

# UNIVERSITÀ DEGLI STUDI DI PADOVA

Dipartimento di Tecnica e Gestione dei Sistemi Industriali

Corso di Laurea Magistrale in Ingegneria Gestionale

*Tesi di Laurea*

## **ANALYSIS OF GREEN PUBLIC PROCUREMENT IMPACT ON SUPPLIERS: AN EMPIRICAL STUDY**

**Supervisor:**

Ch.mo Prof. Andrea Vinelli

**Co-supervisor:**

Ch.mo Prof. Antonio Cavallin Toscani

**Candidate:**

Martina Righetto

N° matricola: 2074218

Anno Accademico 2023-2024



*Gratitude fills every word of this thesis, extending to all whose guidance,  
support, and inspiration contributed to its realization.*

*“Become who you are.”*

*Friedrich Nietzsche*



## *Acknowledgements*

I would like to express my deepest gratitude to my professor and supervisor, Andrea Vinelli, for his support, availability and guidance at every stage of this research project. I am also sincerely grateful to Professor Antonio Cavallin Toscani for his expertise, kindness and valuable feedback. Furthermore, this research would not have been possible without the support of the University of Padua's procurement team, especially Gianni Infante, Graziella Russo, Chiara Favaretto, and Giulia Gambino, for their help, patience, and for making me feel like a valued team member.

To my family, thank you for giving me the opportunity to embark on this arduous but beautiful journey. To my father, for unconsciously instilling in me the determination to persevere. To my mother, for teaching me resilience and the importance of forging my own path. To my brother, my other half: your wisdom and support have inspired me to always strive for excellence. May my achievements stand as a testament to your sacrifices.

To my uncles, your trust in me has been a constant source of motivation, and the desire to make you proud has always prevailed over any difficulties.

To my grandparents, who have guided my steps and illuminated my way from above, I hope I have made you proud.

To my boyfriend, thank you for your unwavering love and for always knowing what I needed, even when I did not know.

To my friends, from those who have been with me from childhood to those who joined me during my university studies, thank you for the laughter, light-heartedness and support.

To the students I had the privilege to mentor, thank you for teaching me that learning is a multifaceted journey and that there are many ways to teach and learn.

To myself, to you...A sincere and immense thank you.



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## *Abstract*

Green Public Procurement (GPP) policies are gaining in importance as public organisations seek to encourage responsible practices to improve sustainability. These policies require public organisations to incorporate green criteria into their supplier selection processes, with the aim of steering supply chains towards more sustainable paths. To date, GPP has been extensively analysed from the perspective of procuring organisations, including its impact on their operations and supply relationships, as well as the factors influencing its adoption. However, existing literature is limited on the evidence of the impact of GPP on public sector suppliers. Accordingly, this master thesis investigates the experiences of suppliers of a large public university in a region with established GPP practices. The impacts of GPP policies on the operations and supply networks of these suppliers are then mapped. Through a multiple case study methodology, this research analyses data collected from semi-structured interviews with suppliers and supporting documentation provided by both suppliers and public partner organisations. This triangulation of data provides insight into the nuances with which GPP influences supplier practices. The results reveal that GPP has a significant impact on the cost structure of suppliers, often increasing the costs associated with meeting stricter environmental criteria and obtaining mandatory certifications to participate in tenders. Furthermore, the findings suggest that GPP has instigated intricate mechanisms of supply chain reconfiguration, both narrowing and expanding the supply base of suppliers. Moreover, the findings of this study can inform policymakers seeking to effectively harness GPP and suppliers operating within the context of sustainable public procurement.

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



## ***Introduction***

GPP has emerged as a powerful tool for governments to use their purchasing power to promote sustainable development and mitigate the environmental impact of public spending. The European Commission defines GPP as “*a voluntary process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle compared to goods, services and works with the same primary function that would otherwise be procured*” (Commission of the European Communities, 2008). Public procurement, accounting for 16% of EU Gross domestic product (GDP), provides substantial leverage to push green products into the mainstream and incentivise manufacturers to green innovation. Thus, GPP offers governments a powerful policy tool to influence supply chains and promote innovative and environmentally sustainable solutions (Li et. al., 2005).

The principle behind GPP aligns with the broader concept of Sustainable Supply Chain Management (SSCM) (Dai et al., 2021), which focuses on the simultaneous achievement of economic, environmental and social objectives for long-term sustainable growth (Seuring and Müller, 2008). As defined by Carter and Rogers (2008), SSCM involves the “*strategic and transparent integration and achievement of an organisation’s social, environmental, and economic objectives in the systematic coordination of key business processes to improve the long-term economic performance of the business and its supply chains*”. By establishing environmental criteria in their procurement processes, public authorities can exert a knock-on effect throughout the supply chain, pushing suppliers to adopt sustainable practices and minimise their environmental impact. As pointed out in Dai et al. (2021), “*SSCM has emerged as a major issue for businesses to gain a competitive advantage and improve business sustainability performance*”. Furthermore, the Dai et al. (2021) study suggests that GPP can act as a catalyst for businesses to develop and leverage their sustainability skills.

With the recent adoption of GPP guidelines by many countries, prescribing lists of Minimum Environmental Criteria (MEC) for the procurement of services and products by public organizations, it is crucial for suppliers to recognize the impact of these criteria on their operations. These criteria aim to identify suppliers that can be considered sustainable (Cheng et al., 2018). There are regularly two forms of criteria: (1) *mandatory criteria*, which suppliers must fulfil in order to be considered for the contract, (2) *award criteria*, which are voluntary and can provide additional points in bid reviews (Rosell, 2021; Testa et al., 2015). The implementation of GPP not only creates market demand for sustainable products and services, but also encourages suppliers to be more innovative, potentially improving their environmental performance. However, this shift towards greener procurement practices also presents challenges for suppliers, who must adapt and align their processes to the environmental criteria set by the GPP guidelines.

Existing literature has extensively examined GPP adoption rates, barriers to implementation, and the perspectives of procuring entities. Yet, there remains a significant gap in understanding the tangible impacts of GPP on suppliers and their subsequent adaptations. Much of the existing research focuses on topics such as “*organisational aspects, individual behaviour and operational tools*” (Sönnichsen et. al., 2020), providing valuable insights into the mechanisms and challenges of GPP implementation. Nevertheless, there is a clear lack of empirical evidence on how GPP influences the practices, strategies, and competitive dynamics of suppliers, particularly those operating beyond the first tier.

This master thesis addresses this critical gap by shifting the focus to the perspective of first-tier suppliers and examining how the adoption of GPP criteria by public organisations influences their operations and supply relationships. Using a multiple case study approach, the research delves into the experiences of suppliers of a large public university in a region with established GPP practices. Data were collected through semi-structured interviews with supplier managers and triangulated with relevant documentation to ensure accuracy. The use of semi-structured interviews facilitated an open and in-depth discussion guided by pre-defined questions,

providing valuable insights into suppliers' perspectives and experiences of GPP challenges. In order to provide a comprehensive understanding of how GPP policies affect suppliers from different sectors and company sizes, suppliers from different business contexts were interviewed in this study.

The results reveal that GPP acts as a catalyst for the reconfiguration of the supply network, mainly through the cascading effect of certifications and the integration of local SMEs. While certifications improve transparency and environmental performance, they also require extensive supplier management and impact cost structures. Additionally, the timing of publishing GPP criteria, particularly MEC, is crucial, as it must align with the "sustainability maturity" of specific sectors to avoid creating bottlenecks. The analysis shows that GPP can contribute to shortening and "fattening" supply chains, favoring localized networks that, although initially costly, can become a source of strategic advantage for companies. By examining these findings through the lens of established theory, this study provides a nuanced understanding of the factors that enable companies to successfully adapt to GPP and improve their sustainability performance. The results also offer valuable insights into the effectiveness of GPP as a policy tool to promote sustainable practices across sectors.

The subsequent sections of this work are structured as follows: *Chapter 1* provides an overview of the existing literature on GPP; *Chapter 2* addresses the methodological approach, including the research question and the details of the multiple case study investigation; *Chapter 3* presents and examines the findings at the supplier level, also evaluating them through the lens of established theory; finally, a *Conclusions* section summarizes the findings and discusses the limitations of the research.



## ***Chapter 1: Green Public Procurement***

The purpose of this chapter is to conduct a comprehensive literature review on GPP. Initially, the concept of sustainability in public procurement is explored. Subsequently, the regulatory framework and GPP practices in Europe are analysed, including an examination of the process through which the European Commission developed the GPP criteria. Afterwards, an Overview of Italian regulations of public contracts is given. Attention then shifts to the implementation of GPP in universities, with a focus on the University of Padua. Finally, the review examines existing studies on barriers to GPP adoption and research on the effects of GPP on first-tier suppliers within public administrations.

### ***1.1 Sustainability in public procurement***

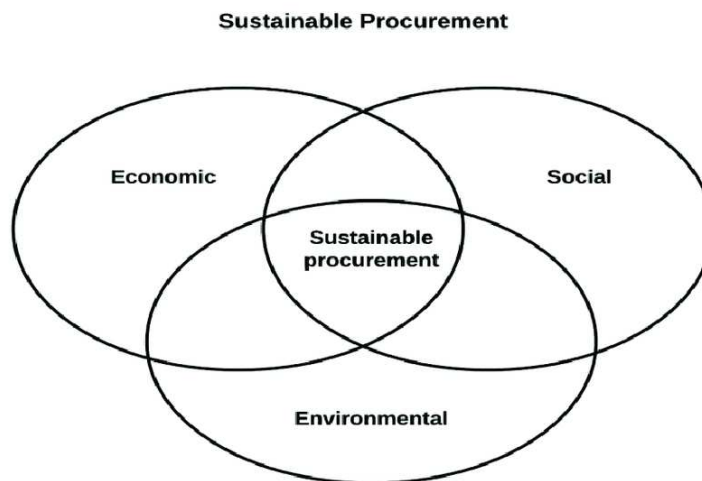
In the European Union, public sector procurement amounts to about 16% of Gross Domestic Product (European Commission - EC, 2023). Public procurement, which includes the purchase of goods, services and works by government institutions from private sector suppliers, has significant potential to promote sustainability if the various objectives are harmonized (Johnson, 2020). Governments use their purchasing power to encourage private organizations to achieve public sustainability goals (Moore, 1995; Rolfstam 2009). Given the economic weight of

public spending, GPP offers governments a powerful policy tool to influence supply chains and promote innovative and environmentally sustainable solutions.

Sustainability, defined as the simultaneous achievement of economic prosperity, environmental protection and social equity – also known as the triple bottom line (3BL; Elkington, 1998) – is increasingly relevant in the industrial landscape. The concept of sustainable procurement is often discussed in the context of SSCM (Bai et. al., 2010). Sustainable Procurement (SP) is the integration of sustainability into the purchasing process, aimed at achieving environmental, social and economic goals simultaneously (Walker et. al., 2010).

According to 3BL theory, companies should consider not only their financial performance, but also operate in social and environmental consciousness and be managed in a way that generates profit while also improving people’s quality of life and minimizing damage to the planet (Elkington, 1998) – see Figure 1.1.

