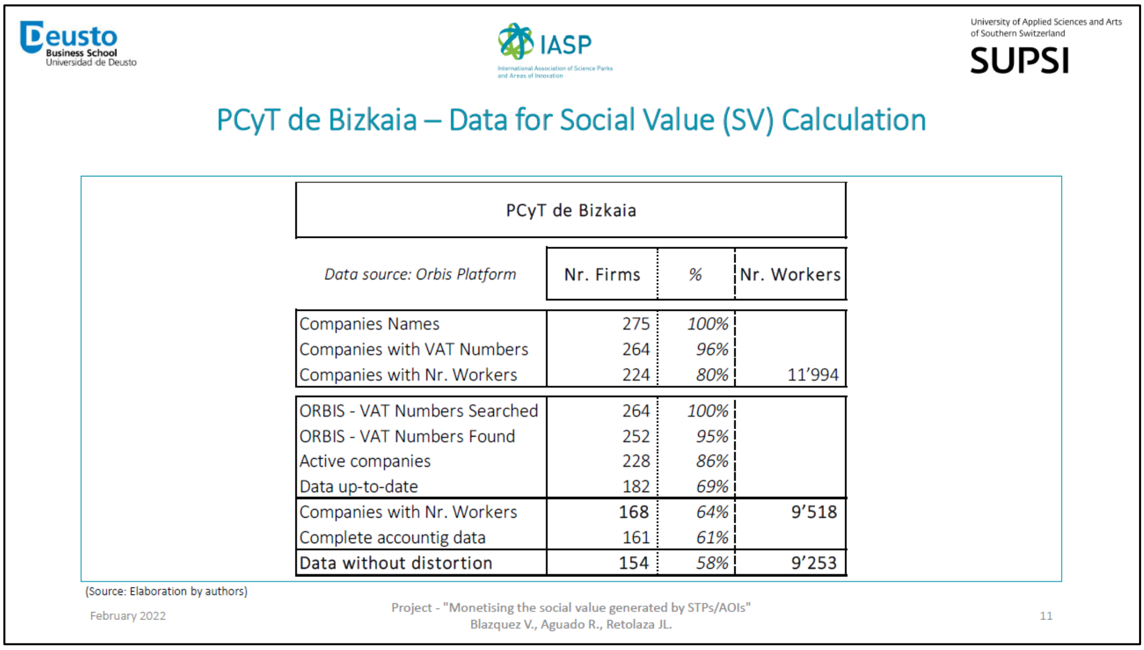
PCyT de Tenerife – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

Parque Científico y Tecnológico de Bizkaia (Spain) - March 23, 2022



PCyT de Bizkaia			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	275	*100%*	
Companies with VAT Numbers	264	*96%*	
Companies with Nr. Workers	224	*80%*	11'994
ORBIS - VAT Numbers Searched	264	*100%*	
ORBIS - VAT Numbers Found	252	*95%*	
Active companies	228	*86%*	
Data up-to-date	182	*69%*	
Companies with Nr. Workers	168	*64%*	9'518
Complete accountig data	161	*61%*	
Data without distortion	154	*58%*	9'253

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | University of Applied Sciences and Arts of Southern Switzerland SUPSI

PCyT de Bizkaia – SV Generation & Distribution

Data source: Orbis Platform
Accounting data years: 5 (2017) 9 (2018) 140 (2019)

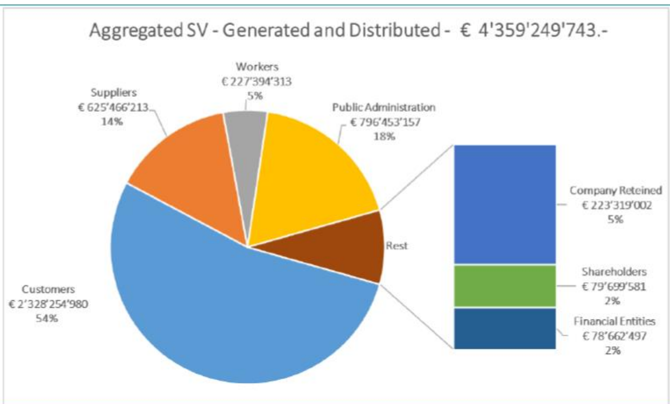
		PCyT de Bizkaia	
Aggregated Social Value		€ 4'359'249'743	
Number of Companies		154	
Number of Workers		9'253	
Social Value per Company		€ 28'306'817	
Social Value per Worker		€ 471'117	
Distibution		In value:	In percentage:
	Customers	€ 2'328'254'980	54%
	Suppliers	€ 625'466'213	14%
	Workers	€ 227'394'313	5%
	Public Administration	€ 796'453'157	18%
	Company Reteined	€ 223'319'002	5%
	Shareholder	€ 79'699'581	2%
	Financial Entities	€ 78'662'497	2%

(Source: Elaboration by authors)

February 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 12

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | University of Applied Sciences and Arts of Southern Switzerland SUPSI

PCyT de Bizkaia – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

February 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 13

Parque Científico Tecnológico de Gijón (Spain) - March 3, 2022

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

gijón impulsa

Preliminary results: Parque Científico Tecnológico de Gijón

February 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 10

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

PCyT de Gijón – Data for Social Value (SV) Calculation

PCyT de Gijón			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	165	*100%*	
Companies with VAT Numbers	163	*101%*	
Companies with Nr. Workers	143	*87%*	4'359
ORBIS - VAT Numbers Searched	163	*100%*	
ORBIS - VAT Numbers Found	142	*87%*	
Active companies	141	*87%*	
Data up-to-date	118	*72%*	
Companies with Nr. Workers	99	*61%*	3'587
Complete accountig data	98	*60%*	
Data without distortion	**87**	*53%*	**3'549**

(Source: Elaboration by authors)

February 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 11

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — University of Applied Sciences and Arts of Southern Switzerland SUPSI

PCyT de Gijón – SV Generation & Distribution

Data source: Orbis Platform
Accounting data years: 1 (2017) 5 (2018) 81 (2019)

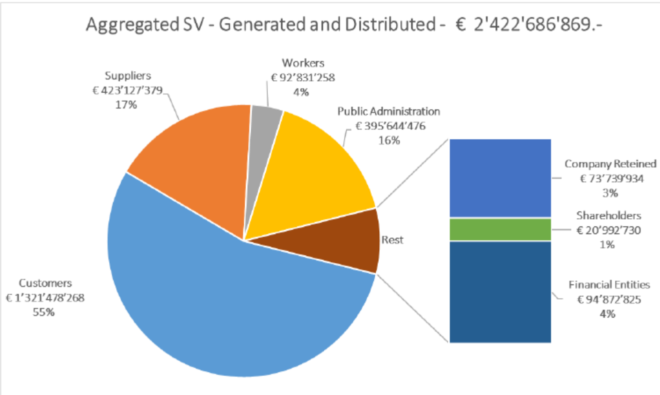
		PCyT de Gijón	
Aggregated Social Value		€ 2'422'686'869	
Number of Companies		87	
Number of Workers		3'549	
Social Value per Company		€ 27'846'976	
Social Value per Worker		€ 682'639	
Distibution		In value:	In percentage:
	Customers	€ 1'321'478'268	55%
	Suppliers	€ 423'127'379	17%
	Workers	€ 92'831'258	4%
	Public Administration	€ 395'644'476	16%
	Company Reteined	€ 73'739'934	3%
	Shareholder	€ 20'992'730	1%
	Financial Entities	€ 94'872'825	4%

(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — University of Applied Sciences and Arts of Southern Switzerland SUPSI

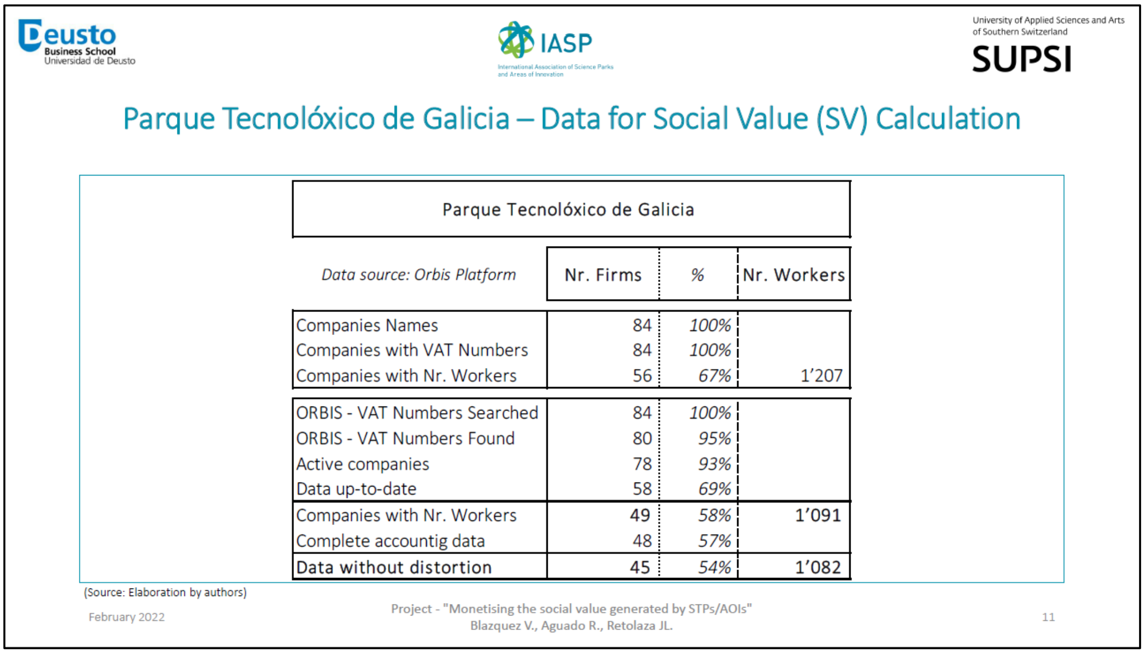
PCyT de Gijón – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

