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THE ORGANIZATIONAL IMPACTS OF GREEN

PUBLIC PROCUREMENT

EVIDENCE FROM A LARGE EUROPEAN UNIVERSITY

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Abstract

Green Public Procurement (GPP) policies are becoming increasingly important as public organizations worldwide aim to improve sustainability and promote environmentally friendly practices. These policies require public organizations to implement green criteria in supplier selection to steer supply chains towards greener trajectories. Research has so far focused on the level of GPP uptake and barriers hindering it. There is, however, a dearth of studies analyzing GPP impacts on stakeholders other than procurers and going beyond the mere procurer-supplier dyadic relationship. Accordingly, adopting a triadic perspective, this study gauges a spillover effect that has not received much attention, namely, the organizational changes brought upon involved stakeholders, focusing on the triad procurers, suppliers, and internal clients within public organizations. Through the multiple-case study methodology, and triangulating data collected from semi-structured interviews with technical documentation of GPP tenders issued by a large European university, several novel dynamics are revealed. In particular, the procurer's green leadership plays a crucial role in less regulated industries by promoting a green bullwhip effect upstream; additionally, there is a need for greater communication to nurture a green culture and enable a ripple effect downstream; lastly, a direct feedback and interaction between suppliers and end clients could facilitate the structuring of suppliers' offer and further improve clients' satisfaction levels.

Keywords: *Green Public Procurement, Minimum Environmental Criteria, Sustainable Supply Chain Management, Triadic Relationship*

Introduction

The adoption of green procurement criteria is deemed of paramount importance to improve the environmental sustainability of organizations and their supply chains [1]. Due to stricter environmental regulations and the widespread adoption of sustainability practices in the business world, many organizations are now considering environmental factors in supplier selection and monitoring processes [2]. This trend extends to the public sector, where organizations are expected to lead by example for the transition to a circular economy [3]. As a result, many countries have implemented policies that require public organizations to use green criteria when procuring certain products and services— a process known as Green Public Procurement (GPP) [4]. The rationale behind GPP is that public procurement accounts for a large share of the Gross Domestic Product of the European Union (approximately 16%), and therefore, it plays a pivotal role in driving sustainable production patterns [3].

Over the past decade, GPP research has notably expanded, especially concerning the level of GPP implementation, and focusing on policy and policy design concerning specific sectors and areas. Researchers have so far focused on identifying key barriers that hinder GPP adoption, such as financial constraints and the lack of environmental knowledge in public organizations [5], [6]. Despite acknowledging the importance of GPP, the literature on the subject reveals that there is a dearth of comprehensive data collection and reporting on the impacts of GPP uptake [4]. From an organizational perspective, the focus has been mostly on procurers though, which explains the ongoing call to analyze GPP from the suppliers' viewpoint [4]. Furthermore, some studies have highlighted the need to go beyond the focus on the procurers-suppliers dyad to include other stakeholders involved in the procurement process [7], [8].

Based on previous research gaps, this paper investigates the organizational impact of GPP on various stakeholders, including procurers, suppliers, and another actor so far neglected in the literature, i.e., the internal clients. Prior operations management literature has highlighted the importance of considering such a triadic perspective in supply chain analysis for comprehensive insights [9]. In line with the objective and the exploratory nature of the research, a multiple-case study methodology was

adopted. The methodology consisted of semi-structured interviews with the procurement staff overseeing the bid process, internal clients requesting the products/services, and the selected bidding organizations who fulfilled the requirements; the data collected were then triangulated with technical documentation related to green public tenders that adopted green procurement criteria. The research is based on an ongoing collaboration with a large European university, actively engaged in GPP, that not only complies with all GPP policies enforced in its country but has also taken on a leadership role in adopting green criteria in the procurement of products/services for which GPP policies have not been developed yet.

The results of this research show that the adoption of GPP criteria has had multiple and nuanced impacts on the three stakeholders involved and on their relationships. In particular it emerged: (i) the role of the procurer's green leadership in less regulated industries, (ii) the need for greater communication to enhance a ripple effect downstream, and (iii) the lack of a direct feedback between suppliers and clients that highlights the need for greater interaction between them to help suppliers stay ahead of the curve and clients be satisfied and engaged.

This study endeavors to make significant contributions to the literature on Green Public Procurement (GPP) in several ways. Firstly, it will delve into the impact of GPP on various stakeholders, particularly procurers, suppliers, and internal clients. The perspectives of suppliers and internal clients have not received much attention – if any for internal clients – in the literature [10]. Consequently, this study will be the first of its kind to examine their triadic relationship comprehensively. Moreover, the selected case studies are drawn from a public university, a type of public organization for which procurement practices have been poorly researched [11]. Thus, this study will bring new evidence and a fresh perspective to the GPP literature.

The subsequent sections of this paper are organized as follows: *Chapter 1* reports a literature review on GPP; *Chapter 2* includes the methodology section which details the gaps to be addressed, the research question and framework guiding the research, and the multiple case study method that has been used to investigate the research question; *Chapter 3* describes and analyzes the results at the level of suppliers, procurers, and (internal) clients.; *Chapter 4* discusses such results comprehensively

using a triadic perspective; and lastly, *Conclusion* section summarizes the results and discusses the limitations of the research.

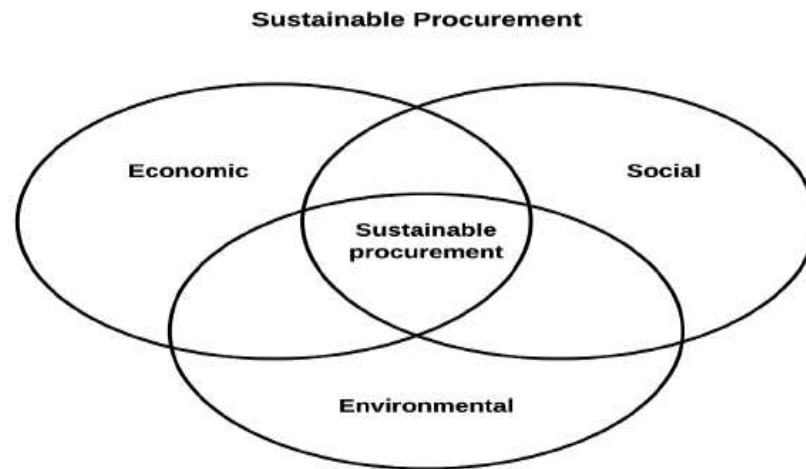
Chapter 1: Green Public Procurement

The purpose of this chapter is to conduct a literature review on green public procurement. Beginning with an overview of sustainable procurement, through an in-depth analysis of green procurement of public institutions, along with the legal framework governing its application in Europe and more in detail in Italy. Then, the chapter will focus on the implementation of GPP practices at the level of universities, taking as a reference the University of Padua. Finally, a case study example of GPP in public tenders will be provided.

1.1 Sustainability in public procurement

According to the ‘triple bottom line’ theory, also known as the 3Ps (profit, people, and planet), businesses should take into account factors other than only their financial performance. Businesses should operate in social and environmental consciousness as well, and be managed in a way that generates profit while also enhancing the quality of people’s lives and minimizing the damage to the planet (Figure 1.1) [1], [2].

Figure 1.1 Triple bottom line of sustainability



Source: Elkington (1997)

In fact, the assessment of the company's impact on the environment and society is no longer optional. When businesses embrace sustainability, they create value for all stakeholders. Integrating all these sustainability factors into the decision-making process is one of the main concerns for procurement. Government agencies all over the world are increasingly using their procurement power to advance social, economic, and environmental policy objectives. Public procurement, which refers to the purchasing of goods and services by public organizations, accounts for approximately 16% of the Gross Domestic Product (GDP) of the European Union [3]; therefore, it is regarded as a key economic driver and has a significant power in orienting the market, including toward environmental protection policies and strategies. Public procurement can indeed affect production and consumption trends while at the same time creating substantial demand for greener products and services.

Sustainable Procurement (SP) represents a growing trend and an essential component to an organization's corporate social responsibility and sustainability strategy. It involves the whole supply chain from suppliers to customers and can provide organizations with a competitive advantage. Thus, organizations are now putting more pressure on their suppliers to adopt sustainable practices [4]. The concept of sustainable development appeared for the first time in 1987 in the report called "Our Common

Future” published by the Brundtland Commission¹. In the report, sustainable development was defined as the “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [5]. The WCED report represented the main political turning point, and its definition of sustainable development has been vital for creating a global perspective on our planet’s future, contributing to national and international policy development [6].

After the WCED, the 1992 UN Conference on Environment and Development, also known as the "Rio Conference" or "Earth Summit," was another breakthrough event. There were four international Preparatory Committees in preparation for the conference, in which each UN member country produced a report covering national environmental aspects and preparing an action plan for promoting sustainable development in their country. The preparatory process included major stakeholders, spreading the concept of sustainable development everywhere in the world. The Rio Conference resulted in the creation of several important documents, including the Rio Declaration, the Agenda 21, and other conventions addressing climate change, biodiversity, and desertification [7].

Finally, the Sustainable Development Goals (SDGs) of the 2030 Agenda have placed sustainability at the center of the development agenda. Member states are committed to “ensure sustainable consumption and production patterns” (SDG 12) and “promote public procurement practices that are sustainable in accordance with national policies and priorities” (SDG target 12.7)[8]. Sustainable Public Procurement (SPP) was defined by the United Nations as “a process whereby public organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole lifecycle basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst minimizing damage to the environment” [9]. In other words, in a SPP perspective, procurement focuses on achieving value for money (VfM) rather than pursuing the lowest cost, and it is strategically employed to achieve the goals related to the three pillars of sustainable development: economic, environmental, and social.

¹ Formerly the World Commission on Environment and Development is a sub-organization of the United Nations (UN) that aims to unite countries in pursuit of sustainable development.

Starting from the principles of the 2030 Agenda, the European Commission launched the “European Green Deal” that is a comprehensive programmatic document that outlines the European Union's commitments in the field of sustainability, with the goal of achieving the 55% reduction in climate-changing gas emissions by 2030 and climate neutrality by 2050. The "Green Deal" also acknowledges and gives the public administration sector a strategic role in developing and implementing sustainable logistical and infrastructure solutions that are in line with the goal of climate neutrality.

1.2 Green Public Procurement: a literature review

Public Administrations (PAs) are considered one of the most important buyers of green products. Given the significant carbon footprint of the public sector, PAs are encouraging the purchase of goods and services with lower environmental negative impacts and promoting the manufacture of greener products [10]. Hence, public procurement is a strategic instrument that can encourage sustainable economic growth while helping in the transition to a resource and energy efficient circular economy. This means that PAs may significantly contribute to sustainable consumption and production by utilizing their purchasing power to select environmentally friendly goods, services, and works, a process known as *Green Public Procurement (GPP)* [11].

GPP has a lot of potential because of the market influence that Public Administrations can have. The behavior of the “PA consumer” may, in fact, have a huge impact on market behavior, on both the demand and supply sides. On the supply side, product and service producers are motivated to reduce their environmental impact in order to have the possibility to continue selling to PAs. On the demand side, Public Administrations act as a model for the behavior of citizens, private institutions, and businesses and can influence production and consumption patterns by fostering demand for environmentally friendly goods and technologies.

The concept of Green Public Procurement (GPP) was developed as a result of the increased consideration of environmental factors in SPP public policies [11]. In fact, GPP is considered an integral part of sustainable development given its ability to have a positive impact on climate change with a lower environmental footprint, as opposed

to doing “business as usual” [12]. According to the European Commission's definition of GPP, it is a "process whereby public authorities seek to produce goods, services, and works with a reduced environmental impact through their life cycle when compared to goods, services, and works with the primary function that would otherwise be procured" [13].

Public authorities can use GPP to help alleviate the pressure on our planet while also saving money by choosing products and services with higher energy efficiency. GPP entails considering a product's impact throughout its whole lifecycle and what happens to it when it is no longer in use. For this reason, Green Public Procurement is more than just an environmental policy tool; it is also a method for optimizing public resources and a stimulus for environmental innovation and circularity. In the 2015 EU Action Plan for the Circular Economy, GPP was identified as one of the necessary instruments for helping ensure a more efficient use of resources and contributing toward the development of a more sustainable, low carbon and competitive economy [14]. This plan outlined a number of actions to help “close the circle” of products lifecycles and so to make it easier to incorporate the principles of the circular economy into public procurement, such as improving waste policy to support waste prevention and circularity, developing a strong secondary raw materials market in the EU, and accelerating the transition through research, innovation, and digitalization [13].

1.2.1 Implementation of environmental criteria

At the base of GPP there is the integration of environmental criteria into the procurement process to enable procurers identify the products and services that deliver the best value for money (VfM). The goal of EU green public criteria is to streamline the procurement for products having a lower impact on the environment. The uptake of GPP is based on having *clear and verifiable* environmental criteria and requirements that rely on a life-cycle perspective and scientific basis. The life cycle perspective, particularly, is crucial to the GPP idea; green criteria indeed need to go beyond focusing on the environmental friendliness of the production/delivery of goods, services, or projects to examine environmental performance over the course of an object's whole life cycle. Thus, it can include the environmental impacts at every stage of a product's life cycle, including raw materials extraction, manufacturing, assembly, packaging,

transportation, maintenance, and disposal. It may also address the operational qualifications of contractors, including supply chain management, staff capacity, and management systems [15]. The European Union has defined ambitious and specific goals to "close the loop" of the life cycle of products with the aforementioned Action Plan for the circular economy of 2015. The European Union, indeed, commits in promoting the integration of circularity in the Minimum Environmental Criteria (MEC), acknowledging that the GPP plays a crucial role in encouraging the shift to the circular economy.

These criteria must be similar and comparable between Member States in order to avoid a distortion of the market that would reduce competition [16]. Thus far, in order to make it easier for Member States to implement GPP locally, the European Commission has created 21 sets of GPP criteria², each set corresponding to a particular group of procurement areas. These criteria rely on existing ecolabels and on data gathered from stakeholders in the industry and society. Their objective is to achieve a good balance between environmental performance, costs, market availability and ease of verification [17].

The criteria, whose application is voluntary, can be divided into two levels of ambition: core criteria and comprehensive criteria. Core criteria are intended to facilitate the application of GPP by any contracting authority across the Member States. They focus on the key areas of a product's environmental performance and are designed to minimize administrative costs for businesses; on the other hand, comprehensive criteria include a higher level or a wider range of environmental performance and can be used by authorities that want to go further in promoting environmental and innovation goals [18].

² EU GPP criteria categories are: cleaning products and services; computers, monitors, tablets and smartphones; data centers, server rooms and cloud services; electricity; food catering services and vending machines; furniture; imaging equipment, consumables and print services; office building design, construction and management; paints varnishes and road markings; public space maintenance; road design, construction and maintenance; road lighting and traffic signals; textiles; road transport.

As previously stated, GPP criteria are used to recognize not only green products/services but also green suppliers and can be applied at each stage of procurement [16], [19]:

- In the supplier selection stage, assessing the technical expertise of bidders in implementing environmental management measures. Qualification or selection criteria focus on the economic operators' ability to perform the contract they are tendering for, taking into account specific experience and competence related to environmental aspects that are relevant to the subject matter of the contract. These qualification criteria can be used to decide which suppliers are invited to submit proposals through a prequalification process. (e.g. compliance with environmental laws, availability of resources, equipment and technologies).
- When defining technical specifications (pass/fail entry threshold) that are required and verifiable characteristics that products and services must have to respond to their intended use; or they may also refer to specifications defined by the so-called ecolabels. Green criteria in technical specification are knock-out or base criteria that bidders must meet to be eligible to be considered at the evaluation stage and usually focus on the highest priority environmental impacts. The use of mandatory criteria removes uncertainty for suppliers, lowers risks for procurers, simplifies green tender design, and establishes a common practice for all contracting agencies [16].
- In selecting award criteria that are optional requirements that encourage bidders to submit proposals for solutions that perform better environmentally. At the award stage, the contracting authority evaluates the quality of the tenders and compares costs. When evaluating the quality of tenders, predetermined award criteria, published in advance, are used to decide which tender is the best; suppliers gain extra points for fulfilling these requirements.
- In the execution of supply or service contract. Contract performance criteria can be used to ensure that winning suppliers execute the contract in an

environmentally friendly way and meet contract requirements. They can be used to encourage suppliers to progressively reduce their environmental impacts, too. (e.g. ecological transport, recyclable packaging)

Environmental criteria associated with procurement increase the complexity of the process and decrease the number of qualified bidders. The literature review suggests that product-related and organization-related environmental criteria predominate in the technical specification requirements and standards in the procurement process. In the GPP process, bids are screened according to their compliance with mandatory green criteria. Only if they pass this first selection, they can advance to the following phase in which the contract is awarded to the final winning bid [20]. In some countries, there are regulations that determine the weights of price versus other performance criteria. In other cases, the Public Procurement Authority (PPA) can indicate how the environmental criteria should be applied in the selection process, specifying which standards should be required as technical qualifications and indicating optional award criteria and the corresponding weights to be applied. Procurers should keep in mind the need to choose criteria for a tender that "push" the market toward green solutions while being achievable to ensure a competitive response from bidders [16].