Figure 1.1 Triple bottom line of sustainability



*Source: Elkington, 1998*

Companies, to be considered sustainable in the supply chain context, must excel in the three dimensions of the 3BL (Klassen et. al., 2012). Carter and Rogers (2008) defined a sustainable supply chain as “*the strategic and transparent integration and*



*achievement of an organization's social, environmental, and economic goals in the systematic coordination of key interorganizational business processes to improve the long-term economic performance of the individual firm and its supply chains."*

When companies embrace sustainability, they also create value for all stakeholders. Moreover, environmental commitment is not only a matter of regulatory compliance but can also be a source of competitive advantage for companies (Carter et. al., 2000). Therefore, organizations are putting more pressure on their suppliers to adopt sustainable practices (Sievo, 2023).

Governments are increasingly using Sustainable Public Procurement (SPP) as a tool to mitigate the negative environmental impacts of production and consumption (Grandia, 2016).

Sustainable Public Procurement (SPP), which includes GPP, is *"a process in which organizations meet their needs for goods, services, works in a way that achieves Value for Money (VFM) over a lifetime in terms of generating benefits not only for the organization but also for society and the economy, while minimizing damage to the environment"* (UNEP, 2013).

GPP requires the integration of green criteria into the procurement process so that procurers can identify products and services that offer the best VFM. Environmental criteria can be applied at every stage of procurement, from supplier selection to technical specifications, award criteria and contract performance. Many countries and international organizations have developed tools (e.g., Ecolabel) that simplify the choice to buy green and reduce complexity (La Cascia et. al., 2021).

In the European Union, green public criteria aim to simplify procurement for products and services that have less impact on the environment to facilitate the transition to a circular economy. Effective implementation of GPP requires strategic environmental criteria and a life-cycle perspective (Annunziata et. al., 2014; Bratt et. al., 2013).

Environmental requirements must be clear, verifiable, measurable and transparent so that all companies participating in a public tender are treated equally and allow for effective verification of bids against tender documents (Palmujoki et. al., 2010).

Life Cycle Assessment is crucial in the GPP implementation process, as environmental criteria must go beyond focusing on the environmental compatibility of the production of goods and services and examine environmental performance throughout the entire life cycle of an object. In addition, LCA is often incorporated into the broader concept of “Life Cycle Thinking,” which represents the application of principles of continuous improvement of environmental performance at each stage of a production system’s life cycle (Sogesid, 2023). This philosophy is based on a comprehensive view of the production system, in which all transformation processes, beginning with the extraction of raw materials, assembly, packaging, transportation, and maintenance, and ending with the disposal of products at the end of their life, are taken into account as they participate in the realization of the function for which they were designed (Sogesid, 2023). Life Cycle Thinking thinks about industrial production from the perspective of the concept of sustainable development, whose fundamental objectives are the conservation of natural resources and the minimization of human impacts on the environment (Sogesid, 2023).

Since the International Conference on Environment and Development in Rio de Janeiro in 1992, awareness of the role of GPP in promoting sustainable consumption and production has grown significantly among public authorities. The Rio Conference led to the creation of several documents, including the Rio Declaration, Agenda 2021 and other conventions addressing climate change, biodiversity and desertification (Clémenton, 2012). Next came the 2030 Agenda for Sustainable Development, approved on 25 September 2015 by the United Nations General Assembly, which consists of the 17 Sustainable Development Goals (SDGs) and 169 related targets<sup>1</sup>. Member states commit to “ensure sustainable consumption and

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<sup>1</sup> Agenda 2030 (2015). *Alleanza italiana per lo sviluppo sostenibile*.

production patterns”<sup>2</sup> and “promote sustainable public procurement practices in accordance with national policies and priorities”<sup>3</sup> (UN, 2015).

Based on the principles of the 2030 Agenda, the EC introduced the “European Green Deal,” a comprehensive program outlining the EU’s sustainability goals. The Green Deal aims to achieve a 55% reduction in greenhouse gas emissions by 2030 and climate neutrality by 2050. In addition, the program emphasizes the strategic role of public administration in developing and implementing sustainable logistics and infrastructure solutions to achieve climate goals.

## ***1.2 GPP legal framework in Europe***

The European Union is considered the largest public procurement market globally and a leader in GPP initiatives (Trybus, 2006).

Public procurement involves the acquisition of goods, services, and works by government institutions and state-owned enterprises from private sector suppliers, and this process is known as GPP. In addition, governments leverage SPP to mitigate the negative impacts of production and consumption, as public procurement has significant potential to promote sustainability (Johnson, 2020). PA demand for greener goods can shape production and consumption trends, effectively creating or expanding markets for environmentally friendly products and services (Li et. al., 2005).

In 1996 the “Green Paper on Public Procurement in the EU” first mentioned the importance of GPP in policies for sustainability, reduction of environmental impacts, eco-innovation and circular economy (Sogesid, 2020).

However, the key document that established the pivotal role of GPP and its impacts is European Communication No. 274/2001 (EC, 2001), which outlined how public

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<sup>2</sup> SDG 12: Ensure sustainable consumption and production patterns

<sup>3</sup> SDG 12.7: target and indicator on Sustainable Public Procurement implementation

authorities can incorporate environmental considerations into their procurement processes. The communication's guidelines were incorporated into Directive 2004/18/EC, which redefined the EU legal framework on public procurement (EC, 2004). The directive allowed contracting authorities to consider environmental issues throughout their procurement process (Parikka-Alhola K., 2008), particularly in the following phases of the public tendering mechanism:

- Technical specifications<sup>4</sup>: environmental criteria may be included in product/service specifications, such as the use of recycled materials or specific production processes; in addition, European eco-labels, which meet scientific and participatory standards, may be used.
- Technical competence<sup>5</sup>: bidders may be required to demonstrate their experience in environmental management, such as holding EMAS<sup>6</sup> registration or ISO 14001<sup>7</sup> certification.
- Award criteria<sup>8</sup>: environmental requirements may influence the selection of the most economically advantageous tender, provided they are relevant to the objectives of the tender and in accordance with EU principles.
- Contract performance<sup>9</sup>: contracts may specify environmental performance requirements, such as green transportation and waste reduction measures.

Procurement in the public sector is subject to intense scrutiny to ensure transparency, limit corruption, and provide fair treatment to suppliers. Regulations and policies are designed to promote principles such as value for money, equal treatment, non-discrimination and transparency (EC, 2014). Recent European directives encourage the use of whole product Life Cycle Assessments (LCA) and

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<sup>4</sup> Specified in Article 42 of European Directive 2014/24/EU

<sup>5</sup> Specified in Article 42 of European Directive 2014/24/EU

<sup>6</sup> Is a voluntary European environmental management tool that enables companies and other organizations to assess, report and improve their environmental performance

<sup>7</sup> Identifies an International Organization for Standardization (ISO)'s technical standard on environmental management systems (EMS) that establishes the requirements for an environmental management system of any organization

<sup>8</sup> Specified in Article 67 of European Directive 2014/24/EU

<sup>9</sup> Specified in Article 70 of European Directive 2014/24/EU

break away from large contracts to support small and medium-sized enterprises (SMEs) (Parikka-Alhola, 2012).

With the Circular Economy Action Plan published in 2015 (EC, 2015), the European Union set ambitious and concrete targets to “close the loop” in the life cycle of products and recognised GPP as playing a key role in facilitating the transition to a circular economy (Sogesid, 2020), which aims to minimise waste and seeks to maintain resources at their maximum value (Sönnichsen et. al., 2020), in contrast to the traditional linear economic model. MECs need to be similar and comparable across Member States to avoid market distortions that would reduce competition (La Cascia et. al., 2021).

To make it easier for member states to implement GPP at the local level, the European Commission has developed 21 sets of standardized GPP criteria<sup>10</sup>, each corresponding to a particular group of procurement areas. These criteria are based on existing ecolabels and third-party environmental management standards. The goal of the environmental criteria is to strike a balance between environmental performance, cost considerations, market availability and ease of verification (La Cascia et. al., 2021).

The guidance provided by the EC distinguishes the criteria into two levels of ambition: core criteria and comprehensive criteria. On the one hand, the core criteria focus on the main environmental impacts of a product and aim to minimize administrative costs for companies; on the other hand, the comprehensive criteria, include a broader range of environmental impacts and higher standards, also can be used in promoting eco-innovation (La Cascia et. al., 2021).

Regardless of the allocation method, green criteria and standards are usually mentioned in the selection process and may be more or less stringent.

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<sup>10</sup> EU GPP criteria categories are: cleaning products and services; computers, monitors, tablets and smartphones; data centres, 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.

Environmental and eco-label requirements are mostly discussed with the concepts of recalls and general requirements; moreover, these criteria may be mandatory or recommended.

The inclusion of environmental criteria in Green Supplier Selection (GSS) introduces complexity to the procurement process and reduces qualified bidders.

Potential suppliers are assessed on their product's environmental impact and their organization's environmental performance, leading to strict qualification requirements. This can result in a smaller pool of eligible bidders as not all can meet these rigorous standards. As a result, the selection process involves multiple stages, where bids must first comply with mandatory green criteria before proceeding to the final contract award stage (Cheng et. al., 2018).

The use of mandatory criteria removes uncertainty for suppliers, reduces risk for procurers, simplifies green procurement design, and establishes a common practice for all contracting authorities (La Cascia et. al., 2021).

In some countries, the relative weights assigned to price and performance criteria are set in regulations. In others, PPA can provide guidance on how environmental criteria should be applied in the procurement process, establishing which criteria should be mandatory as technical qualifications and identifying optional award criteria and their respective weights to be assigned. When choosing criteria for a tender, procurers should keep in mind the need to select requirements that will “push” the market toward green solutions while being feasible to ensure a competitive response from bidders. In other words, GPP can shape production and consumption trends, and significant demand for “greener” products from public authorities can create or enlarge markets for eco-friendly products and services (Li et. al., 2005).

Moreover, in EU the concept of GPP is closely linked with Circular Public Procurement (CPP). The European Commission defines CPP as *“the process by which public authorities purchase works, goods, or services that contribute to closed energy and material circuits within supply chains by minimizing and ideally*

*avoiding negative environmental impacts and waste generation in the entire life cycle”* (EC, 2017). This close relationship between these approaches highlights the potential to align circular economy principles with environmental criteria that shape GPP.

### ***1.3 Process for setting GPP criteria***

Environmental criteria consider the most important environmental impacts of goods, services, and works throughout the product life cycle, striving to address impacts throughout the supply chain, but their definition can be complex on both the design and application side (La Cascia et. al., 2021).

Governments often develop standardized environmental criteria for the most common purchasing categories to facilitate procurement; they may also simplify environmental criteria by focusing on the most significant environmental impacts, using third-party ecolabels and third-party assessments, as well as environmental management standards (La Cascia et. al., 2021). The use of standardized environmental criteria facilitates the task of procurement and provides suppliers with certainty about environmental requirements.