Parque Tecnolóxico de Galicia (Spain) - March 2, 2022



Parque Tecnolóxico de Galicia			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	84	*100%*	
Companies with VAT Numbers	84	*100%*	
Companies with Nr. Workers	56	*67%*	1’207
ORBIS - VAT Numbers Searched	84	*100%*	
ORBIS - VAT Numbers Found	80	*95%*	
Active companies	78	*93%*	
Data up-to-date	58	*69%*	
Companies with Nr. Workers	49	*58%*	1’091
Complete accountig data	48	*57%*	
Data without distortion	45	*54%*	1’082

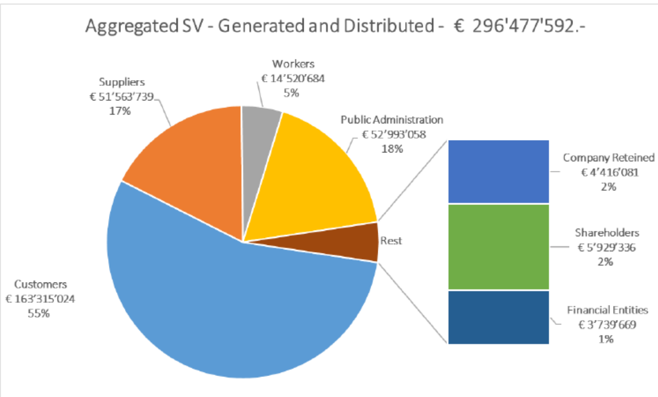
Parque Tecnolóxico de Galicia – SV Generation & Distribution

Data source: Orbis Platform
Accounting data years: 1 (2017) 3 (2018) 41 (2019)

		Parque Tecnolóxico de Galicia	
Aggregated Social Value		€ 296’477’592	
Number of Companies		45	
Number of Workers		1’082	
Social Value per Company		€ 6’588’391	
Social Value per Worker		€ 274’009	
Distibution		In value:	In percentage:
	Customers	€ 163’315’024	55%
	Suppliers	€ 51’563’739	17%
	Workers	€ 14’520’684	5%
	Public Administration	€ 52’993’058	18%
	Company Reteined	€ 4’416’081	2%
	Shareholder	€ 5’929’336	2%
	Financial Entities	€ 3’739’669	1%

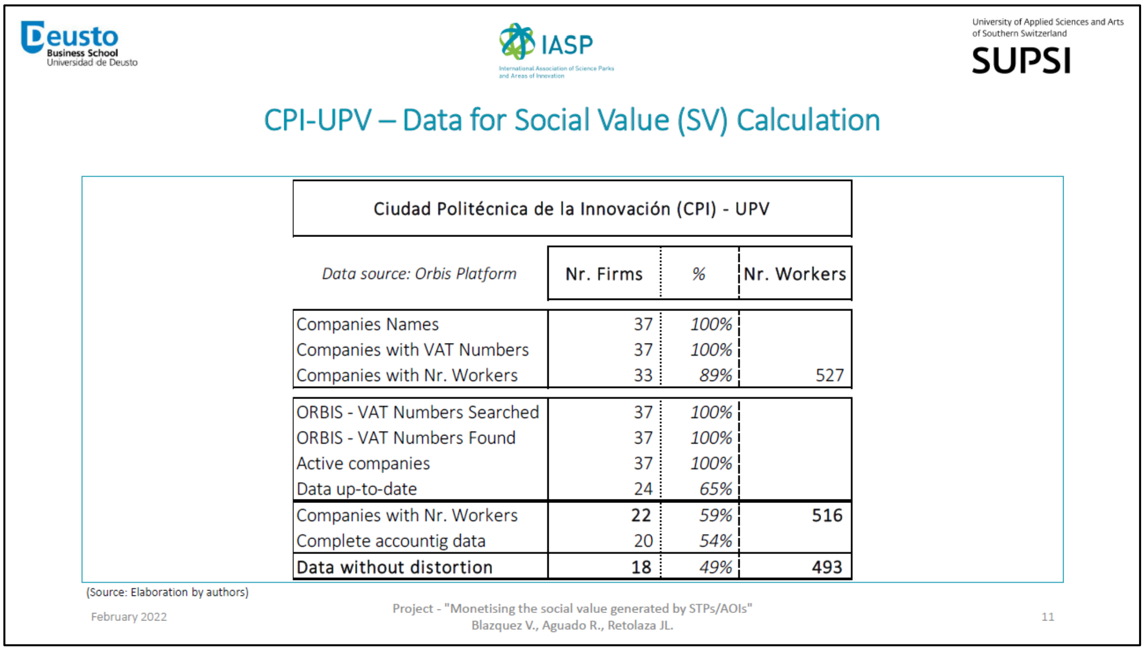
(Source: Elaboration by authors)

Parque Tecnolóxico de Galicia – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

Ciudad Politécnica de la Innovación (Valencia) (Spain) - March 8, 2022



Ciudad Politécnica de la Innovación (CPI) - UPV

Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	37	*100%*	
Companies with VAT Numbers	37	*100%*	
Companies with Nr. Workers	33	*89%*	527
ORBIS - VAT Numbers Searched	37	*100%*	
ORBIS - VAT Numbers Found	37	*100%*	
Active companies	37	*100%*	
Data up-to-date	24	*65%*	
Companies with Nr. Workers	22	*59%*	516
Complete accountig data	20	*54%*	
Data without distortion	**18**	*49%*	**493**

CPI-UPV – SV Generation & Distribution

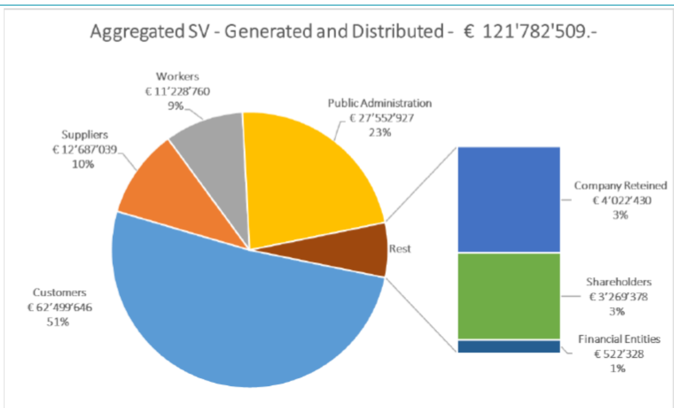
Data source: Orbis Platform
Accounting data years: 1 (2018) 17 (2019)

		CPI-UPV	
Aggregated Social Value		€ 121'782'509	
Number of Companies		18	
Number of Workers		493	
Social Value per Company		€ 6'765'695	
Social Value per Worker		€ 247'023	
Distibution		In value:	In percentage:
	Customers	€ 62'499'646	51%
	Suppliers	€ 12'687'039	10%
	Workers	€ 11'228'760	9%
	Public Administration	€ 27'552'927	23%
	Company Reteined	€ 4'022'430	3%
	Shareholder	€ 3'269'378	3%
	Financial Entities	€ 522'328	1%

(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

CPI-UPV – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

OpenZone (Italy) - March 9, 2022

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | Università degli Studi dell'Insubria | University of Applied Sciences and Arts of Southern Switzerland SUPSI

Openzone

science oxygen business

Preliminary results: OpenZone

February 2022 | Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. | 10

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | Università degli Studi dell'Insubria | University of Applied Sciences and Arts of Southern Switzerland SUPSI

OpenZone – Data for Social Value (SV) Calculation

OpenZone			
Data source: Orbis Platform	Nr. Firms	*%*	Nr. Workers
Companies Names	32	*100%*	
Companies with VAT Numbers	32	*100%*	
Companies with Nr. Workers	32	*100%*	819
ORBIS - VAT Numbers Searched	32	*100%*	
ORBIS - VAT Numbers Found	31	*97%*	
Active companies	30	*94%*	
Data up-to-date	29	*91%*	
Companies with Nr. Workers	27	*84%*	766
Complete accountig data	24	*75%*	
Data without distortion	23	*72%*	731

(Source: Elaboration by authors)

February 2022 | Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. | 11

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA — University of Applied Sciences and Arts of Southern Switzerland SUPSI