1.2.2 Process for setting GPP criteria

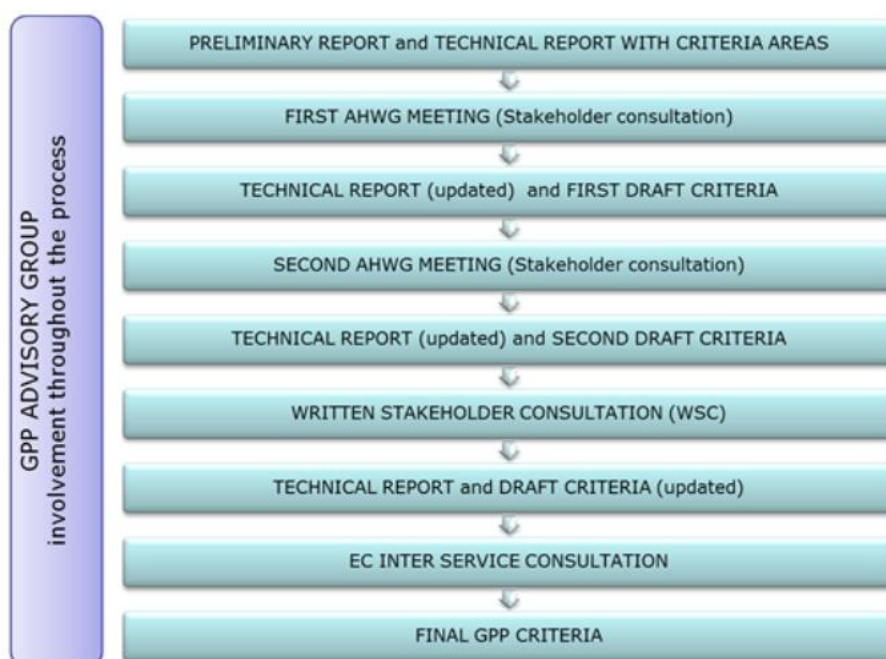
Environmental criteria that strive to address environmental impacts throughout the supply chain and life cycle of all inputs can be complex in both design and application. Governments generally adopt standardized environmental criteria for regularly procured procurement categories in order to facilitate procurement. They may also simplify environmental criteria by focusing on the most significant environmental impacts and employing third-party ecolabels and environmental management standards [16].

The use of standardized environmental criteria simplifies the procurement process and provides procurers with confidence about environmental standards. The PPA is often responsible for developing standardized environmental criteria, usually in coordination with environmental authorities, sector agencies, and external partners. The process of

developing environmental criteria should be transparent and inclusive. The criteria should be objective and verifiable, free of bias toward suppliers or alternative technical solutions with comparable environmental performance and communicated to potential suppliers transparently and effectively to allow for fair competition. Environmental criteria can be designed using legislative requirements and technical regulations, as well as national and organizational environmental policy priorities, specifications recommended by regional bodies, environmental standards, certifications, and labels, market research and industry reports, and criteria developed by other countries [16].

The GPP criteria development procedure established in 2010 aims to make the process transparent and participatory, as well as to improve synergies among various product-related policy instruments such as GPP, Eco-design, EU Ecolabel, and Energy label [21]. The GPP criteria process is structured similarly to the EU Ecolabel criteria-setting procedure. It allows stakeholders to provide feedback on background studies and draft GPP criteria at various stages of the process. The phases of the EU GPP criteria development process are schematically presented in Figure 1.2.

Figure 1.2 – Procedure for the development of EU GPP criteria



Source: European Commission website

The process for the development of GPP criteria starts with an external consultation consisting of two working group meetings, open to all interested parties. During the first meeting the preliminary report, a draft of the technical report and draft criteria are discussed and made available on the Commission's dedicated website. The working group meetings and any online feedback are taken into account when revising the documents. All comments submitted during the external consultation period must receive responses, stating whether they are accepted or rejected and why. Following the external consultation, a proposal for EU GPP Criteria is presented to the informal EU GPP Advisory Group (AG)³ for comments. The AG serves as a consultative body for the development of GPP criteria and its role is to assist the Commission in developing a work plan for criteria development and to evaluate GPP criteria and related reports at the end of the process. Finally, the EU GPP criteria and the technical report will be adopted and published on the EU GPP website following an inter-service consultation within the Commission [22].

1.2.3 Barriers to the implementation of GPP

Establishing environmental standards for goods and services is the cornerstone of green public procurement [23]. However, the practice of environmental sustainability in public procurement has not been fully achieved due to some implementation challenges. Numerous studies have drawn attention to the obstacles that limit the introduction of environmental considerations into public sector procurement. Bouwer et al. [24] identified the major challenges that PAs face when implementing green procurement. Their research examined results from 25 Member States, categorizing them into two groups based on their performance⁴. The findings revealed that the main barriers to GPP adoption were: perceived higher costs of greener products, a lack of environmental knowledge and information tools, insufficient employee training, and a lack of managerial support.

³ The GPP AG is composed of one representative per Member State as well as five representatives of other stakeholders (i.e. civil society, industry, SMEs, public procurement and local authority)

⁴ The study highlighted that there are 7 countries (Austria, Denmark, Finland, Germany, Netherlands, Sweden and UK) hereafter known as the 'Green-7', that are currently implementing more elements of GPP, meaning that they consistently have more tenders with green criteria than the 'Other-18' countries.

Table 1.1: Main barriers to GPP as perceived by public purchasers

Obstacle	All	'Green-7'	Other 18
Perception that environmentally friendlier products would be more expensive	44%	46%	38%
Lack of knowledge about the environment and how to develop environmental criteria	35%	27%	37%
Lack of management support (including money and time), strategic focus and organisational policy strongly promoting GPP	33%	34%	32%
Lack of practical tools and information (e.g. handbooks, internet-tools)	25%	21%	30%
Lack of training for public procurement officers	25%	24%	27%

Source: Bouwer et al. 2006

These key barriers to the uptake of GPP by PAs can be classified into three categories: economic, political and cognitive [19], [25].

i. Economic barrier

Economic constraints have always been one of the main barriers to GPP because sustainable methods and greener products or services are often perceived as more expensive. Using purchasing price alone to choose between offers, rather than the complete life-cycle cost of the product or service, can have an impact on the uptake of green products and services. Applying environmental criteria to procurement processes may result in higher upfront purchasing costs, but overall costs are often reduced because higher purchasing prices of green products and services are offset by lower operating, maintenance, or disposal costs. According to a 2008 research titled "Collection of Statistical Information on Green Public Procurement in the EU," GPP generally does not raise costs but rather can assist the purchasing organization in cutting costs [26]. To overcome this barrier, new and existing procurement officers should be educated in the area of life cycle costing, which they should then be encouraged to use at some level in their purchasing decisions [27]

ii. Political barrier

The political barrier includes lack of support from higher authorities and lack of cooperation between authorities. Many studies highlighted that senior officials in the European public sector are either unaware of the importance of the GPP agenda or are not communicating this to their employees [24]. Poor understanding of the importance of GPP and poor results in spreading awareness can influence the degree to which GPP is implemented in organizations. Furthermore, cooperation as well as coordinated exchange of best practices and networking are necessary to enhance a broader implementation of GPP [28]. Many of the issues faced in implementing GPP are common to all public authorities, and there is a lot to be gained from networking and cooperating with others. For example, sharing information on the environmental criteria used in tendering or the market availability of green products can help save time and effort.

iii. Cognitive barrier

The cognitive barrier includes lack of operational and/or information tools and a lack of training; to implement GPP successfully, staff must have appropriate practical skills, knowledge and access to information. Procurers are typically obliged to get training on the legal and technical aspects of GPP implementation, as well as the notion of life cycle costing. Additionally, the cognitive barrier includes lack of competence in environmental matters and in establishing environmental criteria. In certain circumstances, buyers are still unsure of what constitutes an "environmentally and/or socially preferable" product or service, and how to incorporate appropriate criteria to identify these in tendering. It is also difficult to effectively assess and verify information supplied by tenderers in response to environmental requirements. For some product and service groups, public authorities do not have access to clear and verifiable criteria that allow public bodies to include environmental factors into their tendering while adhering to the requirements of the Procurement Directives and other sources of procurement law [28].

1.3 GPP legal framework in Europe

At the European level, both the Green Book of Integrated Product Policy (IPP) of 2001 and the Sixth Environment Action Programme of 2002 firmly established the key role that green public procurement plays in reducing environmental impacts and raising consumer awareness. The goal of the IPP is to minimize a product's environmental impact throughout its entire life cycle, while also taking market and competitiveness concerns into account. It also emphasizes the role of PAs as market demand drivers for greener consumption through GPP [29]. In 2003, another communication on 'Integrated Product Policy - Building on Environmental Life-Cycle Thinking' (COM (2003) 302) was published, urging all Member States to develop their own national action plan (NAP) for greening their public procurement by the end of 2006 and revise it every three years. In these action plans the targets and the specific measures needed to achieve those targets⁵ must be specified.

The European Communication n. 274/2001 on "A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development", however, stands out as one of the most significant documents regarding GPP [30]. It illustrates the opportunities for public authorities to adopt green purchasing practices and provides operational guidelines on how environmental concerns may be taken into account at each separate stage of the contract award process. It specifically addresses the following concerns as barriers to the adoption of GPP: the requirement for a procedure for establishing common criteria, knowledge of product life-cycle costing, legal and operational guidance, and political support through a political objective. The Communication also outlined an indicative goal, according to which 50% of all tendering processes should be green by the year 2010, in compliance with the fundamental EU GPP criteria. This communication is of interest, but it is not legally binding. The current legal framework in the field of GPP is specified by the provisions of the Treaty on the Functioning of the European Union and by the EU Procurement

⁵ the action plans "should contain an assessment of the existing situation and ambitious targets for the situation in three years' time", "should state clearly what measures will be taken to achieve this", "should be drawn up for the first time by the end of 2006 and then revised every three years" and "will not be legally-binding but will provide political impetus to the process of implementing and raising awareness of greener public procurement".

Directives (2014/24/EU and 2014/25/EU⁶). According to them, public procurement must be compliant with the guiding principles of: *“free movement of goods and services and freedom of establishment, non-discrimination and equal treatment, transparency, proportionality and mutual recognition”* [31] The aim of these directives is to “increase the efficiency of public spending, facilitating in particular the participation of small and medium-sized enterprises (SMEs) in public procurement, and to enable procurers to make better use of public procurement in support of common societal goals”.

To comply with the legal framework’s requirements when considering environmental issues, GPP criteria should be verifiable and should be formulated either as selection criteria, technical specifications, award criteria or contract performance clauses. Technical specifications indicate the requirements for submitting a tender, award criteria allow for a comparison of the various tenders, and contract performance conditions specify how the contract must be carried out. In particular, when looking at public tenders, green criteria can be found in technical specifications⁷ as a required characteristic of a product/service or as referred to “eco-labels” which require the product or service to be certified. Alternatively, they can be found in award criteria⁸ that are used by contracting authorities to compare the offers before making a choice. The two different ways to award contracts are described in EU directives as "the lowest price" and "the most economically advantageous tender" (MEAT) which shall be determined utilizing a cost-effectiveness method, such as life cycle cost [19].

Accordingly, the public sector may award a contract to the bidder who offers the lowest price or the bid that is the most advantageous from an economical point of view while comprehensively taking into account factors like "quality, price, technical merit, aesthetic and functional characteristics, environmental characteristics, running costs, cost effectiveness, after sales service and technical assistance, delivery date and

⁶ These directives respectively replaced the 2004/18/EC on the coordination of procedures for the award of public works contracts, supply contracts and public service contracts and the 2004/17/EC on coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors)

⁷ Specified in article 42 of the 2014/24/EU Directive and article 60 of the 2014/25/EU Directive

⁸ Specified in article 67 of the 2014/24/EU Directive and article 82 of the 2014/25/EU Directive

delivery period of completion, etc." [32]. According to the Directive 2014/24/EU on public procurement, member states should have the authority to forbid or restrict cost- or price-only procurement in order to promote quality-oriented procurement.

1.4 Overview of Italian regulations of public contracts

The Communication of the Public Procurement Commission for a better environment set the target of 50% GPP by 2010. As of today, taking into account the obligations defined by the various Action Plans for the GPP of the European countries, the GPP situation is varied and is presented as briefly described in Table 1.2 [33].

Table 1.2 – GPP situation of the European countries

Country		Country	
Austria	Generic obligation at the federal level	Belgium	Regional standards for specific products
Bulgaria	Product targets defined	Cyprus	Target 50% of purchases
Croatia	Target 50% of purchases by 202	Denmark	Indicative rules for 50% purchases
Estonia	15% in 2018	Finland	Targets for specific products
France	30% target	Germany	Mandatory LCC use
Latvia	30% until 2017 and 100% Community Funds	Italy	Mandatory 100% purchases (art. 34) CAM
Ireland	50% of purchases	Lithuania	50% of purchases by 2020
Malta	High targets for 14 product groups	Norway	None % but GPP and LCC obligation
Netherlands	Objectives 100-75-50% at various levels	Poland	Target 25%
Portugal	60% and 40% for public companies	Czech Rep.	Rules for managers and 25% of vehicles
Slovakia	50% centrally	Slovenia	50% and development of 20 CAM
Spain	25- 100% for product categories		

This research will provide evidence from a large Italian University; thus, regulations at Italian level will be considered. The Public Procurement Code, which became effective

in 2006, governs public procurement in Italy. It covers public work contracts, public supply contracts, and public service contracts. It fully complies with the EU directives and in some cases proposes a use of GPP criteria that exceeds the minimum requirements [34]. In response to the European directives on procurement, Italy imposed the application of the so-called Minimum Environmental Criteria (in Italian, “Criteri Ambientali Minimi - CAM) with the intention of minimizing negative environmental effects, advancing more environmentally friendly production systems, and lowering consumption.

In 2008, Italy adopted its National Action Plan on GPP with the purpose of creating the conditions needed for the GPP to achieve its full potential as a tool for environmental improvement. The Italian Action Plan aims to encourage GPP practices by means of the following actions:

- Participation of GPP stakeholders at the national level
- Education of Government Agencies and other Public Bodies on the GPP through the provision of information and training
- Definition of methodological guidance on setting up "sustainable" procurement processes and environmental criteria to be included in tender specifications for goods, services, and projects identified as priorities in light of their environmental impact and volume of spending
- Definition of national targets to be achieved and redefined every three years
- Periodic monitoring of the GPP's dissemination and analysis of the environmental benefits realized

Even if the implementation of EU GPP criteria is voluntary, Italy made them mandatory with the law n.221 of December of 2015 supporting GPP and restricting the excessive use of natural resources. According to Italian regulations on public contracts, the technical requirements and contractual provisions identified by the MEC must be included in the relevant calls for tenders by contracting authorities who

intend to purchase goods, works, or services falling within certain categories⁹ (article 34)¹⁰ [35]. Other innovations in public tenders introduced with the law n.221 concern the management of the 'below-threshold'. The community relevance thresholds in tender procedures are the starting bid values above which it is mandatory to carry out one of the specific procedures envisaged by the European directives on public procurement, which are open to all European economic operators in possession of the required requirements. There are different thresholds for public works contracts and for service and supply contracts. These thresholds have been updated on January 2022¹¹ as follow [36]:

- 5.382.000 euros for public procurement works and for concessions;
- 140.000 euros for public supply contracts, service contracts and public design contests awarded by contracting authorities which are central government authorities;
- 215.000 euros for public procurement supplies and services and for public design competitions;
- 750.000 euros for the contracts of social services

Moreover, the new Public Procurement Code requires contracting authorities to use the lowest price award criterion¹² only in cases adequately justified in the tender itself, preferring instead the use of the most economically advantageous tender (MEAT) (article 95). So, the Italian Procurement Code gives priority to the use of the most economically advantageous tender, and encourages a synergy with the

⁹ 18 CAM categories: interior furniture, street furniture, incontinence aids, work shoes and leather accessories, paper, cartridges, building, cultural events, public lighting (supply and design), public lighting (service), lighting, heating/cooling for building, industrial washing and rental of textile and mattresses, municipal waste and street sweeping, collective catering, disinfection, printers, textiles, vehicles, public green.