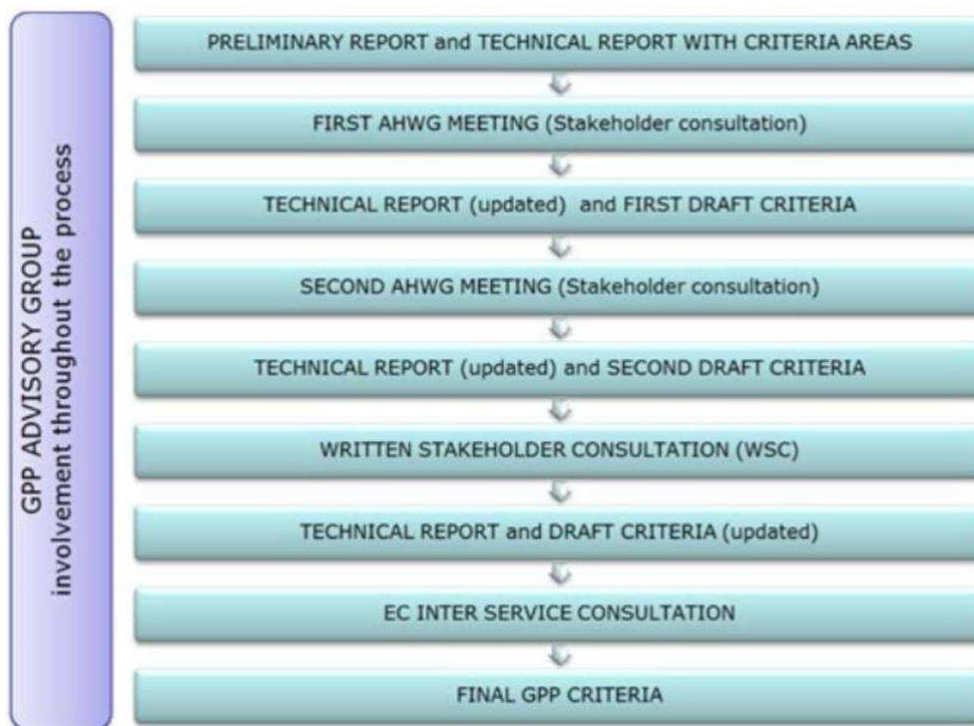
Responsibility for the development of standardized environmental criteria generally rests with the Public Procurement Authority (PPA), which usually works in collaboration with environmental agencies, their respective sector agencies, and external stakeholders.

The process of developing environmental criteria should be transparent and inclusive. Criteria should be objective and verifiable, free of risk of collusion or bias against suppliers, communicated transparently and effectively to potential suppliers, and allow for fair competition (La Cascia et. al., 2021). The design of environmental criteria can be based on legislative requirements and technical regulations, national and organizational environmental policy priorities,

specifications recommended by regional bodies, environmental standards, certifications and labels, as well as market research, industry reports and criteria developed by other countries (La Cascia et. al., 2021).

A new procedure for the development of GPP criteria was established in 2010 that aims to make the process more transparent and participatory, while at the same time strengthening synergies between different product-related policy instruments, such as GPP, Ecodesign, EU Ecolabel and Energy label (Musacchi, 2021). Stakeholders can offer feedback on background studies and draft GPP criteria at different stages of the process. The phases of the European GPP criteria development process are schematized in Figure 1.2.

Figure 1.2 – Procedure for the development of EU GPP Criteria



*Source: European Commission website*

The process for developing GPP criteria begins with the preparation of a preliminary report that identifies the areas of technical criteria to be developed. This



phase is critical to outline the general framework and identify the main areas of focus. Next, the first meeting of the Advisory Working Group (AHWG)<sup>11</sup> is organized, during which stakeholders can express their views and suggestions on the identified preliminary criteria areas. After this meeting, an updated technical report is prepared and a first draft of the GPP criteria is prepared. A second meeting of the AHWG follows, where the first draft of the criteria is evaluated, and additional feedback is gathered from stakeholders. The process continues with a review of the technical report, which is updated to include new input and prepare a second draft of the GPP criteria. This second draft is subject to a Written Stakeholder Consultation (WSC), which allows detailed feedback to be gathered through a formal, documented process. After incorporating comments received during the written consultation, the technical report is further updated.

The next stage involves consultation among the various departments of the European Commission, thus ensuring that the criteria are consistent with EU policies and priorities. Finally, after passing all these review and consultation stages, the GPP criteria are finalized and adopted and officially published on the EU GPP website (EC, 2023b).

## ***1.4 Overview of Italian regulations of public contracts***

GPP can bring about changes in consumption and production patterns, but its adoption varies widely according to the specific obligations set out in each EU member state's GPP action plans.

A study by Testa et al. (2005), had previously shown that there were 7 European countries (Austria, Denmark, Finland, Germany, the Netherlands, Sweden, and the UK), also known as Green-7, that were most active in implementing GPP due in part to a strong policy push and national guidelines.

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<sup>11</sup> The AHWG (Ad-Hoc Working Group) is called GPP AG, and is a working group created specifically for a specific task or to address a particular issue. In the context of the development of Green Public Procurement (GPP) criteria in the European Union.

The European Public Procurement Commission had a goal of making 50% of all public procurement green by 2010 to improve the environment. To date, the situation on GPP adoption in EU member countries is varied and is briefly described in Table 1.1 (Sogesid, 2020).

Table 1.1 – GPP situation of the European countries

Country		Country	
Austria	Generic obligation at federal level	Belgium	Regional standards for specific products
Bulgaria	Product target defined	Cyprus	Target 50% of purchases
Croatia	Target 50% by 2020	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	<b>Italy</b>	<b>Mandatory 100% purchase (art.34) MEC</b>
Ireland	50% of purchase	Lithuania	50% of purchase 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 MEC
Spain	25-100% for product categories		

This study will provide evidence on the impacts of GPP on first-tier suppliers of a large Italian public organisation, so regulations at the Italian level will be considered.

The Public Procurement Code came into force in Italy in 2006 and covers public works contracts, public supply contracts and public service contracts. In 2008, the Action Plan for the Environmental Sustainability of Public Administration Consumption (also known as PAN GPP) was approved and subsequently updated in 2013<sup>12</sup>, consistent with what the European Commission's Communication 2003/302 had stipulated, in which "*Member States were invited to equip themselves with publicly accessible action plans for the integration of environmental requirements into public procurement*" (Sogesid, 2020). In response to the European procurement directives, Italy through the PAN GPP has defined the MECs a set of environmental requirements defined for different categories<sup>13</sup> of products, services and works purchased or entrusted to the Public Administration (article 34)<sup>14</sup>, with the intention of reducing polluting emissions and promoting eco-friendly products.

The Italian Action Plan aims to maximize the diffusion of GPP among public bodies so that its full potential in terms of environmental, economic and industrial improvement can be deployed (Mauri, 2017). The Italian Action Plan aims to spread GPP through the following actions (Mase, 2023):

- Involvement of relevant GPP stakeholders at the national level
- Dissemination of knowledge about GPP to public administration and other public bodies through dissemination and training activities
- Definition of methodological indications for the construction of "sustainable" purchasing processes and environmental criteria to be included in tender specifications for products, services and works identified as priorities for environmental impacts and spending volumes
- Definition of national targets to be achieved and redefined every three years

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<sup>12</sup> Decree April 10, 2013 - Action plan for environmental sustainability of consumption in the Italian public administration sector.

<sup>13</sup> 18 MECs categories: interior furniture, street furniture, incontinence aids, work shoes and leather accessories, paper, cartridges, building, cultural events, public lighting (supply and design), public lightning (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.

<sup>14</sup> 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.

- Periodic monitoring of GPP diffusion and analysis of the environmental benefits achieved.

Although the implementation of GPP criteria in the EU is voluntary, Italy has made the introduction of MECs mandatory in its procurement procedures with Law 221/2015. This law makes the Italian system the one with the most advanced and environmentally sustainable approach in the entire European framework. In addition, in 2016 the historic Public Procurement Code<sup>15</sup> was amended, and the new Procurement Code<sup>16</sup> came into force, which saw the introduction of the mandatory use of “Green Criteria” for Public Administration (Mauri, 2017).

MECs are typically of two types: technical specifications or mandatory criteria, which any bidder must meet, and award criteria, which are voluntary but provide additional points in bid evaluation (Rosell, 2021; Testa et al., 2016). The inclusion of environmental criteria in supplier selection introduces complexity because it requires evaluation of long-term impacts (Preuss, 2002) but increases the impact of GPP.

There have historically been two bid awarding mechanisms available to a PA: the “Lowest Price” criterion and the “Most Economically Advantageous Tender” (MEAT) (in Italian “Offerta Economicamente Più Vantaggiosa – OEPV”) criterion. With the New Procurement Code, contracting stations are required to use the Lowest Price award criterion<sup>17</sup> only in cases adequately justified in the notice itself, favoring instead the use of the MEAT as it is considered the greater guarantor of quality (article 95)<sup>18</sup> (Mauri, 2017).

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<sup>15</sup> Legislative Decree 163/2006

<sup>16</sup> Legislative Decree 50/2016

<sup>17</sup> 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.

<sup>18</sup> Article 95 of the Public Contracts Code gives centrality to the criterion of the Most Economically Advantageous Offer, based on best value for money. Evaluation criteria include technical quality, environmental certifications such as Ecolabel, usage and maintenance costs, greenhouse gas emissions, personnel qualifications, after-sales service and delivery conditions. It also considers health impacts and favours short supply chain goods. These criteria cover the entire life cycle of the work, good or service.

Thus, the Italian Procurement Code encourages a synergy with the environmental issues of GPP and MECs.

### ***1.5 GPP in University***

Universities, as public institutions, are often in the spotlight for their role as promoters of education and awareness-raising tools for society on sustainability issues in all its forms. Traditionally, universities are recognised as a source of innovation, research and education; therefore, the fact that we have integrated environmental criteria into all levels of university management, including purchasing decisions, means that the university plays a key role in contributing to sustainable development. The adoption of GPP in universities implies that they can leverage their considerable purchasing power in the promotion of environmentally sound practices, which extend to their entire supply chain (Pacheco-Blanco et. al., 2016). Universities are actively developing GPP policies and integrating them into their contracts with suppliers. This not only reduces the environmental footprint of university activities, but also proves to be a pressure on suppliers to improve their sustainable performance.

The transition to a more sustainable supply chain involves prioritising green suppliers that align with sustainability values (Giannakis et. al., 2020; Liu et. al., 2021). This requires universities to actively collaborate with suppliers to ensure that they understand and are able to meet the environmental requirements stipulated in their contracts. Consequently, evaluating bidders on their ability and commitment to meet environmental requirements becomes a critical aspect of the procurement process.

Nevertheless, effective implementation of GPP goes beyond simply incorporating environmental criteria into procurement processes. Instead, it requires a fundamental change in organisational culture that extends both within and beyond university boundaries. Universities need to incorporate sustainability into their

vision and strategic plans at a deeper level, going beyond superficial intentions (Young et. al., 2016). By integrating GPP into their core values, universities can emerge as influential catalysts for change, demonstrating leadership in sustainable practices and becoming an example to emulate.

### ***1.5.1 University of Padua: an example of excellence in sustainability***

Founded in 1222, the University of Padua is one of the oldest and most prestigious universities in Europe and embodies a legacy of academic excellence and a deep-rooted commitment to sustainability. The university promotes a culture of human rights, environmental protection and international solidarity, values embodied in the motto “Universa Universis Patavina Libertas”. The University’s commitment to resource management is also demonstrated in the way it conducts teaching, research and innovation activities, as evidenced by the projects it undertakes. In 2021, the renovation of the Student House A. Fusinato was awarded the Compraverde Veneto Prize for its focus on environmental impact and sustainability. The following year, the University received the same award for its Via Gradenigo and Fiera building projects, which were recognised for their focus on revitalising urban space, reducing land consumption and meeting environmental sustainability criteria (UniPD, 2024).