OpenZone – Social Value Generation & Distribution

Data source: Orbis Platform

Accounting data year: 2019

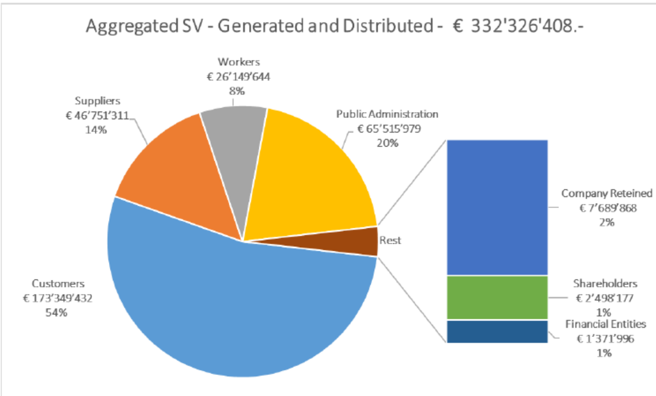
	OpenZone	
Aggregated Social Value	€ 323'326'408	
Number of Companies	23	
Number of Workers	731	
Social Value per Company	€ 14'057'670	
Social Value per Worker	€ 442'307	
Distibution	In value:	In percentage:
Customers	€ 173'349'432	54%
Suppliers	€ 46'751'311	14%
Workers	€ 26'149'644	8%
Public Administration	€ 65'515'979	20%
Company Reteined	€ 7'689'868	2%
Shareholder	€ 2'498'177	1%
Financial Entities	€ 1'371'996	1%

(Source: Elaboration by authors)

February 2022 — Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. — 12

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA — University of Applied Sciences and Arts of Southern Switzerland SUPSI

OpenZone – Social Value Stakeholder Distribution



(Source: Elaboration by authors)

February 2022 — Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. — 13

ComoNExT (Italy) - March 9, 2022

Deusto Business School Universidad de Deusto
IASP International Association of Science Parks and Areas of Innovation
UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA
University of Applied Sciences and Arts of Southern Switzerland SUPSI

COMO NExT INNOVATION HUB

Preliminary results: ComoNExT

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. 10

Deusto Business School Universidad de Deusto
IASP International Association of Science Parks and Areas of Innovation
UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA
University of Applied Sciences and Arts of Southern Switzerland SUPSI

ComoNExT – Data for Social Value (SV) Calculation

ComoNExT			
Data source: Orbis Platform	Nr. Firms	*%*	Nr. Workers
Companies Names	76	*100%*	
Companies with VAT Numbers	70	*92%*	
Companies with Nr. Workers	67	*88%*	596
ORBIS - VAT Numbers Searched	70	*100%*	
ORBIS - VAT Numbers Found	68	*97%*	
Active companies	66	*94%*	
Data up-to-date	66	*94%*	
Companies with Nr. Workers	55	*79%*	452
Complete accountig data	52	*74%*	
Data without distortion	52	*74%*	447

(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. 11

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA | University of Applied Sciences and Arts of Southern Switzerland SUPSI

ComoNExt – Social Value Generation & Distribution

Data source: Orbis Platform
Accounting data year: 2019

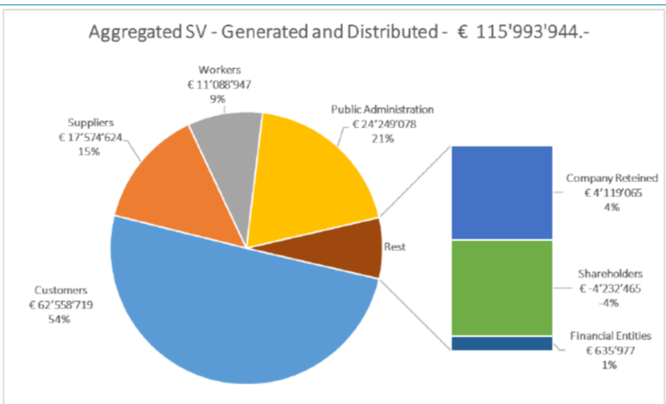
	ComoNExT	
Aggregated Social Value	€ 115'993'944	
Number of Companies	52	
Number of Workers	447	
Social Value per Company	€ 2'230'653	
Social Value per Worker	€ 259'494	
Distibution	In value:	In percentage:
Customers	€ 62'558'719	54%
Suppliers	€ 17'574'624	15%
Workers	€ 11'088'947	9%
Public Administration	€ 24'249'078	21%
Company Reteined	€ 4'119'065	4%
Shareholder	€ -4'232'465	-4%
Financial Entities	€ 635'977	1%

(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. 12

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA | University of Applied Sciences and Arts of Southern Switzerland SUPSI

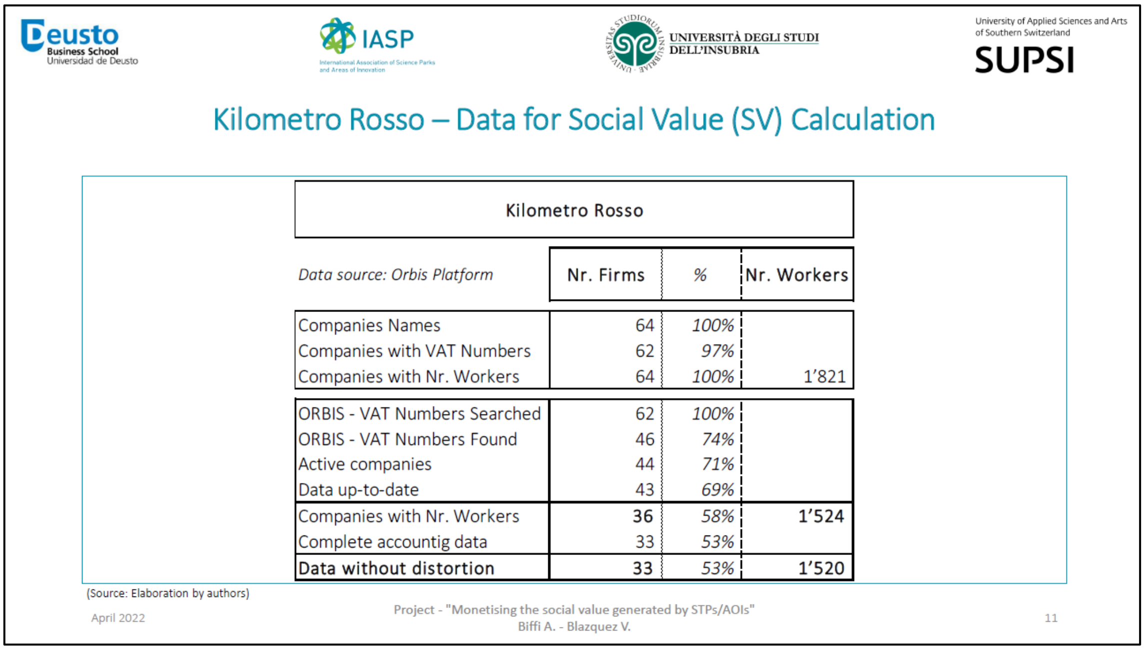
ComoNExT – Social Value Stakeholder Distribution



(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. 13

KilometroRosso (Italy) - April 13, 2022



Kilometro Rosso			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	64	*100%*	
Companies with VAT Numbers	62	*97%*	
Companies with Nr. Workers	64	*100%*	1'821
ORBIS - VAT Numbers Searched	62	*100%*	
ORBIS - VAT Numbers Found	46	*74%*	
Active companies	44	*71%*	
Data up-to-date	43	*69%*	
Companies with Nr. Workers	**36**	*58%*	**1'524**
Complete accountig data	33	*53%*	
Data without distortion	**33**	*53%*	**1'520**

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | Università degli Studi dell'Insubria | University of Applied Sciences and Arts of Southern Switzerland SUPSI

Kilometro Rosso – Social Value Generation & Distribution

Data source: Orbis Platform
Accounting data year: 2019

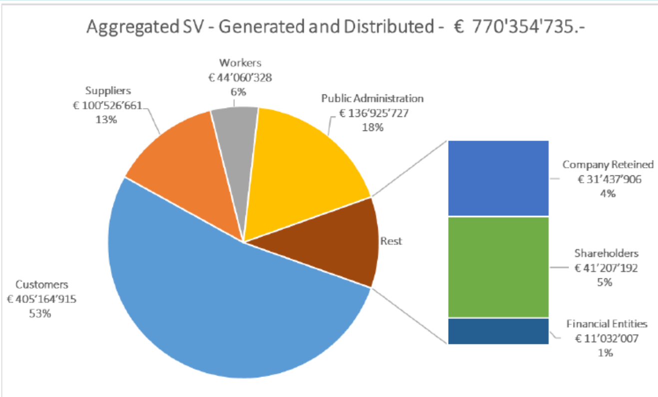
	Kilometro Rosso	
Aggregated Social Value	€ 770'354'735	
Number of Companies	33	
Number of Workers	1'520	
Social Value per Company	€ 23'344'083	
Social Value per Worker	€ 506'812	
Distibution	In value:	In percentage:
Customers	€ 405'164'915	53%
Suppliers	€ 100'526'661	13%
Workers	€ 44'060'328	6%
Public Administration	€ 136'925'727	18%
Company Reteined	€ 31'437'906	4%
Shareholder	€ 41'207'192	5%
Financial Entities	€ 11'032'007	1%

(Source: Elaboration by authors)