¹⁰ Art. 34 of the Italian Procurement Code, Criteria of energy and environmental sustainability, which provides that the contracting station insert, both in the design phase and in the tender phase, "(...) of the technical specifications and contractual clauses contained in the minimum environmental criteria (...)", making their application mandatory by the contracting authorities.

¹¹ EU Regulation 2021/1952

¹² Tenderers are required to guarantee a minimum quality of the supply already established in the technical specifications and to reduce the value indicated by the contracting station on an auction basis. The winner is the one who, for the same quality, offers a more advantageous price for the administration.

environmental issues of green public procurement and the Minimum Environmental Criteria [35].

1.5 GPP in universities

Particular attention is placed on public institutions, and thus on universities, not only as a source of innovation and experimentation, but also for their role in promoting training tools and raising societal awareness of sustainability issues in all their forms. In fact, universities play a pivotal role and may contribute to sustainable development through education, research and daily operations. Universities are now committed to make their operations more sustainable by integrating sustainable criteria into university management at all levels, including purchasing decisions. They are indeed gradually developing a Green Procurement policy and incorporating it into their contracts with suppliers [11]. Public institutions should choose green suppliers¹³, or collaborate with them, to benefit from the environmental advantages that they provide through the supply chain [37], [38]. As a result, supplier selection is a key procurement activity in the implementation of GPP to assess if bidders have the capacity and ability to perform the environmental requirements in the contract.

However, the main obstacle is that integrating SP implies important organizational changes to be enacted within and outside the university's boundaries. This emphasizes how, in order to encourage change, sustainability must be incorporated into broad university vision statements and strategic plans [39].

1.5.1 University of Padua as a reference model

The University of Padua, founded in 1222, is one of the oldest and most prestigious universities in Europe and has the reputation of being a university with a trend of continuous improvement in the areas of environmental, social, and economic sustainability. The University of Padua, in fact, "promotes the development of a culture based on universal values such as human rights, peace, environmental protection, and international solidarity" exactly in accordance with its culture, which is encapsulated

¹³ Suppliers are considered "green" when they are concerned about the environment and their designing, packaging, logistics, and other operations adhere to the relevant environmental criteria.

in the motto "Universa Universis Patavina Libertas". According to its vision, Unipd reiterates its crucial role as a public organization and a supporter of sustainable development in its three primary areas: economic growth, inclusion and gender equality, and environmental protection. This dedication is demonstrated in the ways that the University carries out its teaching, research, and third mission functions. With the creation of the "UniPadova Sostenibile" project, the university promoted the development and implementation of good practices showing its commitment in line with the United Nations 2030 Agenda. This emphasizes the importance that the specifications of environmental criteria are adequate with respect to specific, strategic, and long-term environmental objectives.

Important awards crowned the results of the University's commitment in the fields of environmental, social and economic sustainability that emerge from the pages of the Sustainability Report of 2021-2022. First, ANVUR evaluated the "UniPadova Sostenibile" project as "excellent and extremely relevant" and as a reference model for other universities because it is "highly innovative, effective, and proven to be a national best practice" [40]. Moreover, the University of Padua obtained the CompraVerde Veneto 2022 Award for its "particular attention to the recovery and redevelopment of urban spaces, soil consumption, compliance with CAM, criteria enriched by the presence of requisites and incentives linked to international sector certifications".

To these recognitions are added the important results achieved in both rankings that focus on sustainability policies: the GreenMetric rankings and THE Impact Rankings. In the first one, the University of Padua ranked 97th out of 956 participating universities, while in THE Impact Rankings, it positioned itself in 76th place in the world and in 2nd place among the participating Italian universities. Finally, the University of Padua ranked 1st in Italy and 61st in the world within the 700 universities selected in the first edition of the QS Sustainability ranking of world universities that was released in the fall of 2022. This ranking recognizes universities that have the potential to drive and accelerate the change required for sustainable development in the areas of environment, society, and governance (ESG).

1.5.2 GPP in the University of Padua

In 2019, The University of Padua signed the Memorandum of Understanding on GPP with the Veneto Region, Ca' Foscari University of Venice, University of Verona, IUAV University of Venice, Unioncamere del Veneto and ARPAV. Some of the actions envisaged by the agreement are related to waste management and use of plastic. In the first case, the focus was on minimizing packaging waste, acting on supplies to avoid the use of single-use plastic, raising awareness and providing training on the issues of waste, supporting circular economy and green purchasing aimed at the university community and beyond. Moreover, the University of Padua has always managed hazardous and non-hazardous special waste in accordance with not only legal requirements but also ethical and environmental protection principles, promoting policies that aim to reuse materials in multiple production cycles and reduce waste with a circular economy perspective. In the second case, with the Plastic free project, the University of Padua committed to decreasing single-use plastic by encouraging the use of reusable bottles and containers. The goal was to install more micro-filtered water dispensers at university buildings throughout the two-year period of 2021–2022 [41].

These actions and other Green Procurement policies aimed at reducing the environmental impact show the commitment of the University of Padua to pursue the Sustainable Development Goals of the 2030 Agenda; the University of Padua encourages radical transformation both internally and externally through the "Charter of sustainability commitments" and by continuing the "UniPadova Sostenibile" project. The identified goals, such as enhancing cultural heritage, staff enhancement, student and staff psychophysical wellbeing, attention to the use of resources, buildings' sustainability, simplification, and digitalization, are meant to have a significant impact across the social, economic, cultural, and environmental dimensions.

1.6 GPP in practice: a case study example

In this paragraph, a case study example [42] of GPP in action will be presented to better understand what is GPP, how can it be applied and why is it important.

In 2004, the Environmental Protection Agency for the Tuscan Region (ARPAT) successfully piloted GPP for cleaning services for two of its 19 offices in Italy. The call

for tenders regarded a three-year contract worth €2.2 million for cleaning services, sanitation, washing services for laboratory glassware, with a low environmental impact, and other integrated services. To identify the most economically advantageous tender (MEAT) and balance price and quality needs, an open competitive tendering procedure was chosen. Green considerations were introduced at an early stage of the procurement strategy and were included in the call for tenders as technical specifications, award criteria and contract performance requirements:

- a. Technical specifications: the use of environmentally friendly and healthy cleaning products was required, defined by limiting the presence of volatile organic compounds, perfumes, dyes and surfactants, for example. Bidders were also required to provide instructions for using cleaning products in a sustainable manner
- b. Award criteria: following the MEAT criterion, price received 40 points, while quality received 60 points for employing 'green' cleaning techniques, reduced packaging, environmental product performance (share of products complying with ISO Type I labels or equivalent), and environmental quality of training programs.
- c. Contract performance: The successful contractor was required to implement an 'informal' environmental management system (EMS) for the service provided, to improve the entire environmental performance. The contractor was required to conduct an initial environmental review of the service, launch an environmental program and monitor it.

The main environmental impacts of cleaning services are associated with the use of cleaning products, such as air pollution, ozone formation, bioaccumulation or food chain exposure, and hazardous effects on aquatic organisms, among other things. The various measures included in the technical specifications, award criteria, and contract performance clauses served to improve product quality while decreasing quantity and the impact on the environment.

Chapter 2: Methodology

2.1 Research objectives

In the coming years, public procurement must become a driver of innovation and commercialization of low-carbon and sustainable infrastructures, goods, and services. Therefore, adopting green procurement criteria is deemed of paramount importance for improving the environmental sustainability of organizations and their supply chains [43]. In the public sector, an increasing number of organizations must orient toward sustainability and comply with policies that require them to use green criteria for the procurement of predefined product/service categories – a process known as Green Public Procurement (GPP) [20].

GPP research has notably expanded in the last decade, especially concerning the level of GPP implementation, and focusing on policy and policy design concerning specific sectors and areas. Efforts were also made to investigate the key drivers and barriers facilitating or hindering it [11]. Furthermore, some studies examined the “greenness” of public procurement, as well as how to include environmental issues into procurement processes [20]. However, an analysis of the existing literature reveals that, even if it recognizes the value of the implementation of GPP, it is challenging to monitor and report on GPP activity. Most public institutions across European countries have a rough estimate of GPP as a percentage of total procurement, based on data from e-procurement platforms such as the number of contracts awarded that include some environmental criteria [44]. Beyond that, there does not seem to be exhaustive data collection, aggregation, or reporting on the

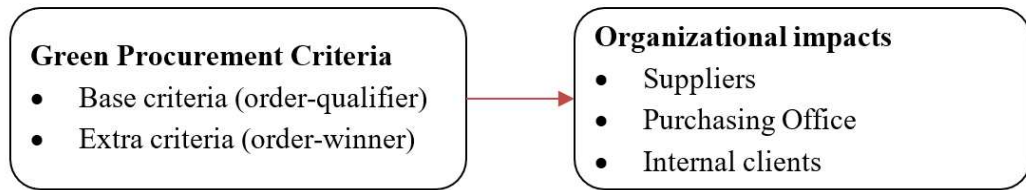
impacts of GPP uptake [44]. Research, in fact, has identified that there is a paucity of reviews covering GPP in terms of the evaluation of its effectiveness as environmental impact reduction and its potential spillover effects resulting from its implementation [20]. From an organizational perspective, the focus has been mostly on procurers though, which explains the ongoing call to analyze GPP from the suppliers' viewpoint [20]. Furthermore, some studies have highlighted the need to go beyond the dyadic focus on procurers-suppliers to include other stakeholders involved in the procurement process [45], [46].

This paper wants to fill this literature gap by investigating the impacts of GPP implementation and gauging a spillover effect that has not received much attention, namely, the organizational changes brought upon involved stakeholders. These include procurers, suppliers, and another actor so far neglected in the literature, i.e., the (internal) clients. Hence, the following research question is formulated:

RQ: *How does the adoption of green procurement criteria impact the organizational performance of a public institution and its relationship with suppliers and (internal) clients?*

Figure 2.1 summarizes the research framework. An accurate review of the literature was undertaken to structure the framework. The framework comprises two different sections: green procurement criteria and organizational impacts. The green procurement criteria will be identified and classified as order-qualifier and/or order-winner criteria (based on the classification of Hill, 1985)[47] in order to assess their impact as mandatory or award criteria on the stakeholders involved in the procurement process. Then their organizational impacts will be analyzed at the level of suppliers, purchasing office, and (internal) clients. Assessing the impacts on these three stakeholders allows to better understand the effects of GPP policies going outside the purchasing or supply department, to include interaction with upstream and downstream members of the supply chain [48]. The research is based on an ongoing collaboration with a large European university actively engaged in GPP, namely the University of Padua.

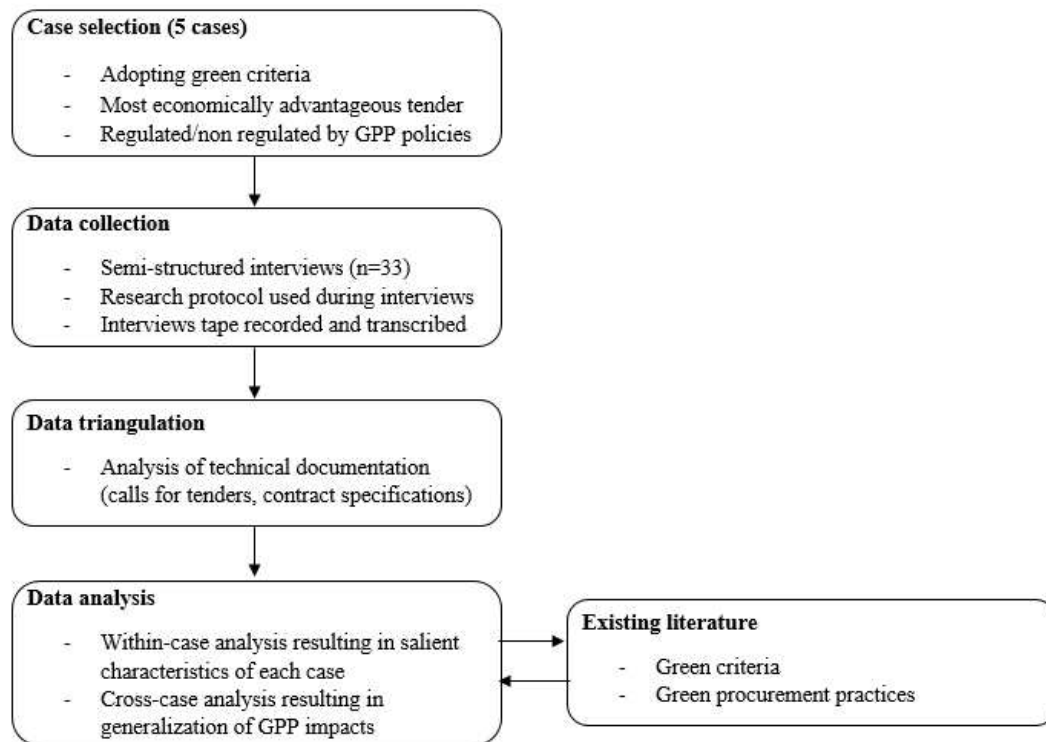
Figure 2.1 – Research framework



2.2 Research methodology

To address the research question, a descriptive and explanatory approach was adopted, based on the multiple-case study methodology. This allows for achieving a more in-depth level of observation as well as increasing the results' external validity [49]. When the research is exploratory and the phenomenon under investigation is still poorly studied, the case study methodology is appropriate because it allows for in-depth results through direct experience [49], [50]. Because the study of the organizational impacts of GPP is a recent field of study, the case study method contributes to generating valuable insights. Figure 2.2 gives an overview of the research method, which will be detailed in the following paragraphs of the methodology section.

Figure 2.2 - Research method



In line with GPP literature (Fuentes-Bargues et al., 2018), single purchases/calls for tender were chosen as units of analysis to investigate the impacts of adopting different green procurement criteria for different product/service categories.

2.3 Sample selection and description

In setting eligibility criteria for the sample, the selection included (i) only calls for tenders in which green procurement criteria were adopted, (ii) and that were awarded in favor of the most economically advantageous tender. Furthermore, (iii) purchases both regulated and non-regulated by GPP policies have been included to investigate the variation related to mandatory criteria adoption due to GPP policies or voluntary adoption due to the organization's commitment and leadership.

Accordingly, a sample of five cases was drawn leveraging the partnership with the University of Padua. The University, indeed, gave free access to all tender documents dated 2019-2022. Eligibility criteria have been applied to those documents, resulting

in the sample provided in Table 2.1. As suggested by Yin (2003) [51], five case studies can be considered a proper sample to provide rich insights during a limited time of data collection. Choosing multiple cases rather than a single case helps to overcome the limit of generalizability of the conclusions by augmenting external validity and helping guard against bias [49]; by choosing five cases making an in-depth analysis is possible. Moreover, the selected cases are heterogeneous in terms of product/service categories and regulations of GPP policies; therefore, they offer a broad overview of the researched topic.

Table 2.1 - Sample

ID	Description	Product or service	Regulated by GPP policies
T1	Interior furnishings-1	Product	Yes
T2	Interior furnishings-2	Product	Yes
T3	Green maintenance and mowing	Service	Yes
T4	Water dispensers and vending machines	Product	No
T5	Porterage and moving services	Service	No

The five cases were developed based on green criteria applied and involved actors at three different levels: (internal) clients, suppliers, and procurement staff. The five tenders are characterized by different categories of products/services (Tender 1-2: interior furnishings; Tender 3: green maintenance and mowing; Tender 4: water dispensers and vending machines; Tender 5: porterage and moving services) and are all linked with green purchase through mandatory compliance with Minimum Environmental Criteria and/or green criteria set by the University to promote green procurement.