The University of Padua sees itself as a key promoter of sustainable development, actively supporting economic growth, inclusion, gender equality and environmental protection (Sustainability Report, 2022). With the “UniPadova Sostenibile” project, the University wanted to demonstrate its strong commitment to integrating sustainable practices into its operations, in line with the United Nations Agenda 2030 for Sustainable Development. This underscores the importance of ensuring that environmental criteria specifications are tailored to specific, strategic, and long-term environmental objectives. The 2022-2023 Sustainability Report reveals important recognitions that have crowned the results of the University’s commitment in the fields of environmental, social and economic sustainability. The

Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca (ANVUR) recognised the “UniPadova Sostenibile” project as an “*excellent and highly relevant*” model for other universities, praising its innovative and effective approach to integrating sustainability into all aspects of university life (Sustainability Report, 2022).

Moreover, the University’s dedication to green practices is further underlined by its impressive performance in important global rankings that focus on sustainability policies. In THE Impact Rankings, the University of Padua consistently ranks among the top one hundred universities globally for its contribution to several Sustainable Development Goals, including good health and well-being<sup>19</sup>, quality education<sup>20</sup>, sustainable cities and communities<sup>21</sup> and gender equality<sup>22</sup>. Although its position in the UI GreenMetric ranking dropped to 131<sup>st</sup> place in 2022 due to an increase in the participation of universities, the University of Padua maintains a strong position, particularly in the areas of energy and climate change, waste management, education and research (UniPD Sostenibile, 2023). In addition, the University of Padua was ranked 110<sup>th</sup> in the world and 2<sup>nd</sup> in Italy in the second edition of the QS Sustainability ranking of world universities, published in December 2023. This ranking recognises universities with leadership capabilities, stemming from their involvement in research, education and local engagement. These institutions play an active role in promoting sustainable development by supporting significant transformations in environmental practices, social initiatives and standards of governance (ESG - Environmental Social Governance) (UniPD Sostenibile, 2024) . The awards obtained by the University of Padua enhance its reputation as a pioneer of sustainability both nationally and internationally, providing a model for other academic institutions to follow.

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<sup>19</sup> SDG 3: Ensure healthy lives and promote well-being for all at all ages

<sup>20</sup> SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

<sup>21</sup> SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable

<sup>22</sup> SDG 5: Achieve gender equality and empower all women and girls

### ***1.5.2 GPP in the University of Padua***

In 2019, the University of Padua signed a memorandum of understanding on GPP with the Veneto Region, Ca' Foscari University of Venice, University of Verona, IUAV University of Venice, Unioncamere of Veneto and ARPAV (UniPD Sostenibile, 2022). This collaboration agreement focuses on minimising waste, reducing the use of plastic and promoting a circular economy.

The University's commitment to these principles goes beyond mere agreements and is translated into tangible actions. The "Plastic Free" project, for example, actively encourages the use of reusable bottles and containers, directly addressing the problem of single-use plastic. Furthermore, the University of Padua has consistently implemented rigorous hazardous and non-hazardous waste management practices, adhering not only to legal requirements but also to ethical and environmental principles (UniPD Sostenibile, 2022). These responsible waste management actions are consistent with the University of Padua's broader objective of promoting a circular economy, favouring the reuse of materials for multiple production cycles and aiming to minimise waste production.

The "UniPadova Sostenibile" project and the "Carta degli impegni di sostenibilità 2023-2027" outline the University's approach of embedding sustainability in all aspects of its operations, actively pursuing the Sustainable Development Goals of Agenda 2030. These documents highlight the University's commitment to resource management, building sustainability, staff and student wellbeing and promoting a culture of sustainability throughout the university community. In particular, the "Carta degli impegni di sostenibilità 2023-2027" emphasises the University's recognition of the profound global challenges that require a shift to sustainable practices. The document recognises the impact of the COVID-19 pandemic, the consequences of the war in Ukraine and other ongoing conflicts, and the pressing issue of climate change, emphasising the urgency of addressing these challenges through sustainable practices (UniPD Sostenibile, 2022).

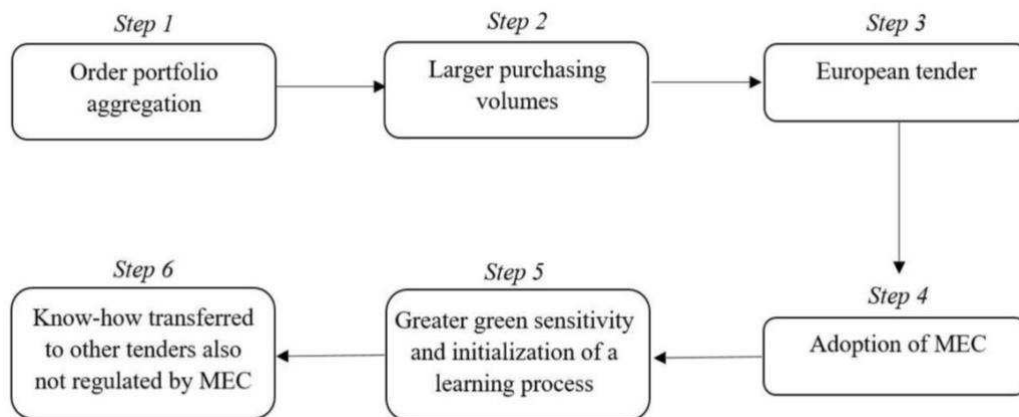


### 1.5.3 Process model of GPP diffusion at the University of Padua

The University of Padua’s path towards integrating GPP into its DNA represents an interesting case study of high impact incremental organisational change.

In the Figure 1.3 is represented the process model of GPP diffusion within the University. The scheme outlines the key stages of green transformation, revealing a dynamic interplay between policy, practical implementation and organisational continuous improvement.

Figure 1.3 - Process model of GPP dissemination at the University of Padua



Source: M. V. Porro, 2023

Based on Porro’s study (2023), it is possible to learn how the strategic decision was initially made to aggregate and centralise procurement processes (1). This change from decentralised departmental procurement to one central system proved to be the catalyst for the adoption of GPP. Centralisation brought immediate benefits, such as standardised procurement approaches and increased efficiency, while meeting the requirements for the product or service. The aggregation of similar orders from different university departments inevitably led to an increase in purchasing volumes (2), potentially leading to cost savings through economies of scale and subjecting the university to European procurement regulations (3), including mandatory environmental criteria. As a result, public administrations

were induced to take environmental considerations into account when making purchasing decisions and to incorporate MEC into public procurement (4). Over time, the purchasing department, which is in charge of incorporating specific environmental criteria, has developed a greater awareness and “green sensitivity” (5), which has enabled the promotion of environmentally friendly practices. In addition, the knowledge and best practices acquired by the purchasing department staff were actively transferred to other procurement processes (6).

In light of the above, it is possible to affirm that the success of the dissemination of GPP in the University of Padua is not solely due to compliance with European regulations, but rather is linked to its intrinsic culture of continuous improvement and the possibility of expanding the best sustainable practices learnt in all the University’s operations.

## ***1.6 Literature review***

The following section presents a literature review exploring the dynamics of GPP. A thorough review is crucial in this context, as it systematically analyzes existing research to provide a nuanced understanding of a complex topic. First, the main barriers hindering the implementation of GPP are examined. Secondly, some studies on first tier suppliers in PAs are presented.

### ***1.6.1 Barriers to the implementation of GPP***

The adoption of GPP can be difficult due to numerous obstacles in the implementation of environmental criteria.

The review of the literature has shown that numerous studies highlight the different challenges that limit the adoption of environmental considerations in public sector procurement.

Walker et al. (2008) identified both internal and external barriers. Internal barriers include costs, lack of legitimacy and misalignment of short- and long-term strategic objectives (Giunipero et. al., 2012). External barriers address regulatory issues, poor supplier engagement and transparency, and industry-specific challenges.

A study by Bouwner et al. (2006) examined GPP implementation by 25 EU Member States and revealed uneven adoption, with 7 countries showing more advanced implementation.

Keaveney et. al. (2014) shows that the key barriers identified in the adoption of GPP are: the perception that ecological products or services increase costs, the lack of training of employees, the lack of environmental knowledge and information tools and finally the lack of support from higher authorities .

Table 1.2: 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*

According to Testa et al., (2012), the main obstacles that public administrations face in implementing GPP can be classified into three categories: economic, political and cognitive.

#### Economic barriers:

Environmentally friendly products and services are often perceived as more expensive than traditional alternatives; moreover, the application of environmental criteria to procurement processes can lead to higher initial purchase costs, but

overall costs are often reduced because higher purchase prices of green products and services are offset by lower operating, maintenance or disposal costs. In addition, the limited demand for environmentally friendly products and services may hinder large-scale production while maintaining high prices. To overcome this barrier, purchasing managers, both new and existing, should be instructed about Life Cycle Costing, and should then be encouraged to use this in their purchasing decisions (Keaveney et. al., 2014).

Political barriers:

The lack of clear and consistent laws and regulations defining GPP criteria creates uncertainty and hinders the adoption of sustainable practices. Moreover, fragmentation between different levels of government and lack of coordination hinder the effective implementation of coherent GPP strategies. To overcome this barrier, cooperation and the coordinated exchange of best practices in tendering should be encouraged (EC, Barriers - GPP).

Cognitive barriers:

Poor knowledge of the environmental and economic benefits of GPP among public officials may limit enthusiasm for adopting such practices. Moreover, the lack of specific expertise for the assessment and selection of environmentally friendly products and services may hinder the effective implementation of the GPP. For some groups of products and services, public authorities do not have access to clear and verifiable criteria allowing public authorities to include environmental factors in their procurement, while respecting the requirements of the Procurement Directives and other sources of procurement law (EC, Barriers - GPP). To overcome this barrier PA staff should be trained to have practical skills, knowledge and access to appropriate information.

Other studies indicate that the practice of GPP has to overcome significant challenges, including lack of knowledge and environmental awareness, organisational objectives and structure, political engagement and financial issues (Cheng et. al., 2018). Although GPP practices vary at different levels of public

authorities and areas, financial constraints have always been considered the main obstacle to green procurement (Brammer et. al., 2011), because environmentally friendly products are perceived as more expensive. However, increasing knowledge of operational tools, such as lifecycle costs, can mitigate this barrier by demonstrating long-term cost advantages (Sönnichsen et. al., 2020).

In addition, the company dimension also has an impact on the adoption of environmental criteria, with larger organisations more likely to engage in sustainability initiatives (Min et. al., 2001). Moreover, legislation and regulation can also help or hinder green supply management (Porter et. al., 1995), acting as a catalyst for proactive companies or perceived as a brake by others (Walker et. al., 2008).

To overcome these challenges, it is critical to integrate process-based collaborative practices into procurement strategies. Engaging key suppliers early in the procurement process can help develop innovative solutions that better address environmental goals (Luzzini et. al., 2015). By combining results-based and process-based practices, public sector organisations can better engage stakeholders and promote innovative approaches to improving environmental outcomes (Johnson et. al., 2021).

### ***1.6.2 Studies on first tier suppliers in PAs***

In recent years, there has been a clear surge of interest in GPP, a trend that is evident from the increase in academic publications on the topic and that signals recognition of the potential of GPP in promoting sustainable economic growth (Sönnichsen et al., 2020; Cheng et. al., 2018; Appolloni et. al., 2014). Indeed, GPP offers governments a powerful policy tool to target supply chains and promote innovative and environmentally sustainable solutions (Johnson et. al., 2021).