April 2022 Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. 12

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | Università degli Studi dell'Insubria | University of Applied Sciences and Arts of Southern Switzerland SUPSI

Kilometro Rosso – Social Value Stakeholder Distribution



(Source: Elaboration by authors)

April 2022 Project - "Monetising the social value generated by STPs/AOIs" Biffi A. - Blazquez V. 13

Madan Parque de Ciencia (Portugal) - May 18, 2022

Deusto Business School Universidad de Deusto
IASP International Association of Science Parks and Areas of Innovation
University of Applied Sciences and Arts of Southern Switzerland SUPSI

madan parque de ciencia

Preliminary results: Madan Parque de Ciencia

May 2022 | Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. | 10

Deusto Business School Universidad de Deusto
IASP International Association of Science Parks and Areas of Innovation
University of Applied Sciences and Arts of Southern Switzerland SUPSI

Madan Parque de Ciencia – Data for Social Value (SV) Calculation

Madan Parque de Ciencia

Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	58	*100%*	
Companies with VAT Numbers	58	*100%*	
Companies with Nr. Workers	58	*100%*	350
ORBIS - VAT Numbers Searched	58	*100%*	
ORBIS - VAT Numbers Found	58	*100%*	
Active companies	58	*100%*	
Data up-to-date	56	*97%*	
Companies with Nr. Workers	51	*88%*	252
Complete accountig data	48	*83%*	
Data without distortion	48	*83%*	246

(Source: Elaboration by authors)

May 2022 | Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. | 11

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — University of Applied Sciences and Arts of Southern Switzerland SUPSI

Madan Parque de Ciencia – SV Generation & Distribution

Data source: Orbis Platform
Accounting data year: 2 (2018) 46 (2019)

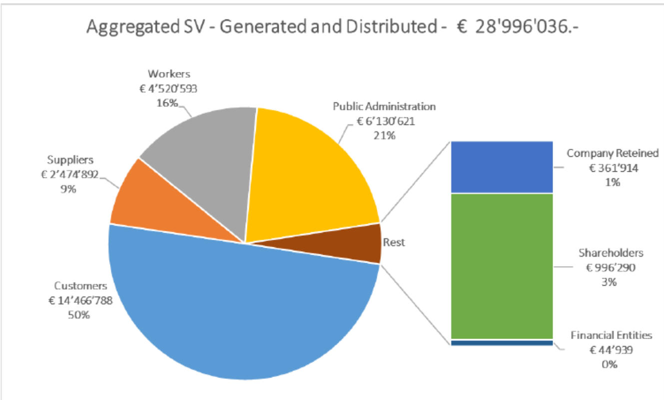
	Madan Parque de Ciencia	
Aggregated Social Value	€ 28'996'036	
Number of Companies	48	
Number of Workers	246	
Social Value per Company	€ 604'084	
Social Value per Worker	€ 117'870	
Distibution	In value:	In percentage:
Customers	€ 14'466'788	50%
Suppliers	€ 2'474'892	9%
Workers	€ 4'520'593	16%
Public Administration	€ 6'130'621	21%
Company Reteined	€ 361'914	1%
Shareholder	€ 996'290	3%
Financial Entities	€ 44'939	0%

(Source: Elaboration by authors)

May 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 12

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — University of Applied Sciences and Arts of Southern Switzerland SUPSI

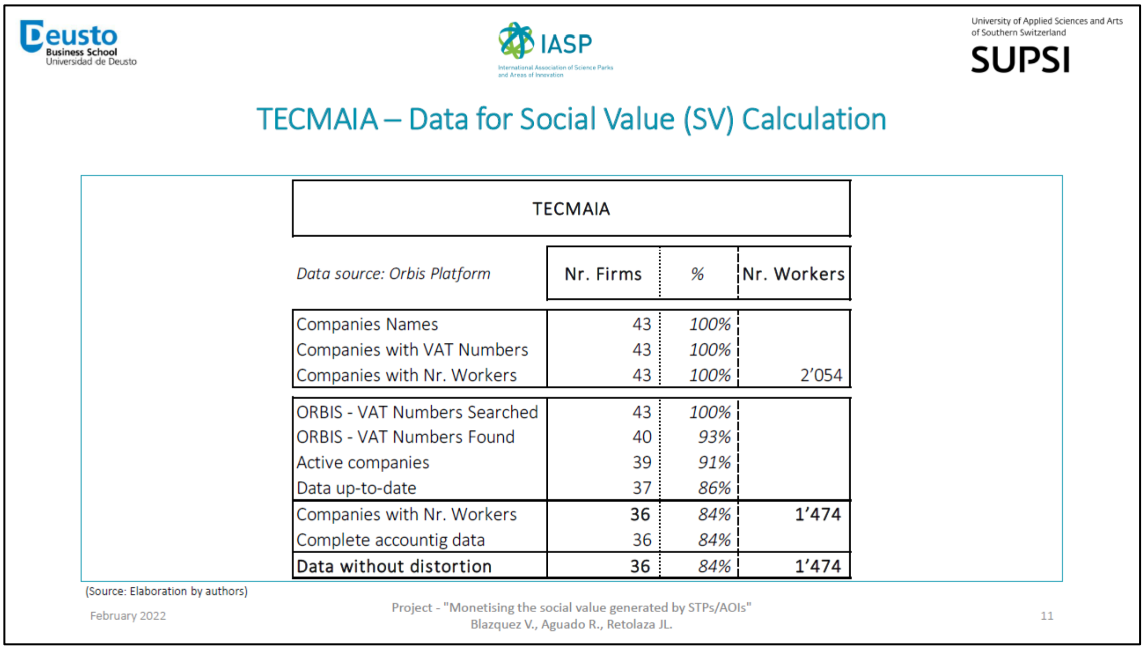
Madan Parque de Ciencia – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

May 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 13

TECMAIA Perque de Ciencia e Tecnologia de Maia (Portugal) - March 3, 2022



TECMAIA			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	43	*100%*	
Companies with VAT Numbers	43	*100%*	
Companies with Nr. Workers	43	*100%*	2'054
ORBIS - VAT Numbers Searched	43	*100%*	
ORBIS - VAT Numbers Found	40	*93%*	
Active companies	39	*91%*	
Data up-to-date	37	*86%*	
Companies with Nr. Workers	**36**	*84%*	**1'474**
Complete accountig data	36	*84%*	
Data without distortion	**36**	*84%*	**1'474**

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

TECMAIA – SV Generation & Distribution

Data source: Orbis Platform

Accounting data year: 1 (2018) 35 (2019)

	TECMAIA	
Aggregated Social Value	€ 247'161'121	
Number of Companies	36	
Number of Workers	1'474	
Social Value per Company	€ 6'865'587	
Social Value per Worker	€ 167'681	
Distibution	In value:	In percentage:
Customers	€ 120'225'140	49%
Suppliers	€ 17'115'114	7%
Workers	€ 43'960'746	18%
Public Administration	€ 52'795'190	21%
Company Reteined	€ 3'725'800	1%
Shareholder	€ 8'003'299	3%
Financial Entities	€ 1'335'831	1%

(Source: Elaboration by authors)

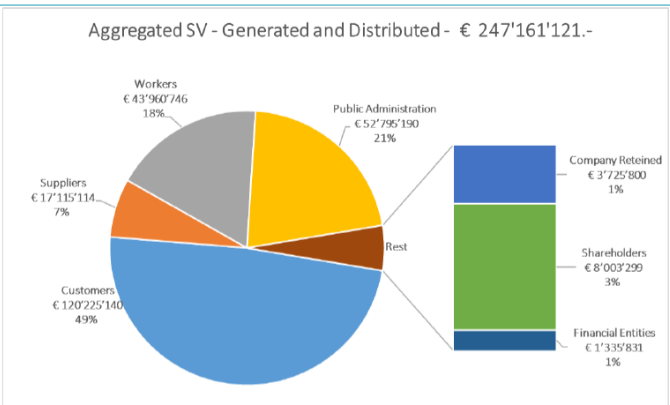
February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

TECMAIA – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

Linköping Science Park (Sweden) - March 10, 2022

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

LINKÖPING
SCIENCE
PARK

Preliminary results: Linköping Science Park

February 2022

Project - "Monetising the social value generated by STPs/AOIs"
Blazquez V., Aguado R., Retolaza JL.

10

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

Linköping Science Park – Data for Social Value (SV) Calculation

Linköping Science Park			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	366	*100%*	
Companies with VAT Numbers	351	*104%*	
Companies with Nr. Workers	340	*93%*	6’298
ORBIS - VAT Numbers Searched	351	*100%*	
ORBIS - VAT Numbers Found	351	*100%*	
Active companies	311	*89%*	
Data up-to-date	307	*87%*	
Companies with Nr. Workers	219	*62%*	5’795
Complete accountig data	200	*57%*	
Data without distortion	196	*56%*	4’108

(Source: Elaboration by authors)

February 2022

Project - "Monetising the social value generated by STPs/AOIs"
Blazquez V., Aguado R., Retolaza JL.