More specifically, the five tenders considered in the analysis are:

- T1: Tender for the procurement of interior furnishings divided into two lots. The first lot includes educational furniture for the University and

communities; the second one regards seats, office furniture, and furnishing accessories needed to complete the common areas of the Beato Pellegrino Complex. It requires compliance with the Italian Minimum Environmental Criteria (CAM) for furniture and includes some award criteria linked to technical characteristics, and warranty. This tender concerns a 3-year contract worth 3.813.000 euros.

- T2: Tender for the procurement of new interior furnishings that includes seats, furniture, and furnishing accessories necessary for setting up spaces for educational activities at the University offices. It requires compliance with the Italian Minimum Environmental Criteria (CAM) for furniture and includes some award criteria linked to qualitative and technical product characteristics, and warranty. This tender concerns a framework agreement of 3 years, worth 1.200.000 euros.
- T3: European open procedure tender for the assignment of green maintenance and mowing service consisting of two lots. The first lot is for the maintenance of the green, gardens and trees in the Municipality of Padua and its surrounding; the second one is for the maintenance of the green, romantic garden and trees of the Park of Villa Revedin Bolasco in Castelfranco Veneto (TV). Compliance with Italian Minimum Environmental Requirements is required, and some award criteria are introduced, such as the use of low environmental pollution vehicles and certifications. The duration of the contract for both lots is 3 years, for a total of around 1.223.000 euros.
- T4: European open procedure tender for the assignment of the administration service of vending machines for food, drinks and water for the offices and facilities of the University of Padua. The technical specifications for this tender were drawn up taking into account the technical specification and contractual clauses contained in the Minimum Environmental Criteria (CAM) relating to collective catering service; In particular, the qualifiers of the tenders imposed the vending machines to belong at least to energy consumption class “E”, to supply FSC certified biodegradable paper cups and wooden pallets, to be compliant with noise and toxicity parameters and to be

CFC free; the University also added some award criteria regarding green economy initiatives and certifications¹⁴, the energy class of vending machines and water dispensers and the supply of glass water bottles. The concession includes 133 vending machines and 57 dispensers. The duration of the concession is 5 years and is worth 950.000 euros.

- T5: Tender for the handling, moving and portorage services to be carried out for the University of Padua's Central Administration, Departments, and decentralized branches within and outside the municipality of Padua. Although there are no specific MEC for moving and portorage services, the University set some environmental sustainability standards in the technical specifications, related to the packaging and pallets material composition and waste delivery. Moreover, in the tender there are award criteria linked to the use of low-environmental impact machinery, equipment, and vehicles. The estimated amount for this tender for the contractual period of 4 years was 3.200.000 euros.

A summary of the estimated economic amount of each tender and the corresponding duration of the contract is provided in Table 2.2:

Table 2.2 – Tender's economic amount and duration of the contracts

ID	Description	Duration of the contract (years)	Total amount (€)
T1	Interior furnishings-1	3	3.813.000
T2	Interior furnishing-2	3	1.200.000
T3	Green maintenance and mowing	3	1.223.043
T4	Water dispensers and vending machines	5	950.000
T5	Portorage and moving service	4	3.200.000

¹⁴ SA 8000 Social Responsibility Certification, UNI EN ISO 22000:2005 Certification, adhesion to the CONFIDA Service Charter

2.4 Data collection

To conduct data collection, an ad-hoc semi-structured interview protocol designed for this specific research [49] was developed for each level of analysis; it focused on gathering information concerning the assessment of the impacts and the organizational changes brought upon different stakeholders with the implementation of GPP practices. The interviews (n=33) were run with stakeholders involved in each green purchase, including bidding organizations, procurement staff, and (internal) clients. To ensure the validity of the collected data for the bidding organizations, senior informants were involved in the research: a Quality, Environment, Safety and Health manager, an Area Service Leader, an agronomist, a commercial director, and an architect assisted by an external consultant. These informants were contacted by phone and email to propose to collaborate on the research project and they all accepted. Interviews lasted around an hour each and were held in presence or via Zoom.

At the level of the procurement staff, the key informants chosen were the tender office director, the procurement office director, and the executive of APAL¹⁵. Finally, at the level of the (internal) clients, the interviews were carried out with representatives of the departments who requested the most the products/services offered by the sampled tenders. Additionally, a professor who directly participated in the drafting of Tender T3, as well as, students who utilize the products and services provided by Tender T4 have been interviewed. The interviewed students of the University of Padua (n=20) were randomly sampled. Sampling was stopped when thematic and meaning saturation were reached. Saturation was defined as when no new themes, or meanings, were identified, only repeated and further interviews would represent research waste [52]. Benchmarking with other qualitative studies based on students' interviews [53]–[57], twenty can be considered an appropriate number of interviews.

All interviews were tape-recorded and then transcribed. The entire data collection was conducted between April and June 2023.

¹⁵ Heritage, procurement, and logistics area

The following table (Table 2.3) shows the key informants chosen at each level of analysis, characterized with an identification code and their professional role.

Table 2.3 - Key informants at each level of analysis

Level of analysis	Identification code	Cases	Role
<i>Suppliers</i>	Supplier 1 Supplier 2 Supplier 3 Supplier 4 Supplier 5	T1 T2 T3 T4 T5	QHSE manager Architect Agronomist Area Service Leader Commercial director
<i>Procurement office</i>	Procurer 1 Procurer 2 Procurer 3	T1, T2, T3, T4, T5 T1, T2, T3, T4, T5 T1, T2, T3, T4, T5	Tender office director Procurement office director COO
<i>(Internal) clients</i>	Client 1 Client 2 Client 3 Client 4 Client 5 Client 6	T1 T2 T2 T5 T3 T4	Technical-administrative officer DTG Technical-administrative officer DM Technical-administrative officer DII Technical-administrative officer CAB TESAF advising professor 20 students

A well-designed protocol enhances the reliability and validity of case research [51]. At the suppliers' level, following the research framework, the interview protocol consisted of two layers: (i) compliance with the green procurement criteria adopted, (ii) and organizational impacts. In particular, it addressed the following:

- Green procurement criteria, checking compliance with basic green criteria and considering whether or not the firms had to review their processes and products to comply with green criteria in technical specifications. Sustainability improvement proposals for award criteria were considered, too.
- Organizational impacts at the level of suppliers, purchasing office, and (internal) clients considering product design and process design for the firm itself, and including also environmental product management and the overall qualitative impacts on the environmental performance of the firm. Finally, going upstream in the supply chain, the possible impacts on the relationship with their suppliers were evaluated, too.

At the procurers' level, a different ad-hoc interview protocol was implemented. The questions aimed at investigating the impact of GPP ex ante and ex post the call for tenders, focusing on the role of the procurement office. Specifically, the two sections included:

- Ex ante call for tenders, inquiring about the objectives that led the procurers to include green criteria in tenders both regulated and non-regulated by the Ministerial Decree. The protocol also focused on how they chose those criteria, investigating if the (internal) clients' needs were taken into account.
- Ex post call for tenders, analyzing the impacts on the relationship with suppliers and customers after the implementation of GPP policies.

Finally, the interviews with (internal) clients were conducted following a specific protocol which questions aimed at investigating the impacts of GPP on the clients that request or use the products or services provided by the university. Four aspects have been considered during the interviews:

- Awareness, examining if the (internal) clients were aware of the presence of more sustainable products/services that meet green criteria.
- Learning process, investigating if there should be more training in the sustainability and GPP fields, and if a green sensitivity has been transferred downstream to (internal) clients.
- Perceived effects, analyzing the consequences of the implementation of green criteria in terms of quality and level of variety of products/services offered and in terms of greater awareness of sustainability within the organization.
- Level of satisfaction for the products/services offered.

The detailed list of questions used for the interview protocols developed for the bidding organizations, procurers, and (internal) clients is available in *Appendix 2*.

Beyond the direct interviews, the data were triangulated with additional data to improve accuracy and reliability by combining different sources of information [58]. Secondary data were obtained from relevant technical documentation provided by the procurement department of the University (calls for tender, contract specifications, decree awarding the tenders, etc.).

2.5 Data analysis

Interviews were recorded and collected data were reported and organized based on the main areas of the interview protocol; the collected data were analyzed by a team composed of multiple researchers that triangulated the information provided by key informants with the technical documentation. All data were content analyzed, and within-case and cross-case analyses were developed using the two layers framework described before. First, the within-case analysis was developed starting from the case descriptions and coded data and looking at the organizational impacts for each case at the level of suppliers, purchasing office, and (internal) clients. At the level of the bidding organizations, each case was analyzed considering changes in product design, process design and changes in the relationships with upstream suppliers; at the procurers' level, the cases were examined considering the rationale behind the procurers' decisions to add green criteria and the methodology employed to select them; finally, at the level of (internal) clients, the within-case analysis focused on awareness, learning process, perceived effects, and satisfaction levels among different clients. At each level, the gathered information was then combined in a cross-case analysis. The cross-case analysis was made to extract common patterns and to enhance the generalizability of conclusions looking at similarities and differences between cases. The existing literature in the field of GPP was used to better understand and characterize the results.

Chapter 3: Results

This research aims to gauge the spillover effects of GPP related to the organizational changes brought upon three different stakeholders, namely suppliers, procurement department, and internal clients. In this chapter, the results for each level of analysis are presented.

3.1 Suppliers' level

First, a within-case analysis is presented, beginning with the description of the winning bidding organizations for each tender, along with the assessment of the main organizational impacts, in terms of (a) *product design*, (b) *process design*, and (c) *relationship with upstream suppliers*. Finally, a cross-case analysis is offered, highlighting relevant impacts, similar or contrasting, that emerge among cases.

3.1.1 Within-case analysis

At the level of suppliers, the winning bidding organizations that have been interviewed are presented in Table 3.1, indicating their turnover and number of employees.

Table 3.1 – Overview of winning bidding organizations

Description	Firm	Turnover (€)	Employees
<i>T1- Interior furnishings</i>	Meco srl	6 million	28
<i>T2- Interior furnishings</i>	Ares Line spa	20 million	55
<i>T3- Vending machines and water dispensers</i>	Gruppo Argenta	130 million	1000
<i>T4- Green maintenance and mowing</i>	Euphorbia srl	6 million	100
<i>T5- Porterage and moving service</i>	SAF srl	16.5 million	258

3.1.1.1 T1: Interior furnishings - Meco s.r.l

Meco s.r.l is an engineering company that designs and manufactures office and storage furniture. It has 28 employees and a factory of about 20,000 square meters located in Rovigo, production activities are all internal. It invoices about 6 million euros a year, with both Italian and other foreign markets. It also often collaborates at the production and materials level with the Mobilferro Group that manufactures furniture for schools and communities. Because of this collaboration, Meco s.r.l raised its quality standards, thanks to increased investments in technology, production, and organization. Meco s.r.l serves the private market as well as the public one participating in tenders. They became aware of the University of Padua contract, verified the feasibility both in terms of administrative documentation and admission requirements and of technical requirements of the furnishings, presented their bid, and won the tender. In the tender, the compliance with CAM was a minimum requirement to participate, and all their offered furnishings already had certifications attesting compliance with the 2017 ministerial decree¹⁶. They only had to improve the furniture from a technical point of view by focusing on the assembly and, in some cases, on the thickness of the tops. They improved their offer in terms of warranty and timing too. They also indicated in the technical offer some

¹⁶ CAM for furnishings of the DM 11/01/2017

certifications that they had carried out on some products with even more critical levels. It means that the legislation required a minimum level of performance, and they have conducted tests with more critical levels. The new 2022 ministerial decree brought about the introduction of a new requirement related to eco-design. This will be the next step the company will focus on, analyzing the raw materials' composition in terms of inputs and outputs.

The acquisition of the CAM's compliance did not require major changes in process structural terms or innovations in plant engineering for Mecco. On the contrary, there has been a large investment in certifications for the compliance with CAM. The final products, in fact, required a series of certifications issued by accredited laboratories, such as Cosmob, that carry out these tests. Moreover, the product legislation could change over time, thus a retesting could be necessary. For example, the legislation on the release of formaldehyde emissions has been updated between 2017 and 2022, and Mecco s.r.l had to retest all the wooden panels to meet the new requirements in the CAM. Obtaining these certifications required not only a large investment for testing finished products, but also a strong selection of suppliers for materials and components. A distinction needs to be made for the upstream suppliers according to the material, especially distinguishing between paper/wood and plastic components. On one side, for the paper and wood sectors, the supply chain is already mature, thus it is easier to find certified panel makers and most of them already have FSC and PFC certifications on the recyclability and origin of the wood. Mecco's suppliers of panels and wooden parts are all companies that carry their tests on their raw materials upstream and have always paid particular attention to eco-sustainability. For example, one of these suppliers, Saviola Group, has set up the ecological panel consortium, one of the first in Italy. On the other side, the plastic supply chain is not mature and it is more difficult to find certified suppliers that are compliant with the requirements required by the CAM.

3.1.1.2 T2: Interior furnishings – Ares Line s.p.a.

Ares Line s.p.a. works in the sector of office, community, and theater furniture in Italy and abroad with a turnover of around 20 million euros and 55 employees. In

Italy, about 90% of its supplies are on tenders to universities, theaters, or general contractors. So, the public market makes a high percentage of their turnover, and this represents a big incentive to adapt in advance to the mandatory minimum environmental criteria defined by the procurement code. Since 2018, when the first CAM for furnishings came into force, they have moved to apply them as much as possible. In compliance with European regulations, their furnishings are produced with materials and production processes with reduced environmental impact. They are the first company in the seating sector in Italy to have obtained the environmental certification from a certified third party, namely Bureau Veritas. Before the introduction of the CAM in the public procurement tendering, Ares Line was FSC, ISO 9000, ISO 14000 and 45001 certified and it also had the EMAS declaration, so it already had a corporate management system that allowed them to be performing on CAM. Despite this, they had to make some improvements for what concerns their product design, by offering paper or recycled plastic packagings and by testing the paddings to make them performant in terms of reaction to fire.

In terms of process design, the adoption of CAM has not led to any change, but it was demanding for the company and for its suppliers to meet all the requirements. Suppliers' approach was collaborative, and this change brought about a strengthening of the relationships with many of them. Some were already efficient in terms of environmental issues, such as Brando and Quadrifoglio who also issued Sustainability Reports. Moreover, thanks to the collaboration with one of their suppliers and another third-party subcontractor and after two years of research, Ares Line s.p.a brought out a new ad-hoc product line called "Aira Green Up" that is completely inspired by CAM. It has fire retardancy - Class 1 and is made from separate waste collection and this product resulted in the eco-compliance called "Plastic Second Life" (PSV).

3.1.1.3 T3: Vending machines and water dispenser- Gruppo Argenta

Gruppo Argenta is part of the Selecta group that is the European leader in the vending machines sector. Its turnover in Italy is over 130 million euros, with around 1000 employees. It has been a supplier of the University of Padua for several years,

participating in different tenders. However to comply with the criteria included in the last call (2021), it had to make some changes to both product and process design. For what concerns the products offered, the major changes concerned the PET removal from vending machines providing aluminum cans instead of plastic water bottles and the replacement of the plastic cups with paper cups and wooden scoops, FSC 100% biodegradable. As award criteria, they also increased the percentage of the snack line dedicated to healthy and bio products and they offered vending machines with a higher energy class.

For both the supply of paper cups and the energy class of the vending machines, the transition has been challenging for Gruppo Argenta. In the first case, the requests for paper cups made by the University led to some organizational impacts on process design. Since they started offering different types of products – paper, plastic, hybrid cups- for different clients, they had to expand the warehouse stock to allow the load and unload of the three different types of cups. This also had a negative impact on the capacity of the trucks, reducing the load capacity of the truck for each product. Consequently, the operator had to enter the warehouse more often to load the truck. Moreover, they faced a difficulty with their suppliers of paper cups because it was demanding for their suppliers to switch plants from plastic to paper and there was high demand and limited availability of raw materials. The commercial director actually stated: “high demand and low supply, prices skyrocketed.” However, eventually, the increasing request of the market in sustainable solutions, like paper cups and wooden scoops, led to an increase in their sales. As far as the vending machine energy class, the higher requirement could only be satisfied by one specific producer (i.e. FAS), thus making this criteria very difficult to get it, with several consequent production and sales implications.