By incorporating the environmental considerations in their procurement processes, public agencies can significantly influence suppliers' behavior, encouraging them to innovate and provide greener products and services (Cheng et al., 2018). Recently, GPP has shifted from the principle of “doing less harm” to a more proactive approach, in which public procurement helps reduce the ecological footprint of the supply chain and promote sustainable development goals (La Cascia et al., 2021; Cheng et al., 2018; Appolloni et al., 2014; Johnson et al., 2021).

Research on Green Public Procurement has delved into the key factors that drive the adoption of environmentally friendly procurement practices and the challenges that prevent their effective implementation (Testa et al., 2005). In addition, the growing relevance of GPP in environmental policies has led to in-depth analysis in various areas, including operational perspectives, cost-effectiveness, feasibility, and public rationale (Parikka-Alhola, 2008; Testa et al., 2012).

Despite the recognized importance and value of green public procurement, it is difficult to fully monitor and report on GPP activities. In many EU countries, e-procurement platforms have been instrumental in shedding light on the prevalence of GPP in public procurement (Turley et al., 2022). However, the data collected often provide limited insight into the actual impact of GPP implementation (La Cascia et al., 2021). Indeed, research has shown a dearth of comprehensive analyses assessing the effectiveness of GPP in reducing environmental impacts, as well as examining the potential spillover effects that may result from its implementation (Cheng et al., 2018).

It should be noted that most research on GPP has focused on procurers, paying limited attention to the opinions and experiences of suppliers of public organizations. Some studies have found that suppliers often perceive GPP not only as a compliance requirement, but also as a catalyst that can reshape the dynamics of inter-organizational networks (Johnson et al., 2021; Rizzi et al., 2014).

Other studies have noted that the establishment of MECs through green public procurement can foster opportunities for local SMEs to participate in the supply chain as secondary or even tertiary suppliers (Preuss, 2009). This inclusion promotes diversity in the supply chain and incentivizes SMEs to adopt sustainable practices. In addition, these criteria can influence how primary contractors structure their supply chains, leading to the discovery and integration of new environmentally conscious suppliers (Preuss, 2009).

As highlighted in Oruezabala & Rico's study (2012), the implementation of environmental criteria can lead organizations to examine their established supply chains, preferring suppliers who adhere to GPP standards. This change can lead to a narrowing of the supply base, which, in turn, fosters stronger relationships. As a result, prime contractors and their selected suppliers can forge more cohesive partnerships focused on shared sustainability goals and lasting collaboration, thus reshaping traditional procurement dynamics (Oruezabala et al., 2012).

These few studies hint that there is a significant void in the literature in exploring the effects of GPP beyond first-tier suppliers, as well as a lack of relevant empirical evidence from suppliers in the public sector. Addressing this gap is critical to fully understanding GPP practices and assessing its effectiveness in moving entire supply chains toward sustainability (Cheng et. al., 2018; Grandia, 2016; Appolloni et. al., 2014).





## ***Chapter 2: Methodology***

This chapter focuses on the research methodology used to determine what happens at the early supply levels of public organizations in the context of GPP. Initially, the process by which the research question (RQ) was formulated is explained. A qualitative research approach based on Multiple Case Studies has been adapted to respond to the RQ. The data collection technique used was semi-structured interviews with the 1<sup>st</sup> tier suppliers of a public organization. Subsequently, how the sample of suppliers was selected is explained, and after this, the data collection method is exposed in detail. Finally, the analysis method used to extract meaning from the collected data is illustrated.

### ***2.1 Research objectives***

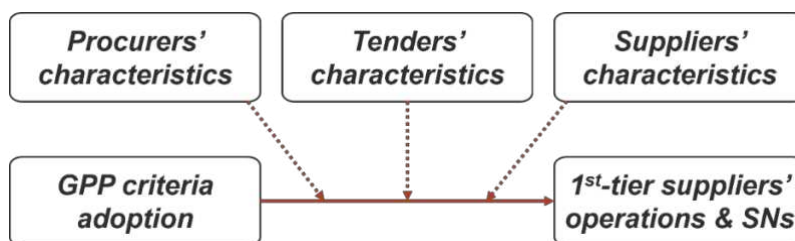
Although the potential of GPP in promoting sustainable practices is widely recognised, the existing literature mainly focuses on adoption rates and barriers to implementation, neglecting the perspectives and experiences of suppliers directly impacted by these policies. To bridge this gap, this master thesis aims to explore the experiences and perspectives of first-tier suppliers engaged with a public organization that practices GPP. Hence, the research question for this study was articulated as follows:

**RQ:** *How does the adoption of GPP criteria by public organizations affect the operations and supply relationships of their 1<sup>st</sup>-tier suppliers?*

The literature review also showed that there are several factors influencing the adoption of GPP and its resulting impacts. The main influences on the adoption of GPP criteria in the operations and supply chain of first-tier suppliers to public authorities, as illustrated in Figure 2.1, are the characteristics of tenders, suppliers, and procurers. The characteristics of tenders, including the established GPP criteria, their integration and prioritization in the procurement process, and the transparency of the tender evaluation, are key to shaping supplier behaviour and compliance. Similarly, the characteristics of the supplier, such as company size, type of sector, and previous experience in public procurement, determine its ability to meet and support GPP criteria. Finally, the characteristics of the procurer, such as the size of the public organization, its procurement experience, and its commitment to sustainable practices, determine the approach and effectiveness of GPP implementation, thereby influencing the transformation of the entire supply chain towards sustainability.

This research is part of a larger three-year collaborative project between the University of Padua and the Veneto Region, investigating the impact of PAN GPP within public administration supply networks. This collaboration provides a valuable real-world example, enriching the research with practical insights into the implementation of GPP and its impact on operations and supplier relationships (Bowen et. al., 2001).

Figure 2.1 - Key factors influencing the adoption of GPP by first tier public sector suppliers.

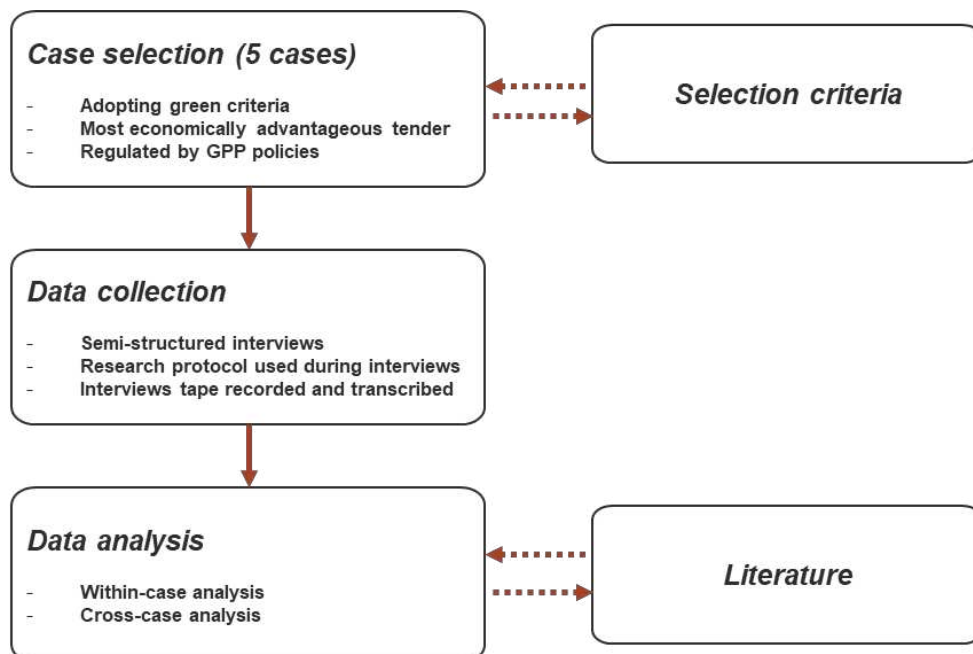


## 2.2 Research methodology

To answer the research question, the study adopted a descriptive and explanatory approach, supported by the multiple-case study methodology (Voss et. al., 2002; Meredith, 1998). This choice proved to be particularly appropriate as it facilitates a deeper level of observation, thus improving the external validity of the results (Voss et. al., 2002). Since GPP from the suppliers' perspective is a relatively unexplored area within the literature, the case study approach is instrumental in generating significant findings. Furthermore, by using more cases, the study aims to increase the generalisability of the results and reduce potential biases. In line with the research objective, supplier organizations were chosen as the unit of analysis, and the study focused on examining suppliers who engage with public sector organizations that adhere to GPP criteria

Figure 2.2 presents an overview of this research method, which will be detailed in the subsequent paragraphs of the methodology section.

Figure 2.2 – Research method



In addition to employing a multiple-case study methodology, the research incorporates the Gioia Method into its analytical approach. The Gioia Method is a systematic technique for the analysis of qualitative data, known for its rigor in inductive research. Using the Gioia Method enhances the research methodology by adding structure and transparency to the analysis of semi-structured interviews, facilitating the synthesis of complex and rich qualitative data into a coherent narrative aligned with the research questions (Gioia et. al., 2013). The application of this method in the current study enables a more nuanced and grounded understanding of the organizational impacts of GPP, as experienced and perceived by supplier organizations.

### ***2.3 Sample selection and description***

The supplier sample was carefully chosen to ensure diversity across various dimensions. These dimensions encompass the industry sector in which each supplier operates, the percentage of their annual revenue from public procurement contracts, and their previous involvement with environmental standards or sustainability certifications before the introduction of MEC in their sectors. This careful selection aimed to illuminate different organisational responses and adaptations to GPP requirements, thus providing a richer and more nuanced understanding of the implications of MEC implementation in different market segments.

As described by Voss et al. (2002), the case selection process adopted inclusion criteria designed to select cases that share common characteristics to ensure alignment with the research aim and to make the study feasible. In addition, cases that vary in certain features were chosen to identify possible patterns and enhance the generalizability of the findings, following Yin's guidance on case study research (Yin, 2014).

The criteria for inclusion were precisely defined:

- Firstly, suppliers that fell within the scope of GPP were included, identifying those that had recently won public tenders that included GPP criteria and were currently engaged in contracts governed by these frameworks.
- Second, to mitigate inconsistencies arising from a heterogeneous policy landscape, the focus was restricted to Italian entities, a nation recognised for its mature GPP protocol, as cited by Testa et al. (2016). This was supported by the practice of the Italian Ministry of the Environment (MASE), which mandates the adoption of updated MEC for certain categories of products and services in public entities.
- Thirdly, recognising the different factors that can influence the effects of GPP in supply chains, variability in cases was sought according to sectors, organisational scale, public sector revenue size and commitment to environmental practices.

A collaborative approach with the partner university directed the research with initial clues on suppliers fulfilling the first two criteria. From this basic selection, a sample of five different cases was distilled, ensuring a breadth of perspective reflecting the factors of the third criterion. As suggested by Yin (2003), five cases are a robust and feasible set to extract accurate results in a practical timeframe for data collection. This multiplicity of cases increases the validity of the study beyond the confines of a single case and strengthens it against bias, ensuring that the nuances of the different product/service categories and the regulatory environment of GPP are appropriately represented and comprehensively analysed.

Table 2.1 contains a summary of the main selected supplier characteristics, while a detailed description follows.