11

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | University of Applied Sciences and Arts of Southern Switzerland SUPSI

Linköping Science Park – SV Generation & Distribution

Data source: Orbis Platform
Accounting data year: 2019

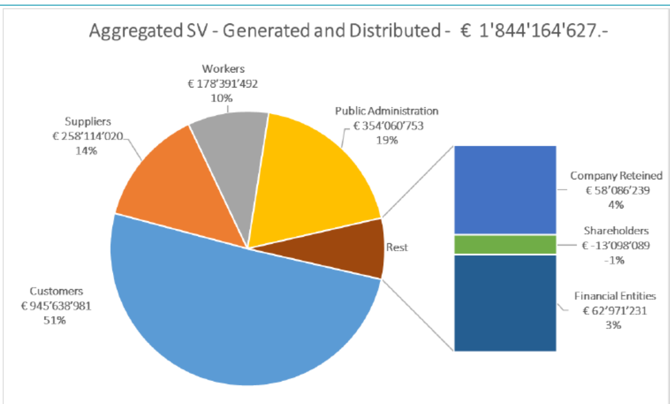
	Linköping Science Park	
Aggregated Social Value	€ 1’844’164’627	
Number of Companies	196	
Number of Workers	4’108	
Social Value per Company	€ 9’409’003	
Social Value per Worker	€ 448’920	
Distibution	In value:	In percentage:
Customers	€ 945’638’981	51%
Suppliers	€ 258’114’020	14%
Workers	€ 178’391’492	10%
Public Administration	€ 354’060’753	19%
Company Reteined	€ 58’086’239	4%
Shareholder	€ -13’098’089	-1%
Financial Entities	€ 62’971’231	3%

(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

Deusto Business School Universidad de Deusto | IASP International Association of Science Parks and Areas of Innovation | University of Applied Sciences and Arts of Southern Switzerland SUPSI

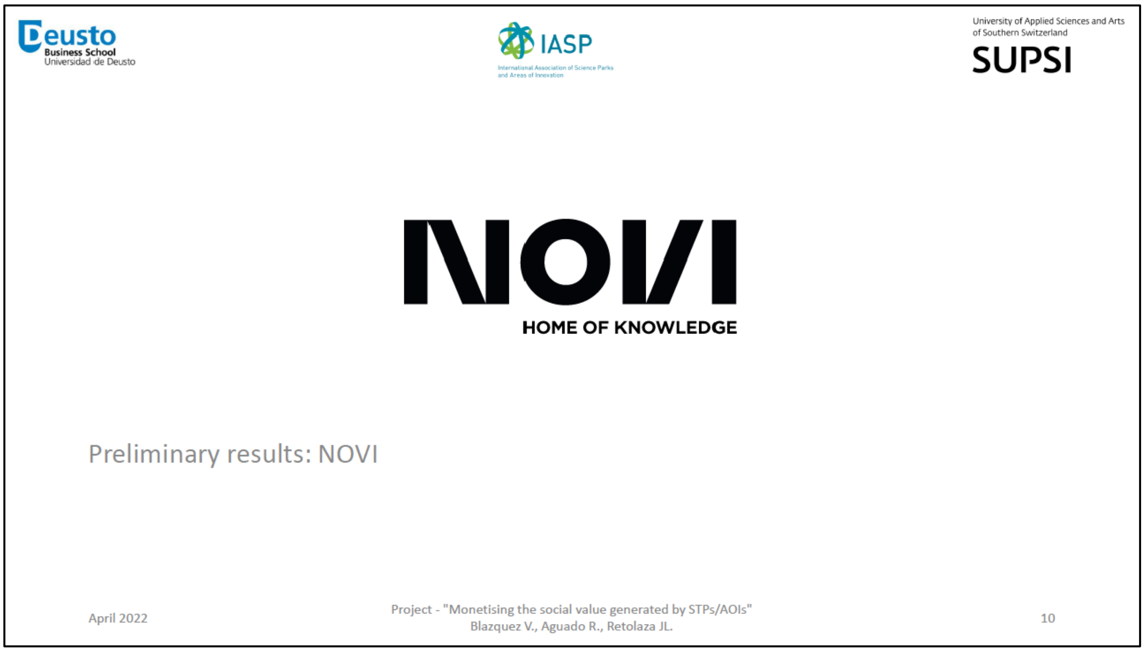
Linköping Science Park – SV Stakeholder Distribution - Visual

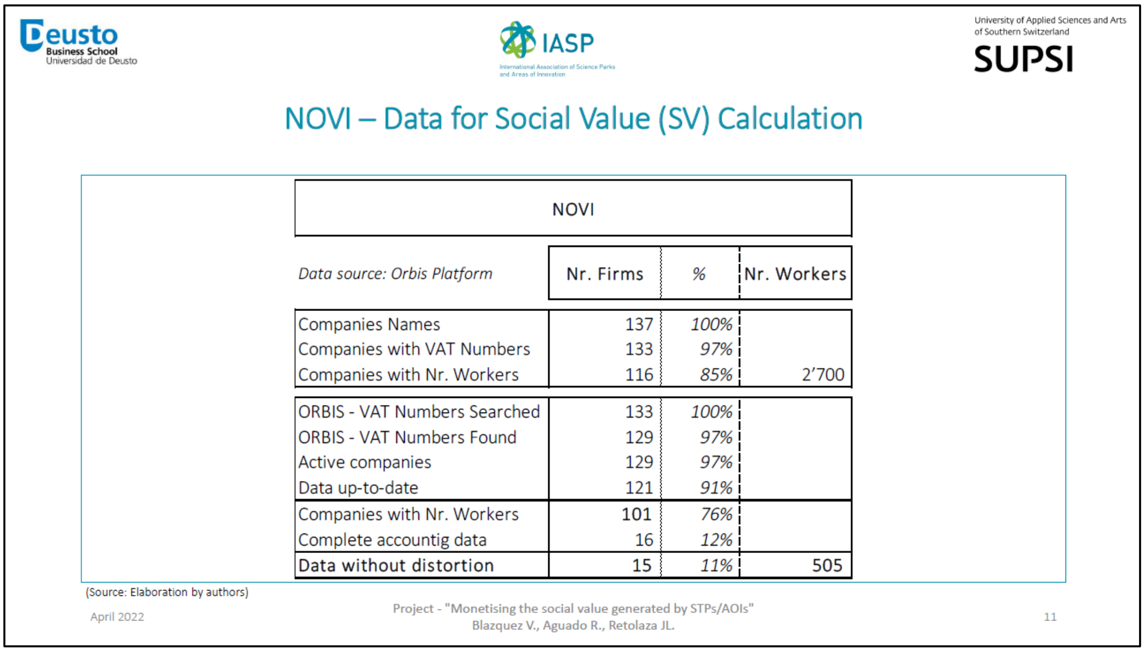


(Source: Elaboration by authors)

February 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

NOVI (Denmark) - April 1, 2022





NOVI			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	137	*100%*	
Companies with VAT Numbers	133	*97%*	
Companies with Nr. Workers	116	*85%*	2'700
ORBIS - VAT Numbers Searched	133	*100%*	
ORBIS - VAT Numbers Found	129	*97%*	
Active companies	129	*97%*	
Data up-to-date	121	*91%*	
Companies with Nr. Workers	101	*76%*	
Complete accountig data	16	*12%*	
Data without distortion	15	*11%*	505

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

NOVI – SV Generation & Distribution

Data source: Orbis Platform
Accounting data year: 2019

	NOVI	
Aggregated Social Value	€ 396'634'326	
Number of Companies	15	
Number of Workers	505	
Social Value per Company	€ 26'442'288	
Social Value per Worker	€ 785'415	
Distibution	In value:	In percentage:
Customers	€ 191'915'393	48%
Suppliers	€ 31'721'217	8%
Workers	€ 47'193'944	12%
Public Administration	€ 56'869'590	14%
Company Reteined	€ 51'180'034	13%
Shareholder	€ 9'959'136	3%
Financial Entities	€ 7'795'010	2%

(Source: Elaboration by authors)

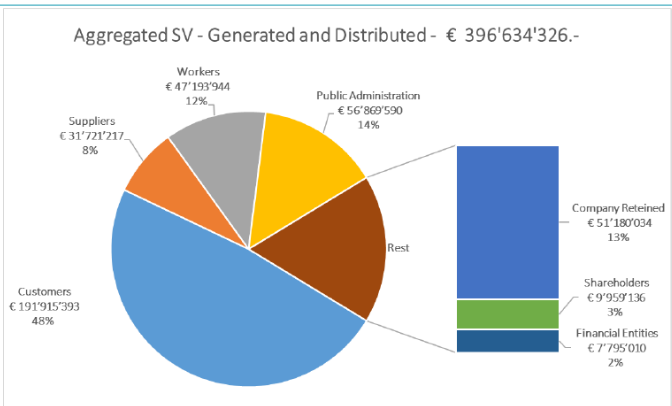
April 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 12

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

NOVI – SV Stakeholder Distribution - Visual



(Source: Elaboration by authors)

April 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 13

University of Warwick Science Park (United Kingdom) - April 26, 2022

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

UNIVERSITY OF WARWICK
SCIENCE PARK

Preliminary results: University of Warwick Science Park (UWSP)