3.1.1.4 T4: Green maintenance and mowing - Euphorbia s.r.l

Euphorbia is specialized in the design, management, and construction of public and private green areas. Its turnover is around 6 million a year and it has around 100 employees. The company's specialization, over the years, has turned not only to the care of the so-called urban greenery, but also to the care and maintenance of parks

and gardens of historic homes. Among its values, there is the attention to sustainability, and it is in constant research for innovations for the protection of the environment. Besides being compliant with the CAM, it has a certification for the Environmental Management System according to the UNI EN ISO 14001:2015 standard and an EMAS Registration Environmental Certification. In its bid for the call for tenders with the University of Padova, Euphorbia also included some solutions for environmental award criteria. Among these, the endotherapy, through which pesticides are injected directly into the trunk of tree plants, avoiding to be spread in the environment. Then, the use of LPG machines in addition to the Euro6 ones, and the use of lubricating oil with ecolabel characterized by a high degree of biodegradation. Finally, they also guarantee the use of alkylated petrol which, compared to others, is almost free of pollutants and burns without leaving soot, smoke and carbon residues.

The compliance with the aforementioned green criteria led to some organizational changes in the process design, requiring an update of the technical and operational staff and the acquisition of new machinery and equipment. Those changes also led to an improvement in organizational efficiency and in an update of the relationships with their suppliers, orienting towards new suppliers that could keep low costs, ensure on time deliveries and offer innovative solutions, with a proactive approach while respecting their environmental policies. For example, the implementation of a novel digital technology for the management of the irrigation system allowed them to make some innovative proposals. They embedded in their irrigation systems weather control units equipped with sensors that allowed them to automate the system according to humidity and rain. They also replaced the sprinkles with more efficient ones in terms of water distribution, and they implemented some agronomic practices such as mulches. All these proposals allowed saving both water and money at the same time.

3.1.1.5 T5: Porterage and moving service - SAF s.r.l.

SAF srl is a road haulage society headquartered in Naples that deals with transports and logistics in the context of private companies, public bodies or public health and

welfare structures such as hospitals and clinics and works in both Italian and international markets. Invoicing around 16.5 million euros with more than 250 employees, SAF srl is the main supplier of the entire Philip Morris group. SAF developed an environmental sustainability project years before its competitors allowing them to keep up easily with the increasingly demanding green criteria required by public administrations. They strive to be at the forefront in the field of sustainability, therefore, although there are not specific CAM for moving and portage services, they were already compliant with the environmental sustainability standards set by the University of Padua in the technical specifications of the tender, concerning packaging, pallets and waste delivery. They, indeed, use recycled-wood pallets and use packaging such as cardboard packaging that are eco-sustainable, thus ensuring low environmental impacts. They offer a complete green service, both in terms of materials and in terms of vehicles. SAF srl provides its service using eco-green small vehicles and trucks: most of their fleet is electric or natural gas fueled.

As primary transport company, SAF srl built a partnership with the certifying body RINA that uses the company as an experimental platform for defining new procedures regarding environmental impact, energy and van recharging methods that will be then included in international certifications. Therefore, they did not have to make big changes in the design of their products since they were RINA¹⁷ certified from 2007, including ISO 9001:2000 and ISO 14001. Besides that, at the level of process design, SAF srl offered periodical updating courses on drive assistance, energy, and environmental efficiency to its employees who drive vans weighing more than 35 quintals.

Going upstream in the supply chain, after the introduction of new requirements to provide greener and greener products, SAF srl strengthened its relationship with its suppliers. The firm has historical, few, and small suppliers that engaged in the development of its sustainability project. According to the administration, finance, and control manager of SAF, they have a relationship of reciprocity with their

¹⁷ The RINA Certification team carries out business assurance activities with reference to regulatory standards of management systems, products and personnel covering a wide range of areas including ESG and decarbonization, ICT & cyber security, health and safety, diversity & inclusion, agri-food, transport and green building.

suppliers where the firm updates its suppliers and vice versa. In this way, they are able to retain their suppliers, enhancing their loyalty and increasing their commitment in proposing innovative solutions. Besides being suppliers of SAF, they also act as intermediaries when it comes to supplies that are not of their sector.

The results of the within-case analysis are summarized in Table 3.2

Table 3.2 – Within-case analysis for suppliers

	Product design	Process design	Relationship with suppliers
<i>T1 Supplier</i>	-New green product line -Paper or recycled plastic packaging	-No significant change	-Initial difficulties -Intensified collaboration -Suppliers already efficient in terms of sustainability
<i>T2 Supplier</i>	- Big investment in certifications	-No significant change	-Panels suppliers already efficient in terms of sustainability -Difficulties in finding certified plastic suppliers -Lower bargaining power
<i>T3 Supplier</i>	-Smart irrigation system -Pesticides reduction	-Technical and operational staff update -Purchase of new machinery and equipment -Organizational efficiency	-Collaborative approach -Proactive suppliers -New suppliers
<i>T4 Supplier</i>	-Switch from plastic to paper cups -PET removal from vending machines -Sugar reduction and no-scoop for bitter drinks	-Greater warehouse stocks to allow the load and unload of different types of cups -Reduced load capacity of trucks for each product	-Initial difficulties due to lack of raw materials -Challenge for suppliers to switch from plastic to paper plants -Only one supplier for high energy efficiency vending machines
<i>T5 Supplier</i>	-Partnership with certifying body -Sustainable cardboard packaging -Low-environmental impact vehicles	-Updating courses for employees	-Intensified collaboration -Proactive suppliers

3.1.2 Cross-case analysis

In the following, a cross-case analysis is offered highlighting the relevant impacts of green procurement criteria adoption on suppliers. In particular, three main aspects emerge from the analysis: (i) *supply network update*, (ii) *sustainability as an investment* that can help to reduce operational costs, and (iii) *the ripple effect of the procurer's green leadership*.

3.1.2.1 Update of the supply network

A major impact resulting from the introduction of green criteria in public tenders is related to the update/upskilling of the supply networks. In fact, green public procurement imposes 1st-tier suppliers participating in the tendering process to meet demanding green criteria. Therefore, it requests them to ask for compliance and improved performance by their own suppliers (2nd-tier). In turn, these should pursue compliance and improved performance by their suppliers (3rd-tier), and so on. The goal, and the eventual benefit, is to build a cascade of sustainable practices that flows smoothly across the whole supply network, what Lee *et al.* [59] conceptualize as the “green bullwhip effect”.

From the analysis of the cases, it emerges that there is a distinction to be drawn between industrial sectors in which sustainability was already well established before the tender and sectors in which it was not. In the former case, the supply network was already mature and ready to act and reply compliant with the requirements specified in the tenders. For example, neither T1 Supplier nor T2 Supplier had any problems in the supply of green wooden components. The suppliers of both companies were already efficient in terms of eco-sustainability, providing feasible ecological solutions for panels. In the latter case, it was much more difficult to find certified suppliers that were compliant with the green requirements. In the furnishing industry (cases T1 ad T2), for instance, this was the case for plastic components. Both analyzed companies highlighted a difficulty in the supply of certified and recycled plastic. The same issue has been faced by T3 Supplier in the purchase of paper cups. Paper cups represented a novelty in the vending machine industry, but at the same time, they were a must-have because of the increasing market attention towards sustainability and the pressing demand from end-customers. Thus, 2nd-tier cup suppliers had to switch from plastic to paper manufacturing processes and plants. However, due to the limited availability of raw materials and the time necessary to reconfigure their processes, 2nd-tier suppliers could not satisfy the high demand for paper cups on time. Interestingly, the introduction of green criteria led to an update of the supply network in the steady state, but, in the short-term, it shocked those supplies that were not ready for the change and caused bottlenecks and shortages of supply.

As a result, a twofold effect was produced. The relationship with 2nd-tier suppliers was intensified, bringing 1st and 2nd-tier suppliers to collaborate to achieve sustainability goals and meet the tender requirements. Both T2 Supplier and T4 Supplier strengthened the collaboration with their own suppliers and, eventually, were able to release innovative solutions, such as a new green furnishing line and a smart irrigation system, respectively. At the same time, the bargaining power was shifted upstream in the supply network, due to the high dependence of 1st-tier suppliers on the few 2nd-tier certified and/or compliant suppliers. In this regard, T1 Supplier stated that in the furnishing industry there are not many companies fully prepared to meet all the requirements, so often it happens that GPP results in lock-in to certain 2nd-tier suppliers and, consequently, constrains the 1st-tier's production and sales.

3.1.2.1.1 The role of the certifier

From the study emerged the increasing importance of a new player in the supply network, namely the certifier. Many bidding organizations, indeed, relied on certification bodies to prove the compliance of their products with the requirements required in the call for tenders. For example, Ares Line s.p.a. made a partnership with the certifier Bureau Veritas¹⁸ who verified the compliance of its products and issued a declaration of conformity with respect to the CAMs in force and Mecos s.r.l worked with COSMOB¹⁹ and accredited laboratories to obtain the required certifications. The role of the certifier in green public procurement is to assess and verify the compliance of products and services with environmental standards and criteria. They evaluate whether the products or services meet the requirements for eco-labels or other environmental certifications, and provide an objective third-party assurance of the environmental performance of suppliers. Reliance on certified bodies leads to a

¹⁸ Bureau Veritas is a global testing, inspection, and certification (TIC) company that provides services to a wide range of industries and sectors. The company offers testing and analysis of products, materials, and facilities, as well as inspection and audit services to ensure compliance with regulatory, safety, and quality standards. Bureau Veritas also provides certification services, including ISO certification, to help businesses demonstrate their adherence to industry standards and best practices. The company operates in over 140 countries and has a workforce of over 75,000 employees, making it one of the largest TIC companies in the world.

¹⁹ COSMOB is a technology center dedicated to the manufacturing sector. It has been established to promote the modernization and development of the manufacturing industry through the application of advanced technology and innovative solutions.

double effect in the public procurement perspective. On one side, organizations save time because once their products are certified they are compliant and can participate at different call for tenders; on the other side, procurers feel more assured because the third-party body gives an objective and unbiased evaluation of supplies compliance. All in all, the certifier plays a crucial role in ensuring that the green procurement specifications are met and that the procurement process is transparent and fair. The certification also enables buyers to make more informed, rational, and reliable choices.

Another interesting aspect brought out from the research is linked to the creation of a strong relationship of collaboration and cooperation between the firm and the certification body that entails a process of continuous assessment, reporting, and improvement. Since 2007, SAF has worked with RINA²⁰ to test new green procedures in the transport sector, in line with its culture projected towards a more sustainable future. The certification body assesses the firm's compliance level, identifies areas that require improvement, and issues recommendations. The firm, in turn, makes the necessary improvements and implements greener practices. The certifier then re-assesses the firm's performance, and the process continues until the set standards are met. The firm acts as a pilot platform for new procedures that will then be included in international certifications. These results highlight the increasing power of the certifier in a supply network that is becoming more and more oriented towards sustainable policies and practices.

3.1.2.2 Sustainability as an investment

From all the cases analyzed, it clearly emerges that being compliant with the requirements of GPP and in general with an approach aimed at sustainability requires investments. And like most investments, these are accompanied by an increase in costs, at least in the short term. For T3 Supplier, the provision of aluminum water cans in the vending machines and free tap water from dispensers represented an

²⁰ The RINA Certification team carries out business assurance activities with reference to regulatory standards of management systems, products and personnel covering a wide range of areas including ESG and decarbonisation, ICT & cyber security, health and safety, diversity & inclusion, agri-food, transport and green building.

increase in costs and a loss in sales, which resulted in a loss of earnings. Then, the switch from plastic to paper cups represented higher upfront costs that were eventually counterbalanced by the increased interest of the market towards green materials. Paper cups cost more, but the customer was willing to pay for them and, in the end, the company registered an increase in turnover. This last example demonstrates how new investments in sustainability and related cost increases are more easily accepted and governed when the customer claims them and is ready to bear the higher price.

Another relevant new and necessary cost was the cost for obtaining the certifications needed to participate in the tenders. This resulted in the need to build partnerships with certification bodies or accredited laboratories. According to T2 Supplier, certifiers are gaining more power within a sustainable supply network. However, even if these certifications are a cost, they could also be considered an investment for enhancing competitiveness and continuous improvement. On the one hand, they are functional and fundamental because they allow companies to approach the public procurement market and participate in the call for tenders. On the other hand, the required tests on finished products are fundamental because they allow to measure the product performance and suggest avenues to improve the product, be it a new prototype or an existing product that has to be renewed. The tests/assessments that need to be performed on finished products to get the certifications allow indeed to measure product performance and suggest avenues to improve product design [60]. Unlike previous examples, some green requirements can also lead to saving money at once. For instance, T3 Supplier developed some non-wasteful solutions for its vending machines, such as sugar defaulted to 0 in coffee machines and the no-scoop option for bitter drinks, which were beneficial from an economic viewpoint too. Similarly, T4 Supplier's newly designed smart irrigation system saved water and, consequently, money. All in all, cases confirmed the controversial nature of sustainability. At first, there is the perception of higher upfront costs, but then it turns into an enhancement in competitiveness and a reduction in operating costs, thus, representing a fruitful investment in the medium long-term.

3.1.2.3 The ripple effect of the procurer's green leadership

The interviews with the various suppliers, both in the case of tenders regulated by GPP policies and not, have brought out the fundamental role played by the customer, in our case the University of Padua. Indeed, the university's high commitment and strong leadership, aimed at seeking sustainability in purchases even when not required by law, triggered suppliers to innovate and revise their product/service offerings in a more sustainable way also for other customers. For example, T3 Supplier admired the university's efforts to eliminate PET from vending machines and said that for them this was not a mere purchasing request, but an innovative perspective that changed their approach towards other customers too. As a result, they now use the new green solutions developed for the university tender as a lynchpin for winning new customers' orders. The same applies to T2 Supplier and T3 Supplier, with their new green product/service lines, and to T5 Supplier, who exploited her natural gas and electric vehicle fleet used for the university tender as a competitive edge to win a large contract in the Piedmont region.

The introduction of these green winning criteria modifies the supply network and changes the relationship among different players, by shifting the bargaining power of suppliers and by bringing out the role of the certifier. All in all, the bidding organizations that became compliant with those green winning criteria can leverage them as a competitive advantage. This way, in a win-win situation is achieved: on the one hand, suppliers can exploit their innovative and more sustainable products/services to attract new customers and win more tenders, reinforcing their competitive positioning in the market; on the other, the customer highly committed to sustainability sees its leadership confirmed, and green best practices naturally spread along the whole supply network.

3.2 Procurers' level

Beginning with a within-case analysis, the following paragraphs present the criteria that the procurement department included in each tender, analyzing the rationale behind the procurers' decisions to add them and the methodology employed to select the criteria. Finally, a cross-case analysis is offered investigating relevant aspects that

emerged between cases, focusing on the impacts of the procurer's decision to include green criteria on the relationship with suppliers and clients.

3.2.1 Within-case analysis

3.2.1.1 T1: Interior furnishings

The interior furnishing tender T1 marked the second framework agreement linked to GPP for the university's procurement office. This agreement aimed to streamline the entire procurement process and address the continuous cycle of furniture tenders initiated with the establishment of new rooms or departments. The procurement staff conducted an extensive analysis of each department's needs and identified the standard items required, such as tables, chairs, and desks, etc. Then, the procurement staff examined the most frequent solutions that were going to be used in the installations and made a list of products to include in the framework agreement, keeping margins of flexibility in mind. The resulting aggregation of products translated into higher purchase volumes, allowing the procurers to launch a European tender with a dynamic system within Consip. As European Union procurement laws mandate the consideration of environmental criteria, the university's public administration embraced Green Public Procurement, mandating the inclusion of MEC in the call for tenders. Therefore, this represented the "element zero" that triggered the implementation of MEC. The procurement department followed the directives issued by the ministerial decree to decide which green criteria to include in the call for tenders for interior furnishings, focusing on the durability of products through requirements for robust upholstery materials, easy repair, disassembly, availability of spare parts, and longer warranties. The directive also demands a substantial reduction in volatile organic compounds (VOCs) emissions from final products and formaldehyde from wood panels, making use of recycled materials for wooden panels, plastic components, and packaging.