Table 2.1 - Characteristics of Selected Suppliers

ID	Main Product or Service Category	Annual Turnover [€]	Share from Public Sector [%]	MEC publication [y] <sup>a</sup>	Pre-MEC Certifications <sup>b</sup>
S1	Interior furnishings (Product)	22,800,000 (2023)	37,3%	2017	Yes
S2	Cleaning & sanitizing (Service)	705,000,000 (2022)	60%	2021	Yes
S3	Interior furnishings (Product)	5,314,000 (2022)	90%	2017	No
S4	Water dispensers & vending machines (Service)	143,565,321 (2022)	20-30%	2023	Yes
S5	Green maintenance (Service)	12,000,000 (2023)	90%	2020	Yes

<sup>a</sup> year of relevant MEC publication by MASE (n.d.)

<sup>b</sup> attainment of sustainability-related certifications prior to MEC publication – proxy for environmental commitment

## 2.4 Data collection

Data collection was carefully orchestrated and conducted in a manner consistent with the research demands of this study. A series of semi-structured interviews were conducted with key informants from each case study to affirm the authenticity and reliability of the data collected (Yin, 2014). To facilitate their participation, they were contacted via email and all agreed to participate in the study. A specific interview protocol was created, containing open-ended questions aimed at discovering suppliers' perceptions of the influence of GPP requirements on their operational procedures and supply chain affiliations. The questions were carefully formulated in accordance with the recommendations of Voss et al. (2002), ensuring that they were broad enough to encourage a comprehensive discourse, but at the same time focused on the key aspects under investigation.

Interviews were conducted between March and April 2024, taking advantage of Zoom's convenience and reach for these dialogues, which lasted an average of one hour. Each session was carefully recorded and transcribed verbatim. This in-depth approach was taken to ensure that all valuable insights were captured, enabling a comprehensive understanding of suppliers' perspectives on the impact of GPP implementation (Voss et. al., 2002).

The information gathered during the interviews was subsequently triangulated with other documents to further support the qualitative rigour of the research (Meredith, 1998). For this purpose, we used sustainability reports published by the suppliers in the sample, as well as technical documents provided by the university's purchasing department (such as tender notices, tender specifications and award decrees). These additional sources validate the perspectives shared during the interviews, increasing the reliability of the data collected (Meredith, 1998).

In accordance with the Gioia Method, the collected data were then systematically consolidated into detailed case reports in line with the structure of the interview protocol developed (Gioia et. al., 2013).

In order to strengthen the credibility of the results of this study, high-level informants with strategic oversight were specifically involved: the head of management systems at S1, the chief innovation officer and the head of sustainability at S2, the sales department at S3, the head of the service area and food safety at S4 and the head of purchasing at S5.

Data collection was strategically staggered so as to end once thematic and significance saturation was reached (Hennink et. al., 2017). This approach is in line with prudent research practice, which avoids the collection of unnecessary data that offer no additional substantial value (Hennink et. al., 2017).

The interview protocol was designed in two levels to verify adherence to the established green purchasing criteria and to ascertain the influence of the MECs on organisational processes and the supply chain of the sample suppliers. Interview questions covered several areas, including adherence to key green procurement standards, involvement in MEC-compliant public tenders, sustainability certifications owned, supplier network configurations and challenges encountered with MEC implementation in various dimensions of the company, from production to procurement, from lead times to materials management. In addition, the impacts on supplier relationships, both domestically and internationally, were examined, as

well as strategies for managing second-tier suppliers and creating new strategic alliances.

The complete list of questions used in the interview protocol is available in the *Appendix*.

## ***2.5 Data analysis***

The data analysis followed a path of inductive reasoning, using the Gioia Methodology to rigorously codify and interpret the insights gathered from the interviews (Gioia et. al., 2013).

The process began by meticulously organising the content of the recorded interviews according to the areas defined in the interview protocol. A detailed content analysis was undertaken, sifting through the interview transcripts line by line to distil relevant concepts, notions and phrases that reflected the participants' perspectives. Subsequently, a careful triangulation of the insights provided by the key informants with the supporting technical documentation was carried out (Yin, 2014).

Subsequently, intra- and cross-case analyses were developed to identify the specificities of each case respectively and to extract common patterns (Voss et. al., 2002). Specifically, starting from the detailed case reports and coded data, the within-case analysis aimed to trace the operations and supply chain changes experienced or introduced by each supplier in response to GPP. Cross-case analysis played a central role in this study, as it aimed to discern the similarities and differences between cases in order to identify patterns of impact related to GPP. This comparative analysis was essential to extract thematic patterns common to different organisational contexts, allowing for a refinement of the understanding of the influence of GPP at a broader industry level. By investigating the parallels and disparities between suppliers' experiences with GPP, the cross-sectional analysis helped to amplify the generalisability of the study's conclusions, ensuring that the



insights gained were not isolated cases, but reflected a more widely applicable trend in the realm of GPP implementation and adaptation (Voss et. al., 2002)

Multiple iterations were needed to confirm developing codes and improve the analysis, promoting consistency and strengthening the study's credibility (Yin, 2014).

The existing literature on GPP was referenced during this process to offer context and enrich the understanding of the findings.



## ***Chapter 3: Results and discussion***

This chapter focuses on a comprehensive analysis of interviews conducted with companies to understand the impact of GPP on their processes and supply network. Initially, the case description of each company is presented, which provides the context for the subsequent analysis. Subsequently, a within-case analysis is presented that examines the specific impacts of GPP on the operations and supply networks of public sector suppliers, focusing on transformations in purchasing, production and sales processes, as well as the overall effects on supply networks. Then, based on these individual insights, the cross-case analysis is presented which aims to identify general patterns of the influence of GPP on supply chain dynamics. Finally, the chapter concludes by discussing the findings through established theoretical frameworks, exploring the interplay of these perspectives in shaping GPP adoption and their implications for supply chain sustainability.

### ***3.1 Case description***

In order to protect the commercial interests of the participating companies and to ensure that the study remains purely focused on the impact of GPP in first-tier suppliers of PAs, the interviewed companies are presented anonymously. This decision is in line with the principles of anonymity and confidentiality emphasised in qualitative research methodologies, as discussed in sources such as “Case study research: Design and Methods” (Yin, 2003) and “Seeking Qualitative Rigor in

Inductive Research” (Gioia et al., 2013). This approach ensures the confidentiality of participants and aligns with ethical research practices.

### S1: Interior furniture

S1 is a leading Italian furniture manufacturer specialising in educational spaces (e.g.: community seating, auditorium seating, office seating, tables), with a strong focus on sustainable practices. In 2023, the company recorded a turnover of EUR 22.8 million, marking a 30% increase over the previous year and a significant doubling of revenues from 2020. Today, the company also has an in-house workforce of 57 employees.

The company’s commitment to sustainability predates the introduction of MECs for interior furnishings, first published by MASE in 2017 and updated in 2022. Prior to the implementation of the MECs, S1 had already obtained several sustainability-related certifications, both management system-based (e.g. ISO 9001, ISO 14001, ISO 45001 and EMAS) and product-based (e.g. FSC for wood products), demonstrating its early dedication to responsible practices. This proactive approach has positioned them as pioneers in the seating industry in Italy, being the first to obtain third-party environmental certification from Bureau Veritas<sup>23</sup>.

Characterised by a low degree of vertical integration, S1 focuses on prototyping, assembly and upholstery, outsourcing production processes to a network of trusted suppliers. This network is made up of 80% Italian SMEs located close to S1's factories, which guarantee a high degree of customisation and a quick response to market demands. The remaining 20% are larger companies engaged in high-volume tenders. S1 makes a significant commitment to local sourcing; in fact, it only uses foreign suppliers for textile components. Furthermore, the company's wood supply chain is relatively short, with second/third tier suppliers often being direct forest owners. Additionally, S1’s textile and wood suppliers had already obtained sustainability certifications even before the MEC obligation, demonstrating a driven approach to environmental responsibility within their supply chain.

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<sup>23</sup> Bureau Veritas Italia is a leading company in inspection, certification and conformity verification services, operating in various sectors to ensure quality, safety and sustainability.

In Italy, approximately 90% of supplies are tendered to universities, theatres or general contractors. Italy accounts for 56% of S1's turnover, and 2/3 of this is accounted for by public administration, including universities. As the public market accounts for a high percentage of their turnover, this has been a great incentive to comply with the mandatory MECs defined by the procurement code in advance. Indeed, S1 recognises that meeting and exceeding MEC requirements provides a competitive advantage in the market segment in which the company operates.

#### S2: facility management service provider

S2 is a facility management service provider specialising in cleaning, portering and security services. S2 is part of a larger company that provides integrated facility services to a diversified customer base, including public and private companies and organisations. The Group, of which S2 is a part, operates in 10 countries and achieved a sales volume of EUR 1,134 million in 2024. With 21,685 employees in 2022, the Group uses its diversified structure to create synergies and provide customers with tailored solutions, a single point of contact and maximum cost and productivity efficiency. This commitment to a comprehensive and high level of service extends to S2's activities and its enterprising stance on sustainability.

Cleaning-specific MECs were published by MASE in 2021. S2 had already recognised the importance of environmental responsibility even before the introduction of the MECs; in fact, the company had already conducted comprehensive Life Cycle Assessment studies to fully understand the environmental impact of its activities. In addition, S2 had obtained Environmental Product Declarations (EPDs) for its hospital cleaning services, providing transparency and measurable data on their environmental performance.

Currently, S2 holds several internationally recognised certifications, both at the organisational and products based. The organisational-based certifications include ISO 9001 for quality management, ISO 14001 for environmental management, ISO 14064 for greenhouse gas accounting, ISO 45001 for occupational health and

safety, and SA 8000 for social responsibility. The product-based certifications includes Ecolabels, to indicate that the company's products have a low environmental impact, and EPDs, to provide transparent and detailed information on the environmental footprint of the company's products.

S2's commitment to sustainability also extends to supply chain management. To minimise its carbon footprint and support local economies, S2 sources goods (e.g., cleaning products) through a structured network of more than 5,000 Italian distributors strategically located close to service delivery points, thus reducing transport distances and related emissions. S2 also entered into framework agreements with its distributors to ensure consistent quality and ethical procurement practices. Products purchased from these distributors were already compliant before the implementation of the MECs, demonstrating that the company has long had an environmentally conscious supply chain.

### S3: Interior furniture

S3 is an interior furniture supplier specialising in metal furniture, such as cabinets and desks, for offices. The company was founded in 1980 and operates in a 20,000 square metre factory, employing 25 people in production, administration and sales roles. Prior to the release of the MECs in 2017, S3 operated without any sustainability certification. However, the company's trajectory changed dramatically when a larger company acquired it. This acquisition, which took place in parallel with the introduction of MECs, stimulated a significant push towards compliance with mandatory environmental requirements.

Under the new ownership, S3 underwent a rapid transformation, obtaining a number of certifications, including ISO 9001, ISO 14001 and EMAS for its management systems and Ecolabels and FSC certifications for its wooden furniture. In addition, S3 is actively pursuing a new industry-specific advanced certification, demonstrating a willingness to go beyond the minimum requirements. Currently, S3 places significant emphasis on public tenders, while also maintaining its existing

sales channels to private customers through a network of national retailers, albeit in smaller quantities compared to before.

The acquisition by the big company also had an impact on S3's supply chain. The company's historical suppliers were replaced with the parent company's existing GPP-compliant network. This strategic move ensured immediate alignment with GPP requirements and streamlined operations. S3's current supply chain consists mainly of large Italian suppliers, chosen for their established relationships with the parent company and strong sustainability credentials. For example, S3 sources wood products, metals and plastic accessories from large, multi-certified Italian companies, using their existing product catalogues.