April 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 10

Deusto Business School Universidad de Deusto

IASP International Association of Science Parks and Areas of Innovation

University of Applied Sciences and Arts of Southern Switzerland SUPSI

UWSP – Data for Social Value (SV) Calculation

UWSP			
Data source: Orbis Platform	Nr. Firms	%	Nr. Workers
Companies Names	103	*100%*	
Companies with VAT Numbers	102	*99%*	
Companies with Nr. Workers	66	*64%*	1’130
ORBIS - VAT Numbers Searched	102	*100%*	
ORBIS - VAT Numbers Found	100	*98%*	
Active companies	96	*94%*	
Data up-to-date	95	*93%*	
Companies with Nr. Workers	53	*52%*	609
Complete accountig data	12	*12%*	
Data without distortion	12	*12%*	408

(Source: Elaboration by authors)

April 2022 Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. 11

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — University of Applied Sciences and Arts of Southern Switzerland SUPSI

UWSP – SV Generation & Distribution

Data source: Orbis Platform

Accounting data years: 1 (2018) 11 (2019)

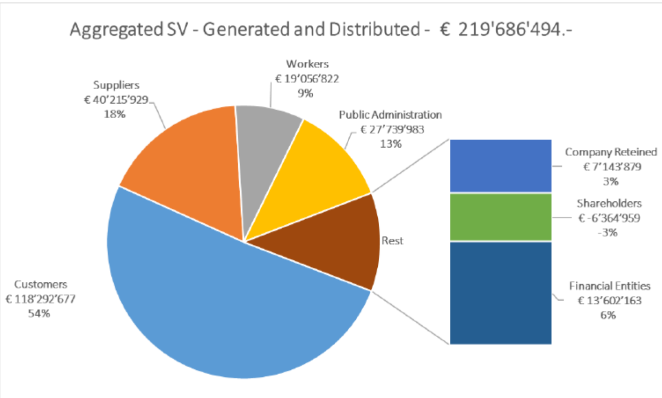
	UWSP	
Aggregated Social Value	€ 219'686'494	
Number of Companies	12	
Number of Workers	408	
Social Value per Company	€ 18'307'208	
Social Value per Worker	€ 538'447	
Distibution	In value:	In percentage:
Customers	€ 118'292'677	54%
Suppliers	€ 40'215'929	18%
Workers	€ 19'056'822	9%
Public Administration	€ 27'739'983	13%
Company Reteined	€ 7'143'879	3%
Shareholder	€ -6'364'959	-3%
Financial Entities	€ 13'602'163	6%

(Source: Elaboration by authors)

April 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 12

Deusto Business School Universidad de Deusto — IASP International Association of Science Parks and Areas of Innovation — University of Applied Sciences and Arts of Southern Switzerland SUPSI

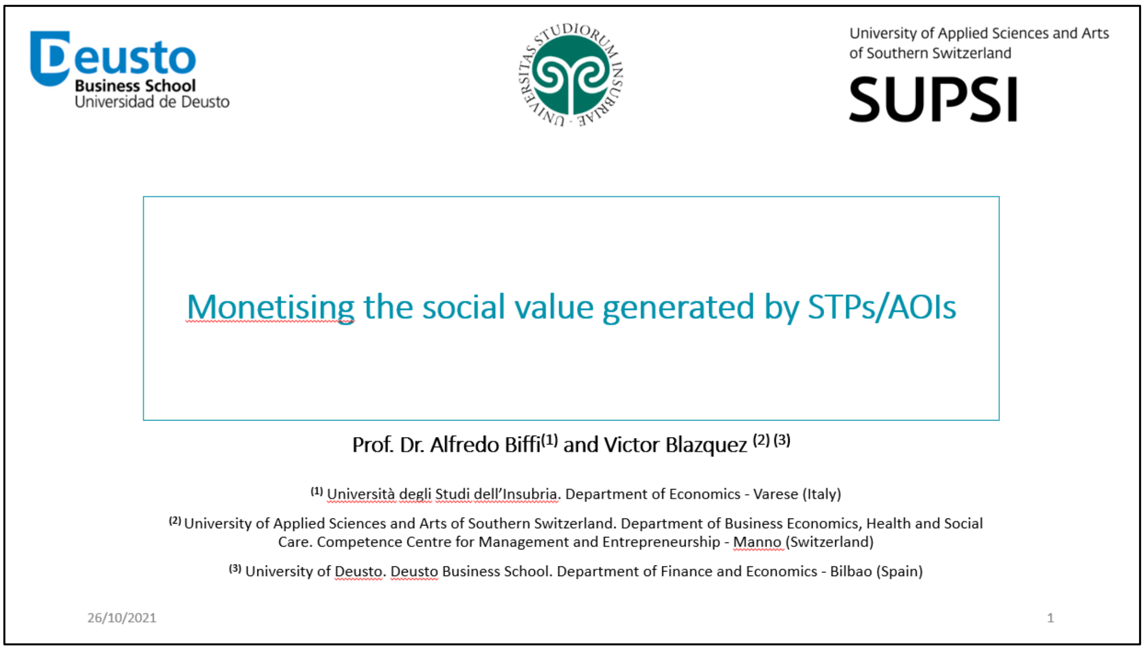
UWSP – SV Stakeholder Distribution - Visual

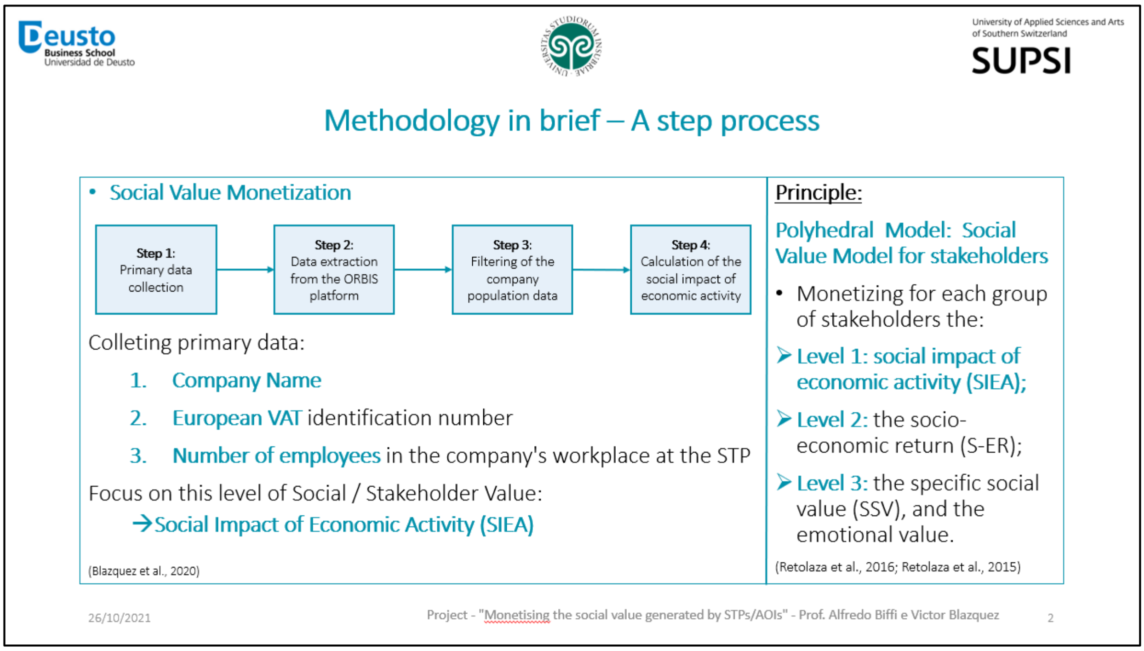


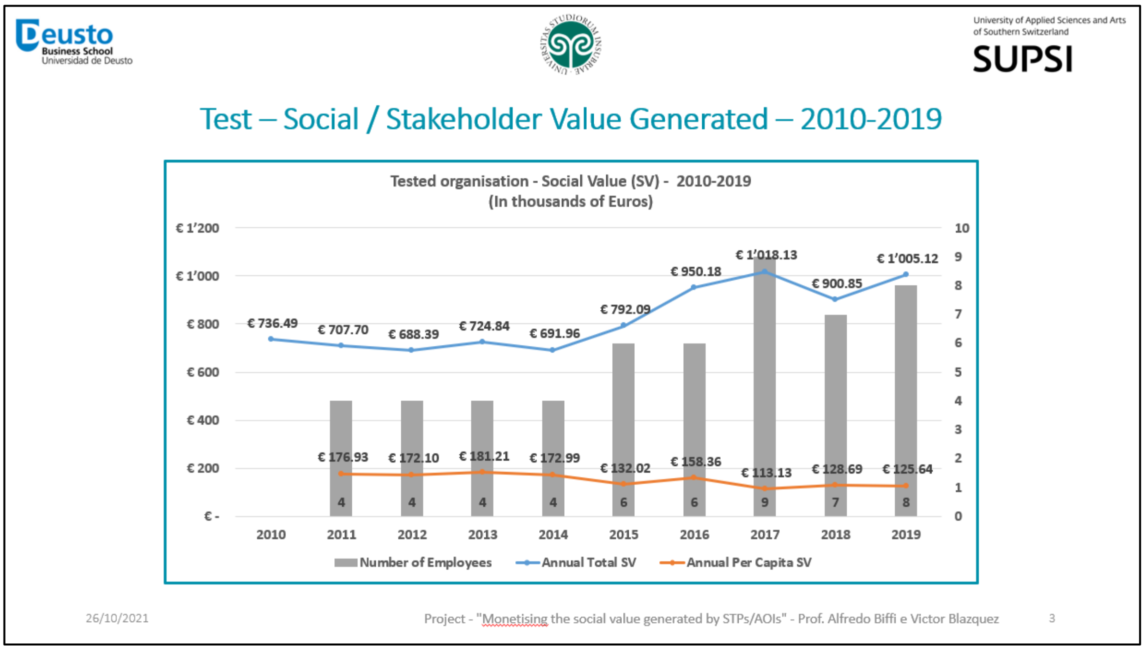
(Source: Elaboration by authors)