3.2.1.2 T2: Interior furnishings

The first teaching furniture experiment (T1) initiated a learning process that translated into greater awareness and deeper understanding of MEC regulations. This led to a re-evaluation of some aspects, mostly linked to the economic part, in the second office furnishings tender (T2). Tender T2 was, indeed, built taking as a reference Tender T1. The procurement department followed the same logic: starting from the aggregation of the orders from the different departments, volumes increased, resulting in the need for a framework agreement and compliance with Italian MEC. Through this approach, they were able to leverage economies of scale to secure more advantageous prices, and to guarantee more sustainable products without compromising their performance. Moreover, opting for eco-friendly furniture and products could lead to significant cost savings in the long term. Recyclable furniture and sustainable materials are durable and reduce the maintenance cost over time. The procurement department further promoted sustainable procurement practices by publishing technical documentation outlining the framework agreements that included green criteria as part of the technical specifications. This provided other departments with a reference point to build their own contracts and encouraged them to prioritize sustainable furnishings, even when compliance with MEC was not required, ultimately resulting in reduced waste and energy consumption. In other words, a ripple effect was enhanced: departments could apply the same principle to their contracts and promote sustainable procurement practices to bring cost savings by reducing waste and energy consumption even with smaller purchasing volumes. As a result, a greater green sensitivity is transferred downstream in the supply chain, to (internal) clients.

3.2.1.3 T3: Green maintenance and mowing

Tender T3 was subject to compliance with the minimum environmental requirements defined by the Ministerial Decree for the assignment of the public green management service. Moreover, the procurement department decided to add some award criteria to promote more sustainable practices. Amongst them, using eco-compatible vehicles with low environmental and noise pollution, such as electric or LGP vehicles, and

holding relevant sector certifications. This tender covered the maintenance of public green not only within the municipality of Padua, but also for the park of Villa Bolasco. Due to its status as a protected area with secular trees, this demanded particular attention. Thus, the procurement department sought expert guidance from a professor from Tesaf in the definition of the technical characteristics to be added in the call for tenders. He offered his expertise and knowledge to the procurement department and provided input on the specification standards that could be adopted. On the other side, after the award of the tender, there has been an involvement of the supplier, too. In particular, the supplier was involved in performing a green census of all green areas, hedges, trees and information related to estimated date, plant age, trunk, and other features of the green public space within the Municipality of Padua. This census turned out to be particularly valuable, allowing more control over pruning and maintenance and helping to develop a greater awareness of the natural heritage of the university. This information will also be useful for subsequent tenders in which it will be possible to give a more precise estimate of how many trees and which trees are involved, which therefore will also facilitate the bidding companies that want to participate.

3.2.1.4 T4: Vending machines and water dispensers

In the tender for the vending machines and water dispensers' service, the procurement department of the University of Padua committed to introducing green criteria, both as order qualifiers and as order winners. The criteria applied aimed at encouraging an improvement in terms of environmental sustainability of the vending machine service, while at the same time directing the market towards a better behavior in this regard. In particular, considering elements relating to food product offer, distributor energy performance, supply management system, and service quality. Specifically, the qualifiers of the tenders imposed the vending machines to belong at least to energy consumption class "E", to have the CE mark, to be compliant with noise and toxicity parameters and to be CFC free. Some award criteria linked to GPP have been added too, regarding the energy class of vending machines, refrigerated dispensers and water dispensers, the presence of the Fairtrade label, the certifications and "green economy" initiatives and the supply of glass water bottles. Besides this, an innovative

proposal was the removal of PET from the vending machines. The stimulus came from a student of the university, thus the final client, who raised a concern about the plastic distribution, wondering if it was possible to replace plastic bottles with water dispensers as other universities around Europe do. This led to a supplier involvement and a brainstorming process to find ways to get to that result. Alongside, another initiative was launched, promoting the use of reusable water bottles. The university had the support of an environmental engineering professor who had trials and tests done in the laboratory on the release of different metals or other implications to choose the right materials doing a life cycle assessment (LCA). It was something not covered by any MEC, but thanks to the commitment of this professor, they were able to assess the feasibility and the environmental impact of this proposal.

3.2.1.5 T5: Porterage and moving services

To increase the sustainability of its operations, the procurement department of the University of Padua further promoted the principles set out in the Charter of Sustainability Commitments in the context of the tender for the porterage and moving service. Although no specific environmental criteria existed for such services, the University adhered to the principles of the Minimum Environmental Criteria and set some environmental sustainability standards in the technical specifications and in the award section. The mandatory standards are related to the packaging and pallets material composition and waste delivery collection. While the additional points could be obtained by using low environmental impact vehicles and less polluting machinery and equipment. Moreover, the provision of an electric car intended for University staff, as well as other improvement proposals useful for the development of the service related to environmental sustainability. For example, the supply of electric scooters or bikes for University staff who are responsible for monitoring activities at various offices and the supply of tablet devices for real-time verification/consultation of the Computer system. The know-how needed for the drafting of this call for tender with the aforementioned green criteria was developed thanks to a learning process that accompanied the implementation of MEC's regulation in Tender T1. Starting from product/service categories where MEC are consolidated, such as the furnishings product category, the procurement staff was

able to increase its green sensitivity and to start a learning process that led to the introduction of environmental criteria even in this call for tenders (T5) in which MEC were not foreseen.

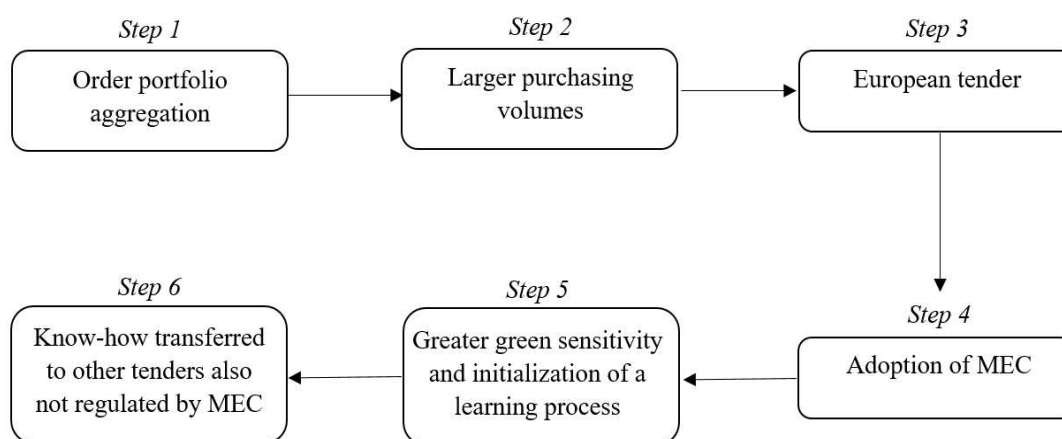
3.2.2 Cross-case analysis

Following the outcomes of the procurers' level within-case analysis previously presented, the next paragraphs offer a cross-case analysis that pinpoints the relevant insights that emerged. The analysis starts with a schematic illustration and a thorough description of the process model that represents the GPP diffusion at the University of Padua, alongside a comprehensive investigation into the effects of GPP on the relationship of procurers with (internal) clients and suppliers and on the best practices adopted by the procurement department. Particularly, four main aspects have been revealed: (i) the presence of an *information asymmetry* between suppliers and procurers, (ii) the opportunity of *leveraging the distinctive capabilities of a multidisciplinary university*, (iii) the importance of *educating (internal) clients to map their own needs*, and (iv) *prompting (internal) clients to buy green*.

3.2.2.1 The process model for a virtuous circle

As resulted from the interviews conducted at the procurement department, the adoption of MEC triggered a virtuous circle towards a greater implementation of GPP practices. This process can be summarized into a 6-step model, which is depicted in Figure 3.1.

Figure 3.1 - Process model of GPP diffusion at the University of Padua



The first step (1) involved a process of aggregation and centralization that enhanced the efficiency of the procurement process. Instead of each department making separate purchases to meet their own needs, the central administration started to procure all necessary items through a framework agreement, consolidating all needs from various units into a single order portfolio. This aggregation helped to identify opportunities to consolidate and standardize procurement approaches and improve efficiency, all the while raising the requirements that the product or service must have. The aggregation of similar orders from different departments within the university, naturally created larger purchasing volumes (2), leading in some cases to “above-threshold” tenders. This meant that those calls for tenders that were first based on a direct award procedure were converted into European tenders (3), where Minimum Environmental Criteria (MEC) are mandatory. In other words, the public administration had now to follow the European Union procurement rules, which require the consideration of environmental criteria in procurement decisions and the incorporation of MEC into the calls for tenders (4). The process of centralization, hence, can be considered the element zero or trigger for the adoption of green criteria and sustainable practices in the call for tenders of the university. By doing so, economies of scale could also be achieved, making it more cost-effective to procure environmentally friendly products and services.

The first framework agreement made following this mechanism was the one for paper. By aggregating all the paper’s orders from each department, they reached larger volumes, obtaining an advantageous purchasing price, and they included a set

of mandatory requirements, or MEC, to enhance quality and environmental standards. Some of the green criteria included were related to the use of recycled paper and the traceability of the material. After this success, the procurement department decided to take a further step in the direction of green procurement, replicating the same underlying logic to the furnishings tender (T1) and adopting the MEC envisaged by the ministerial decree for the furniture sector. This brought about a process of learning from challenges and successes in green procurement that helped to identify new opportunities for further improvements in procurement practices and led to the identification and adoption of new environmentally friendly policies. Therefore, these tenders developed a greater green sensitivity and boosted a learning process (5) that triggered more confidence in this matter. As a result, the procurement department started to transfer the know-how gained from the implementation of green procurement practices to other tenders, even if they were not regulated by the GPP legislation, such Tender T3 or Tender T5, or even into those already regulated by MEC by going beyond the legislation and including some additional green award criteria (Tender T4) (6).

All in all, when procurers learn how to execute MEC-regulated tenders, they become more aware of the significance of environmental concerns and can leverage the lessons learned and best practices adopted in MEC-regulated tenders to influence their business operations in other tenders as well.

3.2.2.2 Information asymmetry

From the interviews conducted with the procurers, it emerged that there is an information asymmetry, which refers to a situation where one party has access to more or better information than another party. Suppliers, indeed, may have more information and expertise regarding green solutions and the market in general, which the procurer may not have. As a result, the procurers may not have the necessary knowledge to properly define green criteria that are practical and feasible and that reflect the latest market and technological trends.

To deal with this information asymmetry, the procurement department should involve suppliers in defining green criteria in green public procurement. The department can conduct collaborative discussions and consultations with suppliers to identify the environmental aspects where greener products or services are needed. After that, they can share the initial set of criteria with suppliers and invite them to provide input and suggestions on how to improve or refine the criteria. Through active communication and engagement, suppliers can provide valuable input on the feasibility, efficiency, and effectiveness of the proposed criteria. They can help identify the critical environmental impacts, technology advancements, and industry best practices that the procurer may not be aware of. By doing so, the procurer can promote a sense of responsibility among suppliers, thereby increasing the likelihood of compliance and continuous improvement. Take the collaboration with T3 Supplier, for instance. T3 Supplier and the procurement department brainstormed together and came up with the plastic free project, through which they completely removed PET from the vending machines and added recycled cups.

Another way to address the information asymmetry is by seeking out the advice and expertise of third-party organizations. The procurer can increase the amount of information available to them or verify compliance with the requirements to make informed decisions about green procurement. The alternative approach, according to Procurer 1 and Procurer 2, is by investing in a dedicated operational structure in the area of sustainability and in the training of procurement staff.

3.2.2.3 Leveraging the distinctive capabilities of a multidisciplinary university

Another major result that emerged from the interviews is that a large university with many departments across multiple disciplines, as the partner of this research, can leverage its internal capabilities as a core asset. Within the different departments, indeed, there are several qualified and skilled professors in many fields of knowledge. It means that there is a competent personnel who can use her knowledge and expertise to enrich the tender's specifications. For example, a professor from Tesaf has been involved in the definition of some specifications for Villa Bolasco greenery and

maintenance (Tender T3); another example of internal capabilities that helped in the drafting of tender documents, is an environmental engineering professor who committed to testing several metals in the laboratory to help in the initiatives of reusable water bottles (Tender T4). In subsequent procedures, this involvement increased either because the product or service to be purchased necessarily had to involve the end user that benefits from those solutions, or because there was a lack of specific know-how in the procurement department. This required the development of technical working groups. Within them, based on the product category, those people who had the knowledge and skills needed to evaluate certain technical requirements were engaged. Having departments across multiple disciplines, a large university has all those distinctive capabilities in-house and can leverage their skills and support to be able to write or to check the criteria, such as using structural engineers or labs for testing. All in all, this know-how can be projected to the procurement department to help define criteria in technical specifications.

3.2.2.4 Educating (internal) clients to map their own needs

The interviews with procurement department staff brought out the importance of (internal) clients education. The procurement department must transfer its know-how to and educate (internal) clients to map their own needs. The (internal) client is often so involved in routinary work that she cannot articulate her needs in an aseptic way. This difficulty to express her needs in a clear and unbiased way can lead to significant inefficiencies in the procurement process. For instance, in the case of loyal purchasing practices, where the departments are used to buy always from single traditional supplier, a know-how is not built to go beyond a supplier's name or brand and describe what is effectively needed in an unbiased way. Therefore, the procurement office needs to educate the clients on how to map their own needs and how to provide a detailed description of the product or service needed. The procurement department must in fact eliminate any subjectivity that may creep into the procurement process and be sure that the technical specifications are clear and objective so that they can be contracted out. Therefore, it is essential to project knowledge and understanding of green products/services to the clients who request those products or services.

All in all, procurers have to transfer their know-how related to need assessment and specification downstream to (internal) clients. By educating them about green products, the purchasing department can ensure that procurement decisions are informed, fair, and sustainable.

3.2.2.5 Prompting (internal) clients to buy green

Another major result that emerged from the interviews is linked to the promotion of green procurement practices even when the procurement department is disintermediated. Disintermediation refers to the removal of intermediaries in a supply chain. When applied to the purchasing department, it means that the department is bypassed, and individual employees or departments buy directly from suppliers or vendors.

Procurers made available/public on an internet platform all the documentation related to public tenders, including framework agreements, technical documentation with green criteria, and a series of guidelines such as how to apply. So, whenever the internal client has or wants to buy a product or service directly from suppliers, she can access that documentation, and adapt it to her needs. Consequently, she can start from a more advanced contract with quality and environmental standards already defined. This happened with the publication of the technical documentation of Tender T1 and Tender T2 which provided other departments a starting point for developing their own contracts and encouraged them to pursue sustainable furnishings even when MEC compliance was not necessary. By doing this, the procurement office transfers its green culture downstream in the organization to (internal) clients who become more aware of greener procurement processes, and enhance their responsibility to source more sustainable products or services. Transferring a green culture to the internal customer means instilling a sense of responsibility for sustainability within all departments. When (internal) clients, e.g. departments, understand the importance of environmental criteria in purchasing decisions, they are more likely to insert them even when buying directly from suppliers and even if there is no mandatory adoption of MEC. This shift towards a green culture can help maintain sustainability standards

even in the absence of a framework agreement. It can also help promote a more holistic approach to purchasing that takes into account the environmental impact of suppliers and products.

Overall, the maintenance of sustainability efforts in disintermediation situations will depend on how well the organization has communicated its sustainability goals, and how well it has trained its employees to make environmentally responsible purchasing decisions. By prompting (internal) clients to buy green and nurture a green mentality, an organization can continue to prioritize sustainability even in a more decentralized purchasing environment.

3.3 (Internal) clients' level

After analyzing the perspectives of suppliers and procurers, the research now shifts its focus to another important involved stakeholder, namely the (internal) clients. This group includes the various departments within the university that request the products and services procured by the central administration. Additionally, a professor and students who utilize these products and services have also been interviewed. The following paragraphs examine the (internal) clients' level using a within-case analysis approach, where each tender is examined based on the level of awareness of GPP implementation, the learning processes achieved, the perceived effects, and satisfaction levels by clients. The information is then combined through a cross-case analysis that highlights relevant insights that emerged throughout the analysis.