In order to complete its offer for public tenders with seating suitable for desks, S3 made a careful selection process to identify local seating suppliers with the right compromise between performance and price, with whom it has also subsequently established partnerships.

#### S4: Vending machines and water dispensers

S4 is a vending service provider, part of a large European group, involved in the installation, maintenance and refurbishment of vending machines and water dispensers in the Italian market.

The group, to which S4 belongs, has been operating since 1957 and is one of the leading companies in the Food Tech sector with an important self-service distribution network throughout Europe. In 2022, the Group generates an annual turnover of EUR 1.4 billion and employs more than 6,500 people in 16 countries. The parent company is dedicated to offering innovative convenience food services and renowned coffee brands in workplaces and public spaces. S4 takes advantage of the Group's dedication to sustainability and experience in public procurement; in fact, this has established collaborations with institutions, such as the University of Padua.

The introduction of MEC specifications for vending machines was published by the MASE at the end of 2023. S4 was already aligned with these criteria through its active participation in industry associations and the careful study of MEC for similar service categories such as catering. This foresight meant that S4 was ready to participate in tenders governed by environmental criteria, although it has not yet had the opportunity to do so. Prior to the introduction of MECs, S4 had already obtained several management system certifications, including ISO 9001, ISO 14001, ISO 45001 and SA 8000.

S4's commitment to sustainability also extends to its supply chain. S4's network consists of a number of large, market-leading Italian companies that were already GPP-compliant and enjoy advantages in terms of certification and sustainable innovation. The vending machines that S4 sells are rather standard and the only possible customisation concerns the arrangement of foodstuffs, which is done according to customers' wishes. As far as food products are concerned, S4 usually makes centralised purchases from large retailers, with whom it has established national partnerships. The food suppliers in these retailers' networks were already GPP-compliant prior to the introduction of MEC.

#### S5: landscape service provider

S5 is a provider of landscaping services, with a focus on the maintenance of green areas, naturalistic engineering and construction work. The company has a long history, dating back to 1969, and has seen the succession of three generations of leadership. S5 operates throughout Italy and 90% of its turnover comes from the public sector.

MECs for green maintenance were published by MASE in 2020. Even before the introduction of the MECs, S5 had already adapted its operational processes and obtained the relevant management system certifications, including ISO 9001, ISO 14001 and SA 8000. Following the implementation of MECs, S5 further



strengthened its sustainability image by obtaining ISO 45001, EMAS and other relevant certifications.

S5 provides a comprehensive range of services, from landscape design to installation and ongoing maintenance of greenery. The company has a fleet of 85 vehicles and 500 pieces of equipment to support its operations. S5 actively contributes to environmental responsibility by absorbing approximately 1250 tonnes of CO<sub>2</sub> per year. S5's supply network consists mainly of long-standing Italian suppliers for both capital goods (such as mowers and trucks) and raw materials (including plants and street furniture), with the exception of a limited number of foreign suppliers for specialised recreational equipment.

### ***3.2 Within-case analysis***

The within-case analysis, drawing upon insights gleaned from semi-structured interviews with company representatives, provides a detailed examination of each case study's unique context and experiences. This approach, frequently employed in operations management case research as highlighted in "Case research in operations management" (Voss et. al., 2002), allows for an in-depth exploration of the specific realities and intricacies of each company's GPP engagement. By adhering to the principles of qualitative rigor outlined in "Seeking Qualitative Rigor in Inductive Research" (Gioia et al., 2013) and the structured framework for case study research presented in "Case study research: Design and Methods" (Yin, 2003), the within-case analysis aims to uncover valuable insights into the diverse drivers, challenges, and outcomes associated with GPP adoption.

Subsequently, the key findings from the interviews are presented in more detail, and the summary of the within-case analysis is provided in at the end of this sub-chapter in Table 3.1.

### S1: Interior furniture

S1 is a leading Italian furniture manufacturer company committed to GPP since the introduction of the MECs for the above-mentioned product category published by MASE in 2017. S1 promptly trained its suppliers on the MECs as soon as they were introduced. Furthermore, it did not need to make any asseverations or changes to its processes when the MECs were updated in 2022, as they were already compliant. S1's purchasing process was adapted to align with the MECs, while its operations, such as prototyping, upholstery and assembly, were already flexible and did not require major changes. It is common for S1 to carry out spot checks on products from suppliers and to meticulously verify supplier certifications in databases.

According to the interviewed manager, the costs of certification with the bodies did not have a significant impact on the company because, by participating in many tenders, the costs are well distributed. Furthermore, compliance declarations are made internally within the company, which saves money. Furthermore, the interviewed manager states that he did not notice any impact on the supply lead time due to the implementation of MECs, but this is still difficult to interpret because there were external factors, such as the COVID-19 pandemic and the war in Ukraine, which may have influenced these results.

Product quality was not affected by the MECs, and indeed the company spokesperson believes that the MECs helped to remove environmentally unsound products from the market.

Since S1 outsources all production, it is important to look at the impact MECs have had on its supply network. S1's supply network consists mainly of SMEs, which S1 trained and assisted in the certification process when the initial MECs were introduced. Due to S1's strong bargaining power with these suppliers, it was easy for the company to obtain the necessary GPP-compliant procurement documents. However, S1 also uses a few large companies, from which it faced more difficulties in obtaining the required certifications and documents, probably due to the imbalance in bargaining power. Most of S1's suppliers are geographically close to

the company, as speed of response is crucial for the company. Furthermore, S1 engages in strategic partnerships with large companies with whom it co-designs, as S1 does not make non-catalogue products but only made-to-order products.

For wood, S1's suppliers have been Forest Stewardship Council (FSC) certified since the release of MEC in 2017. In addition, the company's wood supply chain is often short, as second/third tier suppliers are often forest owners. However, in order to comply with the MECs, S1's wood suppliers had to change their suppliers and production processes because the criteria required the replacement of glues that contained harmful substances such as NAF (formaldehyde N-alkylamide), as they were considered harmful to human health and the environment.

For the packaging, S1 had to look for a new supplier that met MEC requirements and was GPP compliant. This new supplier is FSC Recycled and Plastic Second Life certified.

For the fabric, S1's suppliers had already obtained OEKO-TEX certification before the introduction of MEC. OEKO-TEX is an internationally independent certification system for raw materials, semi-finished and finished products in the textile industry, which guarantees the health safety of consumers and the ecological responsibility of production. Possession of the Oeko-Tex Standard 100 certificate generates a competitive advantage for companies holding it in public tenders. Oeko-Tex Standard 100 certifies the absence of more than 400 harmful substances in textile products to protect human health, in particular that of infants and children. The leather supplier has recently been certified Leather Standard. In the past, the company did not have a supplier with this certification, so it missed some tenders due to this lack. Compliance with the fire resistance requirements specified in the MEC can be demonstrated through adherence to the relevant UNI standards, such as UNI 9174 and UNI 9175. When evaluating tenders, the contracting authority may consider the Fire Resistance Leather Standard certification as a positive factor, awarding a higher score to companies with this certification.

The supplier of cold-foam, which is also the manufacturer of the raw material, recently obtained CertiPUR™ certification. This certification attests that the flexible polyurethane foam (PU) used in the products has been manufactured from raw materials with low volatile organic compound (VOC) content and without the use of harmful substances such as formaldehyde, methylene chloride and phthalates.

It is common practice for S1 to interface directly with its suppliers (second/third tier suppliers) to ensure compliance with GPP requirements.

Overall, the interview revealed that S1 demonstrated a strategic and enterprising approach to ensure that its procurement processes and supply chain were in line with the MEC and GPP requirements. By fostering close collaboration with its network of predominantly local suppliers and SMEs, S1 was able to maintain product quality and responsiveness while complying with evolving environmental regulations.

#### S2: Facility management services provider

S2 is a facility management services provider that specializes in cleaning, portorage, and security. Its inclusion in the analysis provides a unique perspective on the adaptation of GPP in a service-oriented context.

Recognizing the importance of employee awareness, S2 invested in staff training on the MECs, ensuring that the new standards were understood throughout the company. Although the MECs did not directly affect product quality, S2 observed an unintended “rebound effect” with the use of bio-based cleaning products. Staff, perceiving the bio-based products as less effective, tended to overuse them. This underlines the importance of considering behavioral factors and providing adequate training to the workforce on the proper use of GPP-compliant products.

Although S2 recognized a general increase in costs due to GPP, its analysis reveals a more nuanced perspective. The interviewed manager emphasized that the most significant cost factor was not the certification itself, but rather the increased costs associated with verifying compliance and ensuring their activities were correct. Additionally, the company experienced an increase in product procurement costs of about 6-7% because the MECs required upgrading the production facilities and the entire supply chain. However, this increase was not overly significant, as the company's high-volume purchases allowed it to benefit from quantity discounts. Despite the cost increases, S2 has never missed a tender due to a lack of MEC-compliant products or GPP-compliant suppliers.

Unlike some companies struggling with significant operational adjustments, S2's transition to GPP compliance has been relatively smooth. Their network of 5,000 Italian distributors already offered MEC-compliant products before the legislation came into force. This pre-existing compliance highlights the importance of market readiness and the role of early adopters in paving the way for broader GPP implementation. Furthermore, this pre-existing distributor compliance did not impact S2's product procurement lead time. With these incumbent distributors, S2 has concluded framework agreements, and these distributors are typically located close to the place of use to reduce emissions.

Despite already having an MEC-compliant supply chain, S2 strategically used the opportunity to differentiate itself in a level playing field. Recognizing that all chemicals now conformed to the same standards, S2 sought out Italian chemical SMEs that had more award-winning certifications (e.g., EPDs) and were innovative. After a scouting process, S2 identified 7 new suppliers with whom it concluded direct contracts, through which it gained a competitive advantage, demonstrating that GPP compliance and market differentiation are not mutually exclusive.

Furthermore, S2 is committed to verifying the compliance of purchased products as a matter of quality control and to mitigate the resulting risk.

Looking ahead, S2 identifies green transport as the most significant challenge for its GPP compliance. The interviewed manager anticipates a substantial cost impact as the industry transitions to more sustainable transport solutions.

Overall, S2's experience demonstrates that GPP adaptation in a service-oriented context can be achieved with minimal disruptions when pre-existing compliance is high. However, it also underscores the importance of strategic supplier diversification and internal staff training to maintain a sustainable competitive advantage.

### S3: Interior furnishings

S3, an interior design company, initially faced potential challenges as it lacked the environmental certifications needed to compete effectively in an increasingly sustainability-oriented market. After the strategic acquisition by a larger company with a pre-existing MEC-compliant supply chain, S3's trajectory underwent a radical transformation as S3's historical supplier base was replaced by that of its parent company. This seamless integration allowed S3 to avoid the often time-consuming and resource-intensive process of individual verification and onboarding of new suppliers, ensuring a smooth and immediate transition into the realm of sustainable procurement.

The positive impact of this acquisition is clearly reflected in the operational efficiency of S3, which did not lose any public tenders due to the lack of GPP-compliant suppliers.