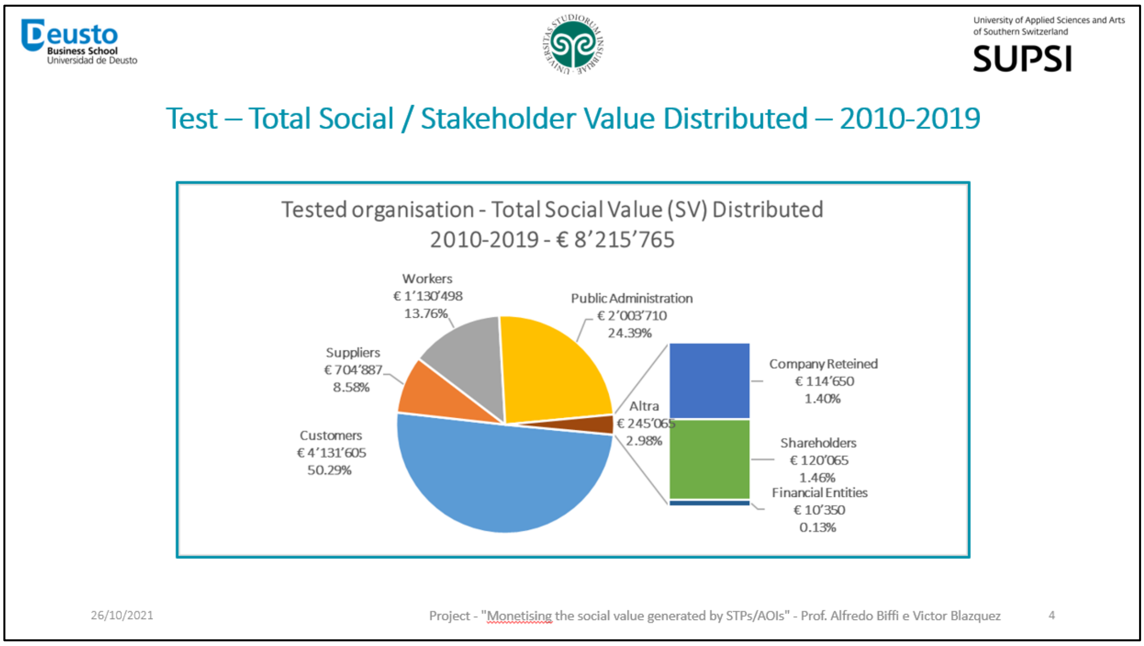
April 2022 — Project - "Monetising the social value generated by STPs/AOIs" Blazquez V., Aguado R., Retolaza JL. — 13

Annex 4 – Tested Organisation – Monitoring Function






Deusto Business School Universidad de Deusto
University of Applied Sciences and Arts of Southern Switzerland
SUPSI
Test – Social / Stakeholder Value Generated – 2010-2019
Tested organisation - Social Value (SV) - 2010-2019
(In thousands of Euros)
€ 1'200
€ 1'000
€ 800
€ 600
€ 400
€ 200
€ -
€ 736.49
€ 707.70
€ 688.39
€ 724.84
€ 691.96
€ 792.09
€ 950.18
€ 1'018.13
€ 900.85
€ 1'005.12
€ 176.93
€ 172.10
€ 181.21
€ 172.99
€ 132.02
€ 158.36
€ 113.13
€ 128.69
€ 125.64
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Number of Employees
Annual Total SV
Annual Per Capita SV
26/10/2021
Project - "Monetising the social value generated by STPs/AOIs" - Prof. Alfredo Biffi e Victor Blazquez
3


Deusto Business School Universidad de Deusto
University of Applied Sciences and Arts of Southern Switzerland
SUPSI
Test – Total Social / Stakeholder Value Distributed – 2010-2019
Tested organisation - Total Social Value (SV) Distributed
2010-2019 - € 8'215'765
Workers
€ 1'130'498
13.76%
Public Administration
€ 2'003'710
24.39%
Suppliers
€ 704'887
8.58%
Customers
€ 4'131'605
50.29%
Altra
€ 245'065
2.98%
Company Reteined
€ 114'650
1.40%
Shareholders
€ 120'065
1.46%
Financial Entities
€ 10'350
0.13%
26/10/2021
Project - "Monetising the social value generated by STPs/AOIs" - Prof. Alfredo Biffi e Victor Blazquez
4

Annex 5 – Multilevel Modelling

Multilevel Model Analysis of SV-SIEA for Stakeholder: Employee

```
REML criterion at convergence: 5258.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.9399 -0.5504 -0.0665  0.4334  4.8833

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 ID_2     (Intercept) 38.3909  6.1960
          Ebitda_cub   0.1513  0.3889   0.43
 Residual             94.5930  9.7259
Number of obs: 708, groups:  ID_2, 14

Fixed effects:
                            Estimate Std. Error       df t value Pr(>|t|)
(Intercept)                  13.2459     2.5907  10.7727   5.113  0.00036 ***
log_Employees                 0.9984     0.2090 688.2530   4.777 2.17e-06 ***
P_Cat_PCyT_collapsedPrivado   8.4976     4.2874  13.0846   1.982  0.06889 .
P_Dimension_3_f2              5.0844     4.4072  10.2913   1.154  0.27473
P_Dimension_3_f3             13.1680     4.5515   8.8906   2.893  0.01802 *
Ebitda_cub                    0.4069     0.1425   5.5732   2.857  0.03142 *
Assets_Inmat_Cat_22           2.9538     1.4245 692.5678   2.074  0.03849 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) lg_Emp P_C_PC P_D_3_2 P_D_3_3 Ebtd_c
log_Employs -0.141
P_Ct_PCyT_P -0.395 -0.068
P_Dmnsn_3_2 -0.460 -0.006 -0.030
P_Dmnsn_3_3 -0.490 -0.043  0.104  0.271
Ebitda_cub   0.137 -0.200 -0.078  0.042   0.083
Asst_I_C_22  0.022 -0.193  0.038  0.006  -0.032  -0.121
```

Source: Own elaboration.

R Software – Activity Report

P_Cat_PCyT_collapsed

data_model_2 <- data_model_2 %>% mutate(P_Cat_PCyT_collapsed = recode(P_Cat_PCyT, “Mixta” = “Publica/Mixta”, “Publica” = “Publica/Mixta”))

P_Dimension

data_model_2$P_{D}imension < -ordered(data_{m}odel_{2}$P_Dimension, levels = c(“Pequeño”, “Mediano”, “Medio-Grande”, “Grande”, “Muy Grande”))
data_model_2$P_{D}imension_{l}inear < -as.numeric(data_{m}odel_{2}$P_Dimension)

data_model_2$P_{D}imension_{3} < -ifelse(data_{m}odel_{2}$P_Dimension_linear < 3, 1, ifelse(data_model_2$P_Dimension_linear ==3, 2, 3))

data_model_2$P_{D}imension_{3_{f}} < -factor(data_{m}odel_{2}$P_Dimension_3)

Assets_Inmat

data_model_2$Assets_{I}nmat_{C}at_{2} < -ifelse(data_{m}odel_{2}$Assets_Inmat<800, 1,2)
data_model_2$Assets_{I}nmat_{C}at_{2} < -factor(data_{m}odel_{2}$Assets_Inmat_Cat_2)
table(data_model_2$Assets_{I}nmat_{C}at_{2})summary(data_{m}odel_{2}$Assets_Inmat)

Ebitda

borra2 <- data_model_2[!is.na(data_model_2$Ebitda),]hist(borra$2Ebitda)
borra2$Ebitda_{c}ub < -sign(borra$2Ebitda) * (abs(borra2$Ebitda))^(1/3)

DATA

borra2 <- data_model_2[!is.na(data_model_2$Ebitda),]

hist(borra2$Ebitda)borra$2Ebitda_cub <- sign(borra2$Ebitda) * (abs(borra$2Ebitda))^(1/3)

pc01 <- quantile(borra2$Ebitda, probs = (0.01))pc025 < -quantile(borra$2Ebitda, probs=(0.025)) pc05 <- quantile(borra2$Ebitda, probs = (0.05))quantile(borra$2Ebitda, probs=(0.075)) quantile(borra2$Ebitda, probs = (0.1))quantile(borra$2Ebitda, probs=(0.9)) quantile(borra2$Ebitda, probs = (0.925))pc95 < -quantile(borra$2Ebitda, probs=(0.95)) pc975 <- quantile(borra2$Ebitda, probs = (0.975))pc99 < -quantile(borra$2Ebitda, probs=(0.99)) borra3 <- borra2[borra2$Ebitda >= pc01 & borra2$Ebitda<= pc99,] borra3 <- borra3[!is.na(borra3$Assets_Inmat),]