3.3.1 Within-case analysis

3.3.1.1 T1: Interior furnishings

With over 2000 seats recently purchased, worth more than 600,000 euros, the Department of Engineering and Management (DTG) can be considered one of the biggest (internal) clients that required and used the products provided by the teaching furnishings tender (T1). The DTG staff was knowledgeable regarding the university's dedication to move towards more sustainable furniture and was aware of the environmental requirements that the products had to meet, including

formaldehyde emissions, VOC emission and other criteria such as fire-resistance materials. The interviewed technical officer (Client 1) confirmed their dedication by emphasizing their commitment to promoting a circular economy, highlighting the importance of recycling and designing products to ensure longevity and sustainability before disposal. Additionally, the department acknowledged that there is more attention to environmental criteria, as they noticed an increasingly stricter request for certifications. Nonetheless, despite being aware of the need to include environmental considerations when procuring goods, the department sought guidance and advice from the central administration that is more informed about the procedures and legislations. They acknowledged the procurement department's valuable contribution on providing useful documentation via an online platform, allowing departments to be aligned and to follow a common approach. Despite their efforts to consider environmental concerns during the furniture procurement process, they experienced some difficulties to include them when purchasing through direct award procedures rather than selecting products from the procurement department's framework agreement. The technical officer explained that the primary reason for this was that, as a department, they rarely made large tenders, and thus they did not have the bargaining power to propose significant requests. For smaller contracts with budgets of a few tens of thousands of euros, they sometimes lacked the contractual strength to implement these proposals effectively.

Moreover, they believe the aggregation process that triggered the implementation of green criteria in the calls for tenders is beneficial from an economic point of view. It allows achieving economies of scale and facilitating procedures. However, on the other side, it sometimes stifles the variety of products on offer, resulting in an inability to fully meet the needs of the department in question. It means that sometimes the product that ends up in the framework agreement does not fully satisfy the needs of the department. In that case, they did the procedure independently. This happened for the procurement of some additional tables for a meeting room of the Department - for justified aesthetic and continuity reasons they did the procedure autonomously. Overall, the DTG is satisfied with the products offered and perceives them as in line with the aspects of durability, quality, and sustainability.

Finally, in accordance with the ministerial decree of not replacing furnishings for simple aesthetic reasons, a dialogue between structures has been enhanced: the DTG recently recycled 15 closets from the Math Department (DM). The DM no longer needed them, thus, instead of buying some new closets, the DTG used those ones. According to the technical officer there is “internal synergy between departments and between structures”, that helps prolonging the life span of goods and reducing waste.

3.3.1.2 T2: Interior furnishings

The Math Department (DM) and the Department of Industrial Engineering (DII) - as main (internal) clients for office furnishings recently - have been considered to investigate the impacts of green criteria implementation in Tender T2. According to Client 2 and Client 3, both departments are aware of the existence of minimum environmental criteria for the furnishing product category, and they do also acknowledge the University's commitment to orient towards more sustainable choices across various areas. Client 2 stated that he first became aware of these green criteria during a course on the public procurement legislation where they did mention this topic but did not go into further details. Despite being aware of MEC existence, in both departments there is a lack of formation about green procurement. They receive information and indications about the tenders, but the procurement department does not go further into telling them or explaining the green choices made. As a result, the learning process is almost null. Neither Client 2 nor Client 3 included green criteria when carrying out their own below-threshold procurement procedures. In fact, if the environmental criteria are not effectively communicated or shared, the significance of buying green risks not being acknowledged downstream in the supply chain. Without proper education and information on the benefits of making green choices, (internal) clients may not recognize and perceive their importance. Hence, clients tend to focus more on other procurement aspects, specifically the economic part, and less on sustainability.

Furthermore, there has been some negative feedback regarding the perceived variety of furnishing products offered within the framework agreement of Tender T2. For instance, the DM needed to purchase autonomously some desks with specific dimensions because they were not available in the framework agreement. Similarly,

the supply of office chairs to DII was not completely satisfactory. The reason behind this was principally the comfortness of the chairs. According to Client 3, this was a trivial example that could be easily overcome by enhancing the quality of the selected products. Overall, according to both interviewees, there is the belief that centralizing is a good initiative for improving procurement processes and driving economic gains and there is a good satisfaction level for the green furniture offered, with limited exceptions.

3.3.1.3 T3: Green maintenance and mowing

For Tender T3, the Department of Land, Environment, Agriculture and Forestry (TESAF) has been considered because of its relation with the park of Villa Bolasco, whose maintenance is included in the contract. The interviewed professor has the delegation from the rector for the management of that garden, because of its skills and experience. Not only he was aware of the presence of green criteria, but he also participated as informed person in the definition of some of them and of some improvements, such as the setting up of a historic orchard with ancient varieties and the presence of two permanent gardeners. As he explained, staff from an agricultural company, which had time and skill constraints, initially managed the green, only providing the mowing of the grass and the pruning of the bushes. A step forward has been made with Tender T3 in which, as basic requirement, there was the census of all the greenery, both horizontal (e.g., lawns) and vertical (e.g., hedges and trees). This allowed for better management, appropriate treatments, and ad-hoc maintenance, significantly enhancing and revaluing even the small gardens of historic sites of the University. Furthermore, the smart irrigation system linked to environmental conditions via functional sensors to reduce water consumption received great appreciation, reflecting the sustainability aspect of managing greenery. As the professor explained, "greenery must reflect sustainability as much as possible, and its management must be equally sustainable."

3.3.1.4 T4: Vending machines and water dispensers

The proposals put forward in Tender T4 were generally well-received and garnered a high level of satisfaction among students. In fact, all 20 interviewed students expressed their appreciation for the new vending machines and water dispensers, both for their environmental benefits and for the cost-saving measures they afforded. There was awareness that the new vending machines presented some green changes, such as the use of paper cups instead of plastic cups for coffee, the “without cup” option and “no paddle” option for bitter drinks, and the sugar defaulted at 0/5 instead of 3/5. Yet, this awareness was gained through first-hand experience, and, at least initially, signs of resistance to change were revealed. During the introduction phase, indeed, not all students were completely happy with the new configuration. Many students were not used to those novelties and ended up selecting wrong hot drinks, drinking bitter coffee, or wrongly selecting the without cup option, thus wasting coffee. Despite this, they ultimately recognized the positive impact the upgrades had on the environment and were enthusiastic about the university’s commitment to sustainability. Moreover, students were excited to see water dispensers throughout the campus, which not only provided an eco-friendly option but also helped them save money on bottled water. Students, indeed, can now use their reusable water bottles and refill them as many times as they want, rather than buying plastic water bottles from the vending machines, which results in both waste and money savings.

Students were also aware of the university’s commitment towards sustainability, and they cited the University of Padua’s participation in the Sustainable Development Festival²¹ and the questionnaires sent to all students to assess their experience with the services offered by the University. However, more information and promotion is needed to involve students, and to increase their participation in sustainable projects and initiatives. According to some of them, if there had been more communication about the green choices made by the university for this service, it would have made it easier for them to adapt to these changes in the first instance.

²¹ The Sustainable Development Festival, promoted by Italian Alliance for Sustainable Development (ASviS) aims at raising awareness and drawing attention to the 17 Sustainable Development Goals of 2023 ONU Agenda.

3.3.1.5 T5: Porterage and moving service

A representative from the University Center for Libraries (CAB) has been interviewed to offer her perspective about Tender T5, being CAB one of the departments that makes the largest use of the porterage and moving service. The CAB department was aware of the existence of green criteria for certain product categories and relied heavily on the framework agreements issued by the procurement department, where the presence of such criteria is already foreseen. This ensured that the products used in the department have a minimal negative impact on the environment. When CAB had to move or use the porterage service, such as when the Botanical Garden was renovated, there was a need to temporarily place the books in another site. They relied on the central office and then on the company that provides the porterage service, both for the cartons, packaging, and all the other related support required in the relocation. By using the service provided by the central administration, they were able to use more sustainable products. However, there are specific requirements for a library system, which makes it challenging to consider environmental concerns when they procure autonomously. For instance, they sometimes have to purchase magnetic strips, glues, and materials to bind the book or keep the cover, all of which have very few suppliers offering sustainable options. This forces the CAB department to adapt and purchase products that not always follow the green line. According to Client 4, even if they wish to choose sustainable alternatives, it is not always possible. Besides this, CAB recognizes the need for more training and information to help cultivate a greener mindset across the decentralized branches of the university. Interchanges among departments and further insights are key to achieve this goal.

The results obtained from the analyses of the cases are summarized in Table 3.3.

Table 3.3 – Within-case analysis for (internal) clients

ID	Awareness	Learning process	Perceived effects	Satisfaction level
<i>T1</i>	-There is awareness - Information and training are needed	Limited	-Reduction of product variety and purchasing flexibility	Good
<i>T2</i>	-There is awareness - Information and training are needed	Almost null	-Reduction of product variety and purchasing flexibility	Good
<i>T3</i>	-There is awareness	Almost null	-	Good
<i>T4</i>	-Awareness gained from first-hand experience	-	-Initial resistance to change	Good
<i>T5</i>	-There is awareness	Almost null	-	Good

3.3.2 Cross-case analysis

Starting from the gathered information, the following paragraphs present a cross-case analysis highlighting the main aspects that emerged: (i) a general *good level of satisfaction* with some exceptions, and (ii) *missed opportunity of downstream green culture transfer* that highlights the importance of effective communication.

3.3.2.1 Good level of satisfaction for green products and services

The satisfaction level for all product and service categories is generally good with some exceptions. The acceptance of new green products and services, indeed, has been positive, but there are certain areas where the satisfaction level is slightly lower. Specifically, in the furnishings category (Tender T1 and Tender T2), there was a perceived reduction in flexibility. Departments sometimes had to buy chairs or desks on their own because the ones provided by the framework agreement did not fully meet their needs. This led to some dissatisfaction among the department heads and staff.

Similarly, in the vending machines category (Tender T4), there was an initial period of learning and adjustment. There was awareness that the new vending machines presented some green changes, such as the use of paper cups instead of plastic cups for coffee, the “without cup” option, and “no paddle” option for bitter drinks, and the default sugar level at 0/5 instead of 3/5. However, this awareness was gained only from first-hand experience, when the students started using the new machines. Initially, there was some resistance to change as many students were not used to these novelties. It means that during an initial phase, not all students were completely happy with the new configuration of the vending machines. Many students ended up selecting the wrong hot drinks, drinking bitter coffee, or wrongly selecting the “without cup” option, thus wasting coffee. This led to some sort of frustration among the students, especially those who were used to the old configuration. This initial resistance to change was easily overcome, and eventually students commented positively about the vending machine service.

Despite these exceptions, the overall satisfaction level for all the analyzed product categories is still good. There has been a positive reaction to the new green products and services, and most (internal) clients appreciated the effort made by the institution to reduce its carbon footprint. The introduction of new products and services has also helped to raise awareness about sustainability and the importance of environmental protection. It is worth noting that the discontent expressed in the furnishings (Tender T1, Tender T2) and vending machines (Tender T4) categories is not a reflection of dissatisfaction with the green initiatives themselves but rather the execution of those initiatives. In the case of the furnishing category, departments had to source their own furniture because some of those provided did not meet their needs. In the case of the vending machines category, there was a learning curve that took some time to adjust to. These issues can be resolved through better planning and communication, and the institution can take steps to ensure that the implementation of future initiatives is smoother and more effective.

3.3.2.2 Missed opportunity of downstream green culture transfer

From the interviews emerged that the learning process is limited and in some cases almost null. The greening process often stopped at the procurement department and was not projected downstream to have ripple effects that could impact various aspects of the organization. It appeared that there was a missed opportunity in not taking the green culture transfer further downstream, beyond just the purchasing office. If the university had instead projected their greening process downstream, the resulting effects to their products and services could have been interesting, as well as created more awareness amongst its customers and users. As a result, the learning effect could have led to greater knock-on effects, which could have been beneficial to both the university and its constituents. Interestingly, it appeared that only one department, the DTG (Tender T1), admitted to being committed in aligning its independent procurement procedures to the ones provided by the central administration and in considering environmental concerns when procuring furniture autonomously. Furthermore, in the case of Tender T4, greater awareness and information sharing would have made a significant impact. For instance, if students were more informed and aware of the sustainable choices made for the vending machines and water dispensers, they could replicate those same behaviors in their homes or other places, such as using reusable water bottles instead of buying plastic ones.

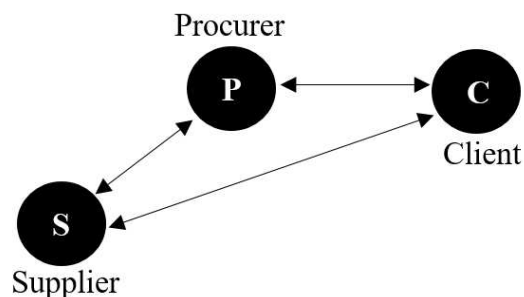
It is apparent that there is a need for more effective communication and training within the university to take advantage of the potential benefits of the greening process. It is worth noting that students learned about sustainable options by using the vending machines service firsthand, rather than receiving promotion about it or being formally taught. Greater communication should be set up to make people understand the things that the university has done and educate users on re-proposing these changes in their activities. The university's initiatives should, therefore, be promoted and shared so that everyone who is part of the institution understands the benefits of going green. This increases the likelihood of others replicating the green behavior and, by extension, making a more significant impact on the environment. Such effective communication would bring about awareness of green products and

services' benefits and make people more proud of being part of a virtuous university. Subsequently, overall satisfaction levels could further increase.

Chapter 4: Discussion

There is much evidence in the literature that highlights the need to deepen the GPP impacts on public institutions and their respective supply networks. In this sense, this paper contributes to the literature by mapping such impacts with a triadic perspective, considering the supplier-procurer-client triad [1]. Prior operations management literature has highlighted the importance of considering such a triadic perspective in supply chain analysis for comprehensive insights [1]. Based on the results in the previous chapter, this discussion section offers a cross-case analysis based on the supplier-procurer-client triad presented in Figure 4.1. The following paragraphs will examine whether the previously highlighted effects of GPP in each level of analysis are confirmed by all the stakeholders involved, and if not, what is the reason behind such a gap.

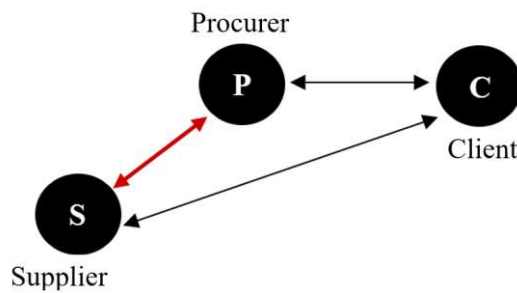
Figure 4.1 - Supplier-procurer-client triad



4.1 The role of the procurer's green leadership in less regulated industries

Many public institutions incorporate environmental criteria in their purchasing policies to reduce carbon footprint and mitigate climate change effects. Yet, despite these efforts, there is an information gap at the heart of the procurement process: the information asymmetry between the procurement office and suppliers (Figure 4.2).

Figure 4.2 - Supplier-procurer link



While the procurement staff strive to incorporate environmental criteria into their purchasing policies, there is a gap in knowledge between them and suppliers. The issue with environmental criteria is that they are often interpreted differently between the two parties. The procurement office understands the importance of including environmental factors when choosing suppliers, but they may struggle to interpret the data accurately. The criteria may be difficult to assess, and it may not be clear whether they are suitable for the supply chain. In other words, the procurers may not have the necessary knowledge to properly define green criteria that are practical and feasible and that reflect the latest market and technological trends or to verify them.

In this context, drawing from principal agency theory by Jensen et al (1976) [2], the procurer can be seen as the principal who hires the bidding organization as an agent to carry out a certain task or project, such as providing goods or services that are environmentally friendly. The bidding organization, on the other hand, acts as an agent to the procurer and is responsible for fulfilling the task in the most efficient and effective way possible. Principal-agent theory highlights the potential problems that can arise when there is an information asymmetry between the principal and the agent. In other words, the bidding organization may have more information and

expertise regarding green solutions and the market in general, which the procurer may not have. Consequently, the procurers should involve the suppliers in defining, assessing, and checking green criteria in green public procurement to offer more practical and feasible criteria that reflect the latest market and technological trends. When this information asymmetry is addressed through engagement with suppliers, a green ripple effect is enhanced. Green criteria are mostly established from a top-down perspective, either for cogency of the law or out of a university's commitment to sustainability, and in both cases, compliance with green criteria was found to push suppliers to innovate and revise their product/service offerings for their other customers as well. This is similar to the Bullwhip Effect theory proposed by Lee et al., (1997) [3], where the upstream distorts the demand signal due to demand variability. In the case of GPP, procurers' green demand signals are transferred upstream to suppliers who then manipulate their offerings to meet this demand. This results in suppliers revising their products and services to be more sustainable, leading to a green ripple effect [4].

It is worth noting that this green ripple effect can have different connotations and there is a distinction to be drawn between calls for tenders already regulated by MEC and calls for tenders that are not yet regulated. In the former case, the consultation with the actors of the supply network in order to mitigate the information asymmetry and to create shared/sensible criteria is already made at a national or ministerial level. Therefore, the information asymmetry is limited to the relevance of the criteria (especially award criteria) and their verification. In these regulated contexts, because of the cogency of the law, most suppliers had already adapted their product or service offerings to be compliant with MEC. This adherence to the Minimum Environmental Criteria has not only ensured compliance but has also pushed suppliers to go even further and improve their sustainability practices. This process of revising their offerings to meet green requirements has prompted some suppliers to innovate and propose innovative green solutions. Two suppliers confirmed this: T1 Supplier and T3 Supplier. Besides being compliant with green requirements, they came up with innovative green solutions such as, respectively, the "Aira GreenUp" and the smart irrigation system. Both T1 Supplier and T3 Supplier serve as examples of how suppliers can not only comply with regulations but also use them as a catalyst for sustainable innovation.

On the other hand, in areas where MEC are not yet established, the information asymmetry is greater. Therefore, collaboration becomes even more necessary, starting from the definition of green criteria. In such cases, the procurement department can engage in collaborative discussions and consultations with suppliers to identify the environmental aspects where greener products or services are needed. Through active communication and engagement, suppliers can provide valuable input on the feasibility, efficiency, and effectiveness of the proposed criteria. They can help identify the critical environmental impacts, technology advancements, and industry best practices that the procurer may not be aware of. In these non-regulated contexts, although starting from a lower green level, the ripple effect enhanced could be even greater. In such cases, the greater collaboration, and the commitment of the university to seek out and implement sustainable procurement practices was found to push suppliers to be proactive and to propose innovative green solutions. Take the collaboration with T4 Supplier, for instance. T4 Supplier and the procurement department brainstormed together and came up with the plastic free project, through which they completely removed PET from the vending machines and added recycled cups. Similarly, T5 Supplier improved the sustainability of their fleet in response to the requirements of the university, ultimately using this as a competitive advantage to secure additional contracts. Thus, by adopting such green practices, suppliers were able to enhance their market position and attract new customers, while also contributing to a more sustainable procurement process. While this drive for innovation is evident in the short-term, there is no evidence that this remains sustainable in the long-term too. This will depend on the commitment and awareness of the individual supplier. These calls for tenders can further serve as pilot tests to provide knowledge and support the national policymaker in the creation of MEC regulations in other industries.

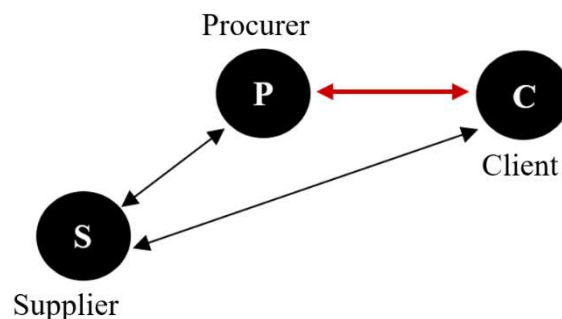
4.2 Greater communication for a ripple effect downstream

The analysis of GPP at the procurers' level showed that there could have been a ripple effect also downstream thanks to the procurers' commitment in prompting (internal) clients to buy green. Upon analyzing the procurers' behavior, indeed, it was discovered that they had made all documentation related to green public tenders

available on an internet platform. (Internal) clients who wanted to purchase a product or service directly from suppliers could thus access this documentation and modify it to suit their needs. By doing so, the procurement staff tried to transfer its green culture throughout the organization, aiming at raising awareness among internal clients on the need for sustainable procurement practices. As departments become more aware of the importance of environmental criteria in their purchasing choices, they may opt to apply these criteria even when sourcing directly from suppliers, even when MEC adoption is not mandatory. This shift towards a greener culture could help sustain environmental standards, even in the absence of a framework agreement or of a large contract that requires them.

However, although the commitment of the procurement department to prompt (internal) clients to buy green products is well-intentioned, it is often not reflected downstream. There is a discordance between the procurement department's commitment and its actual influence on the behavior of internal clients (Figure 4.4).

Figure 4.4 – procurer-client link



Interviews with clients revealed that the learning process was limited, and that the greening process often stopped with the procurement department failing to project downstream for wider organizational impact. Only one department committed to aligning their procurement procedures with the central administration's green policies and requirements when it comes to interior furnishings (Tender T2); and students were able to learn about sustainable options through firsthand experience with the vending machines (Tender T4), rather than by receiving formal instruction or promotion. Hence, a missed opportunity exists for the university to transfer its green

culture beyond just the purchasing office and lead to greater awareness and knock-on benefits for both the university and its constituents.

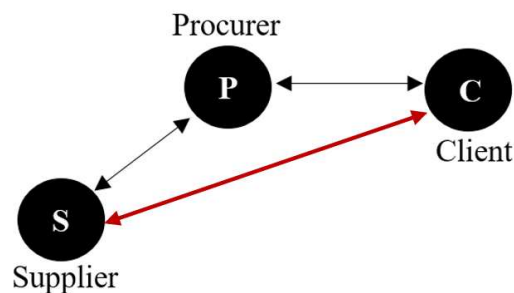
This discordance highlights the need for greater promotion and information sharing across departments to fully leverage the potential benefits of the university's green initiatives. In the literature [5] it is emphasized that to promote GPP, there should be more collaboration amongst departments and stakeholders in the organization – the engagement of expert professors in some of the case tenders is a good example of such collaboration efforts. Furthermore, communication within procurement departments and with stakeholders needs to prioritize environmental criteria in the decision-making process. By promoting and sharing the university's initiatives, everyone within the institution will become better informed about the benefits of going green, leading to a greater likelihood of replication, generate engagement in existing initiatives and, as a consequence, a more significant impact on the environment. Such communication efforts would also help increase awareness of the benefits of green products and services and foster a sense of pride in being part of a virtuous institution.

4.3 Lack of direct feedback

The implementation of green criteria in purchasing processes, both for compliance with the law or for the university's commitment, had a positive impact on the quality and satisfaction levels of the products and services delivered to internal clients. Customer satisfaction levels have been high, with many clients showing appreciation for the institution's efforts to reduce its carbon footprint and promote sustainability. Internal clients (e.g., Client 1, Client 2, Client 3, Client 4) generally valued positively the green products and services provided by GPP tenders, acknowledging they can promote innovation, environmental responsibility, and cost savings. In addition, external clients (e.g., Client 6) ultimately benefited from them. For instance, Client 6 appreciated the Tender T4 offerings, in particular, they were excited to see water dispensers throughout the campus, which not only provided an eco-friendly option but also helped them to save money on bottled water.

However, despite the overall positive outcomes, there are still areas for improvement. The results have highlighted a lack of direct feedback between suppliers and clients (Figure 4.5).

Figure 4.5 – supplier-client link



Currently, clients' feedback is mediated by procurers and then communicated to the suppliers. While this process ensures that feedback is received, it limits the direct interaction between clients and suppliers. A greater connection between clients and suppliers could facilitate a better structuring of the offer of the suppliers also for smaller calls for tenders or private purchases. Examining the results from the clients' perspective, there were instances where flexibility appeared to be reduced in certain cases, such as Tender T1 and Tender T2. Departments sometimes had to independently procure chairs or desks because the options provided by the framework agreement did not fully meet their requirements. This, in turn, led to dissatisfaction among department heads and staff. By directly listening to the feedback and concerns of end clients and fostering greater interaction between suppliers and clients, these issues could be easily addressed and solved.

All in all, suppliers should engage not only with their first clients (e.g., procurers), but also with their end clients to gain a more comprehensive understanding of their clients' needs and expectations. By gathering and integrating end clients' feedback in their business practices, suppliers can stay ahead of the curve, delivering better-tailored products and services that meet their needs, and ensure that their clients

remain satisfied and engaged. This would ultimately contribute to the overall success of the institution's commitment to green procurement.

It is important to note, however, that further research is needed to fully explore the link between suppliers and clients. This research should delve deeper into the impact of direct interaction and feedback integration, as well as the potential benefits for both parties involved.

Conclusion

In conclusion, Green Public Procurement is crucial for fostering sustainable development and addressing environmental concerns. As governments have significant purchasing power, GPP enables them to use their procurement process to promote eco-friendly and socially responsible products and services [3]. By incorporating environmental criteria into purchasing decisions, indeed, GPP policies help reduce the impact of public consumption on climate change, resource depletion, and pollution. So far, research has focused on the level of GPP uptake, and barriers hindering it [5], [6]. Besides this, there is a scarcity of studies covering GPP in terms of evaluating its effectiveness as an environmental impact reduction strategy and the potential spillover effects resulting from its implementation [4]. Moreover, studies have highlighted the need to go beyond the procurer-client dyad and consider other stakeholders involved in the procurement process [7], [8]. This paper wants to fill this literature gap by investigating the impacts of GPP implementation and gauging a spillover effect that has not received much attention, namely, the organizational changes brought upon involved stakeholders, including procurers, suppliers, and another actor so far neglected in the literature, i.e., the (internal) clients. Through the multiple-case study methodology, and triangulating data collected from semi-structured interviews with technical documentation of GPP tenders issued by a large European university, within-case and cross-case analyses have been developed for each level of analysis. The results have then been combined with a triadic perspective, revealing some novel dynamics.

The preliminary findings at the level of suppliers showed that green requirements have led to an upgrade of the supply network, especially in those sectors in which environmental sustainability was not well-established. In some cases, though, this has also resulted intensified relationship with 2nd-tier suppliers or in a short-term shift of bargaining power towards the few compliant 2nd-tier suppliers. Second, green criteria initially required significant investments and higher upfront costs for the suppliers. These, however, led in many cases to an increased competitiveness and reduced operational costs due to, for instance, material and energy savings. Lastly, the university's commitment to sustainability in purchases, triggered suppliers to

innovate and offer more sustainable solutions, which has helped them enhance their market position and attract new clients. The analysis at the procurers' level revealed that there is an information asymmetry between procurers and suppliers. Suppliers, indeed, may have more information and expertise regarding green solutions and the market in general, which the procurer may not have. Second, having departments across multiple disciplines, a large university has all distinctive capabilities in-house and can leverage their skills to be able to write or to check the criteria, such as the support of qualified professors, structural engineers or using labs for testing. Third, the procurement office needs to educate the clients on how to map their own needs going beyond a supplier's name or brand and describe what is effectively needed in an unbiased way. Procurers also tried to prompt (internal) clients to buy green even when buying directly from suppliers or vendors. To promote this, the procurement office made available on an internet platform all the documentation related to green public tenders, and a series of guidelines that other departments can follow. Finally, during the analysis conducted at the clients' level, it was found that there is generally a high level of satisfaction with green products and services, with some exceptions related to a perceived lack of flexibility or an initial resistance to change, respectively in the furnishings and vending machines categories. Moreover, it emerged that there is a missed opportunity to transfer green culture downstream, and the learning process appears to be limited or almost non-existent. This highlights the need for more effective communication strategies to address these issues.

To conclude, this research has demonstrated that the adoption of GPP criteria in public procurement has had multiple and nuanced impacts on the triadic relationship between suppliers, procurers, and clients. First, it emerged the role of the procurer's green leadership in less regulated industries. In regulated cases, national or ministerial consultations help mitigate information asymmetry and establish shared criteria. Suppliers in these contexts have already adapted their offerings to comply with MEC and can use them as a catalyst to sustainable innovation. On the other hand, in non-regulated contexts, the information asymmetry is more pronounced. As a result, collaboration becomes even more crucial, beginning with the definition of green criteria. In these cases, the upstream ripple effect can be even greater, with suppliers actively proposing innovative solutions. Ultimately, such tenders could support the creation of MEC regulations in other industries, making them effective

pilot tests. Second, to enhance a green ripple effect also downstream, greater communication is needed. There is, indeed, discordance between the procurement department's commitment to prompt (internal) clients to buy green and its actual influence on the behavior of clients. Increased promotion and more effective communication can lead to greater awareness and likelihood of replication of green initiatives and can foster a sense of pride in being part of a virtuous institution. Lastly, currently clients' feedback is mediated by procurers and then communicated to the suppliers. A greater connection and interaction between clients and suppliers could help suppliers stay ahead of the curve, facilitating a better structuring of their offer and ensuring that their end clients remain satisfied and engaged.

It is worth noting, that more research is needed to investigate the supplier-client link. Moreover, as a main limitation of the research, our focus on the green purchases made by a single institution may limit the generalizability of our results and future research may thereby extend the scope to other public organizations and other settings to investigate how different context conditions affect the identified impacts. Further research could be focused on understanding the dynamics of the triadic relationship between suppliers, procurers, and clients across different public organizations, and how these dynamics can be leveraged to maximize the positive impact of green procurement initiatives.

Appendix

Appendix 1 - Interview Protocols

Suppliers' level

PROFILING OF THE COMPANY

1. What does your company do? (Turnover-employees)
2. How did you come into contact with the University of Padua and what prompted you to participate in the call for tenders of the University?
3. Did your company already comply with the basic criteria required, or did participating in the call for tenders lead you to review your products and processes? In the first case, what are the reasons that led you to propose products/services related to environmental sustainability? (e.g., ethics and CSR, legal aspects, higher product value)
4. In your bid for the call for tender you participated in, did you include any sustainability improvement proposals that were among the award criteria? If so, which ones?

ORGANIZATIONAL IMPACTS - PRODUCT VS PROCESS DESIGN AND RELATIONSHIP WITH SUPPLIERS

5. Did participating in public tenders related to GPP lead to an organizational/operational change in product design? (e.g., better product design, changes in product specifications, if necessary, to obtain ecolabels/certifications)
6. Did participating in public tenders related to GPP lead to sustainability-related changes in your products/services? (e.g., use of sustainable materials, durability product repairability, waste recyclability, use of renewable energy sources)
7. Participating in GPP public tenders, what organizational/operational impact did it have on process design? (e.g., resource optimization, purchasing

new machinery and equipment, offering staff training, organizational efficiency, and more efficient delivery)

8. What impact has the implementation of green practices had on the environmental performance of your company? (e.g., reduction of CO2 emissions, energy efficiency)

9. Have these changes required your company to update its relationships with suppliers? (e.g., integration or selection of new suppliers, change of agreements with existing suppliers)

10. Have the green criteria in the tenders you have participated in had an indirect impact on your suppliers? (e.g., request to implement green practices, comply with environmental requirements or amplification of environmental requirements by requiring more rigid ones)

Procurers' level

EX ANTE CALL FOR TENDERS

1. In the call for tenders there were basic green criteria and green award criteria. Which were the objectives and why did you decide to include green criteria in the tender? (e.g. internal sustainability objectives, green sensitivity, CAM legislation)

2. What did you base your decisions on and how did you choose the green criteria to add to the tender?

3. Who are the customers who benefit from the supply of this product/service? When defining the requirements in the tender, did you also consider the needs of internal customers?

EX POST CALL FOR TENDERS

4. With this GPP tender, how do you perceive the relationship with suppliers and customers has changed?

5. Were there any unexpected results from this call for tenders? (e.g. replicability to other tenders, increase of knowledge in the team, supplier loyalty)
6. Has knowledge also increased in the other actors of the triad, i.e. suppliers and customers?
7. What did you learn from this tender?

(Internal) clients' level

AWARENESS

1. The university's purchases have been directed towards more sustainable choices by including certain environmental criteria in the calls for tender. Have you noticed that the products and services offered meet more sustainable criteria?
2. Was it your request/requirement to include green criteria in the tender for this product/service? Were you already aware that there were CAMs or were you informed by the central administration?

LEARNING

3. Have you received training or information on sustainability criteria in tenders? If so, which ones? Do you think that more training/awareness-raising would be useful?
4. After taking advantage of the products/services resulting from the tender, did you change the specifications and take environmental aspects into account when you competed independently?

EFFECTS

5. What consequences has the inclusion of CAMs and environmental criteria in the services and products offered? (e.g. product/service level, product/service variety)
6. Does the Commission consider that the adoption of environmental criteria has led to a greater awareness of sustainability within the organization?

LEVEL OF SATISFACTION

7. On a scale of 1 to 5, how satisfied are you with the product/service offered?

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