MODEL

m11 <- lmer(SV_work_capita ~ log_Employees + P_Cat_PCyT_collapsed + P_Dimension_3_f + Ebitda_cub + Assets_Inmat_Cat_2 + (1+ Ebitda_cub| ID_2), data = borra3, control = lmerControl(optimizer = “bobyqa”, optCtrl = list(maxfun = 10000))) summary(m11)

ranef(m11)

MODEL DIAGNOSTIC

1. Residual plots

par(mfrow=c(2,2))

dev.off() plot(resid(m11), type=‘p’, main=“Residual plot”) # Residuals vs Order plot(fitted(m11), resid(m11), xlab=“Fitted values”, ylab=“Residuals”, main=“Residuals vs Fitted”) # Residuals vs Fitted

2. Normality checks

hist(resid(m11), breaks=20, main=“Histogram of residuals”) qqnorm(resid(m11), main=“Normal Q-Q plot”) qqline(resid(m11))

Conduct Shapiro-Wilk test

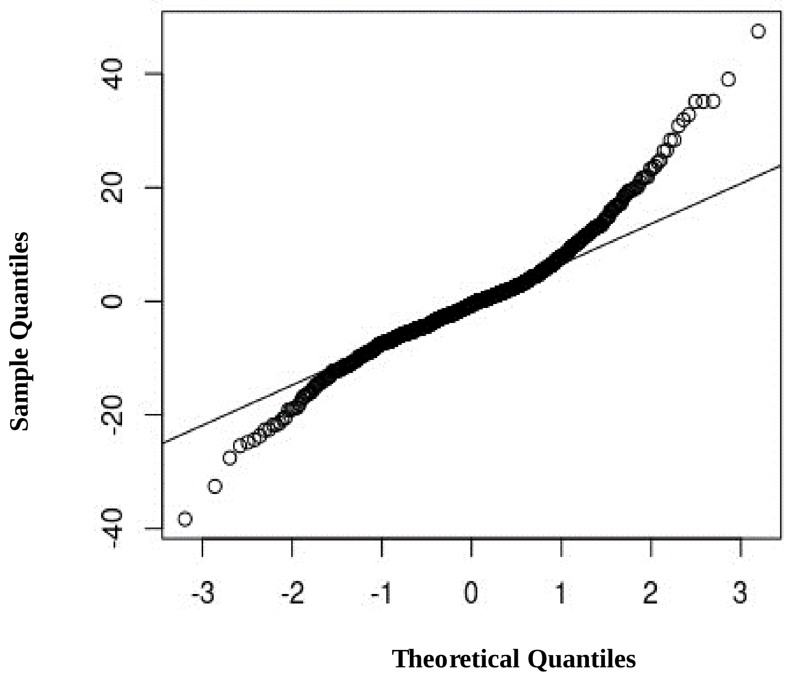
shapiro.test(resid(m11))

3. Check for Multicollinearity

install.packages(“car”) # Installa il pacchetto “car” se non l’hai già fatto library(car) # Carica il pacchetto “car” per poter utilizzare la funzione “vif”

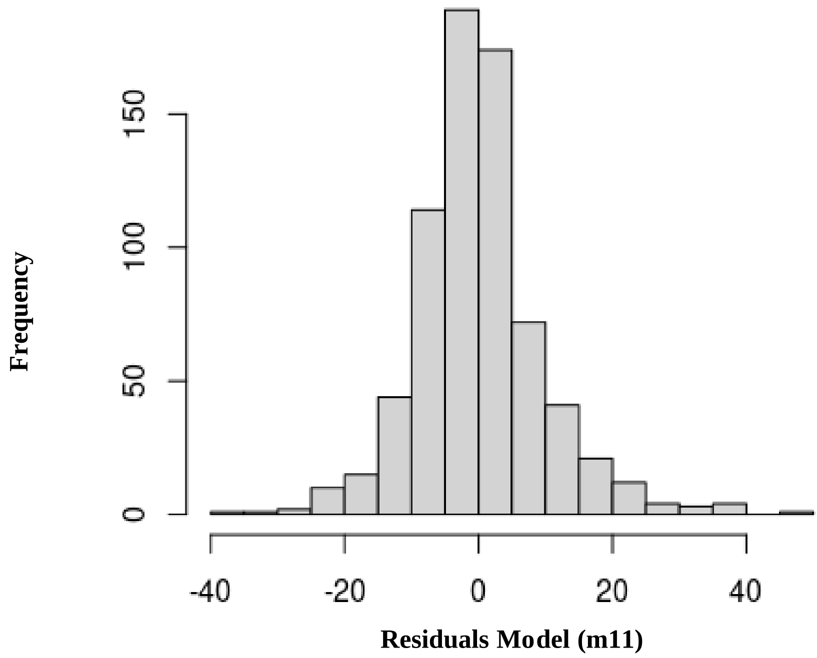
vif(m11) library(ggplot2) library(lattice) # 4. Random Effects dotplot(ranef(m11)) ranef(m11) # 5. Check for outliers cooksd <- cooks.distance(m11) plot(cooksd, main=“Cook’s distance”, type=‘p’) # Cook’s distance plot borra3$cooksd < -cooksd borra < -borra$3[$borra$3cooksd>1,]

Multilevel Model Q-Q Plot



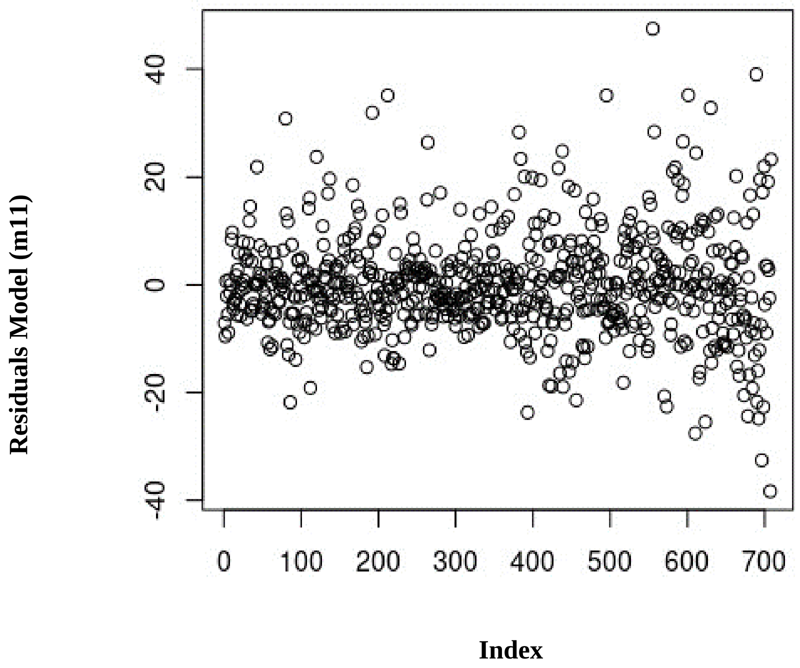
Source: Own elaboration.

Multilevel Modelling Histogram of Residuals



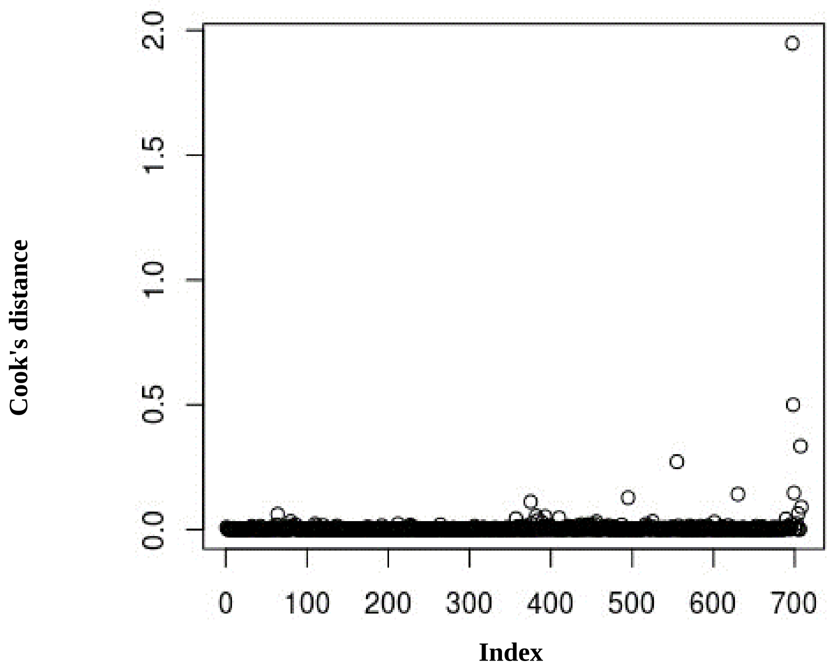
Source: Own elaboration.

Multilevel Modelling Risidual Plot



Source: Own elaboration.

Multilevel Modelling - Cook's Distance



Source: Own elaboration.