S3's supplier base, after the acquisition by the larger company, consists of large, multi-certified companies from which it buys semi-finished products. The company has established partnerships with these suppliers, guided by the historical nature of their supply relationships. For wood panels, S3 sources from Saviola, a leading Italian manufacturer of ecological panels made from 100% recycled wood. For

metals, S3 sources from Mercegaglia, a company that offers high-quality and technologically innovative steel solutions for interior design. From these major companies, S3 selects the best performing products or materials from their catalogues. With regard to packaging, S3 had to both adapt the supplier it relied on and look for a new one, as some products required specific packaging that the existing supplier did not have. For seating, S3 uses other suppliers when it has to complete a tender. In this case, S3 scouts suppliers to identify those with the best performance and the best compromise between quality and price. These suppliers may be SMEs or larger, but typically Italian, companies. For this category, S3 makes use of the certificates provided by its suppliers.

S3 encountered internal challenges related to documentation requirements and the implementation of eco-design principles. These challenges, although surmountable, necessitated a restructuring of internal processes, requiring greater organisational efficiency and strategic allocation of resources. The interviewed manager acknowledged that while S3 did not face significant challenges in meeting the MEC requirements, it did encounter difficulties with the required documentation and implementation of eco-design principles, which required greater organisational efficiency and strategic allocation of resources.

Overall, S3 successfully utilised the capabilities of the parent company to smoothly transition to a GPP-compliant supply chain, as the acquiring company already had all the necessary certifications and documents. However, it emphasises that internal process changes, in particular with regard to eco-design, can still pose significant challenges that require organisational adaptation.

#### S4: Vending machines and water dispenser

S4 is a vending machines and water provider and its experience highlights the importance of early engagement with sustainability standards and proactive supply chain management to ensure a smooth transition to the new regulations. In fact, S4 was already compliant with MECs prior to their release in October 2023 due to its

previous experience with public procurement, in particular with the University of Padua, where contract requirements were already aligned with future MECs. Moreover, S4's current compliance with the 2020 MECs for catering services facilitated the transition.

The implementation of the MECs, to date, has had minimal impact on S4's existing operations and processes. The service delivery model and core operational processes have remained largely unchanged. Furthermore, S4 already adheres to sustainable waste and packaging management practices, including the use of Televend technology. Additionally, MEC did not affect the recovery of coffee grounds, as S4 was already sending them to biogas plants, aligning with the circular economy philosophy.

S4's supply network consists of vending machine suppliers and food suppliers. S4's vending machine suppliers are large, market-leading Italian companies, already MEC-compliant. These established companies are able to cover S4's capacity and hold a high number of relevant certifications, reflecting their advanced sustainability practices. Furthermore, these suppliers are more structured and up-to-date in terms of sustainability than other options. The standardised nature of vending machines limits the potential for customisation; moreover, MECs influence the preparation of the vending machine layout, but not the selection of the overall design or the purchasing process. Moreover, S4 experienced an increase in vending machine costs, attributed to general inflation and not directly related to the implementation of MEC.

S4's food suppliers are generally the same as the large-scale retail distribution with which S4 establishes national partnerships. These suppliers also have the necessary certifications. S4 makes centralised purchases from these suppliers and gives preference to suppliers experienced in vending operations, selecting those already operating in this sector. The products to be placed in vending machines have changed in response to market demand. However, S4 faces difficulties in incorporating fresh products, such as vegetables and fruit, into vending machines



due to individual packaging and labelling issues and the limited availability of local suppliers. In order to meet the MEC reward criteria for the short supply chain of fresh produce, S4 had to look for new suppliers, as the existing ones were unable to supply MEC-compliant products. This process resulted in increased costs due to the search for and purchase from local suppliers. These SMEs often find it difficult to obtain the necessary certifications, so S4 became available to support their efforts to certify MEC compliance. The partnership with local product suppliers is limited to the geographical area of sourcing.

S4 relies on the product certifications of its suppliers and conducts documentary checks to ensure compliance.

Although the company has encountered difficulties in integrating local suppliers of fresh produce, S4 has not suffered exclusions from GPP tenders due to supplier-related problems.

Overall, S4 adapted smoothly to the new MECs, taking advantage of its existing experience and established supplier network.

#### S5: landscaping services provider

S5 is a company that specializes in green maintenance, naturalistic engineering, and landscaping services across construction sites throughout Italy. All tenders in which S5 participates are subject to the MECs.

The introduction of MECs has had a significant impact on S5's activities, particularly on the purchasing, production and sales processes. The most challenging MEC for S5 concerned the reduction of carbon dioxide emissions through electric trucks and equipment as the productivity of electric vehicles is lower than that of traditional mechanical vehicles. To meet the stringent certification requirements, S5 had to make substantial investments in new

equipment. For the supply of electric trucks and equipment, S5 went through a transition phase. In fact, it initially relied on new, large, European suppliers who saw a market opportunity in Italy and opened several locations in the country. These large European suppliers producing electric trucks and equipment had an advantage in terms of MEC certification. However, S5 later returned to its historical Italian supplier, which was smaller than the European ones but had adapted and trained itself on the MECs. Similarly, for plants, S5 initially sourced from larger, Italian and European suppliers who were readily certified, but eventually reverted to smaller, Italian, local and competitive suppliers once they had trained and achieved MEC compliance. The MECs require that the origin of seeds and plants must be in the GPP procurement region or neighbouring regions. This necessitated the integration of new suppliers, prompting S5 to go through a scouting process to identify local SMEs; this increased costs due to this activity.

The MECs made it necessary to train S5's workers on the new products that met the criteria, so S5 experienced an increase in personnel training costs. Initially S5 experienced resistance to change from its workforce even though these new products produce less noise, are more sustainable, reduce processing time, thus increasing productivity, and emit less carbon dioxide. In addition, the integration of geolocation devices in the vehicles has enabled optimisation of routes, further reducing fuel consumption and improving operational efficiency. S5's commitment to eco-friendly practices has extended to the use of ECO fuels and biodegradable equipment lubrication oils.

The adoption of mulching for waste and fertiliser circulation, while requiring an initial investment in specialised mulching equipment, ultimately led to a reduction in long-term operating costs and an improvement in service quality as they allow for greater precision, aesthetics and productivity. Initially, this equipment was difficult to find, but not anymore.

The implementation of MECs has significantly reshaped S5's supply network. While S5 maintained relationships with historical suppliers of plants and

playground equipment, benefiting from established discounts, the company had to integrate new suppliers to fulfill specific MECs. When S5 has a GPP tender in a certain geographic area, they assess whether they have sufficient suppliers in that area. If not, they scout and identify new local suppliers, with distance being a key factor for minimizing transport costs. S5 then often establishes partnerships with these new suppliers, in addition to its existing supplier relationships, for future GPP tenders in that geographic area.

The need to verify product and vehicle certifications, while increasing internal management costs, has mitigated the risks associated with non-compliance. This emphasis on transparency has probably fostered greater trust and accountability between S5 and its suppliers.

Despite the initial difficulty in scouting new suppliers, S5 did not miss any GPP tenders due to lack of compliant suppliers.

Overall, S5's adaptation to GPP requirements led to the benefit of developing localized supply chains, which highlights the potential of GPP to stimulate innovation and generate value beyond mere compliance.

Table 3.1 – GPP impact on the operations and supply network of public sector suppliers

	<b>Impact on purchasing, production, sales processes</b>	<b>Impact on the supply network</b>
S1	<ul style="list-style-type: none"> <li>- No impact on lead times, inventory management, product quality, certification and purchasing costs</li> <li>- S1 needed to train its contractors and suppliers on MECs, with related costs</li> <li>- Sample checks of products &amp; certifications required</li> <li>- The purchasing process was restructured based on the MECs, the production process was not modified</li> <li>- Most affected sourcing category: packaging</li> </ul>	<ul style="list-style-type: none"> <li>- No impact on wood, steel, and fabric suppliers because they were already certified</li> <li>- MECs made it necessary for S1 to scout new packaging suppliers with higher recycling contents</li> <li>- MECs made it necessary for the leather supplier to adapt to the fireproof leather standard</li> <li>- S1 missed one GPP tender because it did not have a certified leather supplier</li> </ul>
S2	<ul style="list-style-type: none"> <li>- No impact on lead times, inventory management, certification costs, staff training (performed by default), and purchasing process design</li> <li>- Service quality remained constant, but the use of GPP-compliant products triggered a <i>rebound effect</i>: staff perceive compliant products as less aggressive than traditional ones and hence use a greater quantity</li> <li>- Request for checks on the conformity of supplies</li> <li>- Slight increase in service delivery costs due to the higher controls and a 6% increase in purchasing costs</li> <li>- Most affected sourcing category: transport vehicles</li> </ul>	<ul style="list-style-type: none"> <li>- MECs made basic sustainability features a qualifier in the cleaning products market, requiring advanced performances for differentiation in bids. To stand out, S2 identified 6 local SMEs with more certified and innovative products and established direct contracts with them despite the higher costs</li> <li>- No failure to participate in GPP tenders due to a lack of compliant suppliers</li> </ul>
S3	<ul style="list-style-type: none"> <li>- No impact on lead times, inventory management, production costs, and purchasing process design</li> <li>- The product design process was modified to integrate eco-design</li> <li>- Training on MECs for their small public clients became necessary, which was provided by S3</li> <li>- Cost increase linked to the verification of products coming from suppliers using third-party laboratories</li> <li>- Significant impact on certification costs</li> <li>- Most affected process: product design</li> </ul>	<ul style="list-style-type: none"> <li>- More performing materials sourced from the catalogs of their wood, metal, and plastic accessories suppliers</li> <li>- S3 requested the adaptation of its historical packaging supplier for some materials; for others, S3 scouted new suppliers</li> <li>- Initial failure to participate in GPP tenders due to a lack of compliant suppliers – before the transition to the parent company’s suppliers</li> </ul>
S4	<ul style="list-style-type: none"> <li>- No impact on internal process design, service delivery (including associated waste management), and purchasing costs for vending machines</li> <li>- MECs influenced the preparation of the vending machine layout, not its design selection/purchasing</li> <li>- More conformity checks required for food supplies</li> <li>- Increase in purchasing costs to integrate fresh local products in machines’ food assortment – due to scouting, higher prices, and often the need to support local suppliers in obtaining relevant certifications</li> <li>- Most affected sourcing category: fresh food items</li> </ul>	<ul style="list-style-type: none"> <li>- No impact on vending machine and water dispenser suppliers because they were already GPP-compliant</li> <li>- S4 integrated new fresh products suppliers, prioritizing SMEs located close to the service delivery locations, which will allow them to obtain greater scores in GPP tenders</li> <li>- Difficulties in participating in GPP tenders due to lack of fresh food suppliers in some locations, but not to the extent of missing the relevant tenders</li> </ul>
S5	<ul style="list-style-type: none"> <li>- Reduction in service delivery costs and increase in service quality (e.g., aesthetics) and sustainability thanks to the use of more efficient and greener capital goods (e.g., electrical, mulching cutting equipment)</li> <li>- Increase in staff training costs as MECs required the use of new capital goods and materials</li> <li>- Increase in purchasing costs for capital goods (e.g. electrical and mulching cutting equipment) – due to scouting (initially they were difficult to find) and their significantly higher costs (offset by the decrease in service delivery costs)</li> <li>- Increase in purchasing costs for some material supplies (e.g., eco-fuels, biodegradable lubrication oils, and local plants) – due to scouting (local plants) or higher costs (sustainable fuels and oils)</li> <li>- Cost increase linked to conformity checks</li> <li>- Most affected sourcing category: transport vehicles and mowing equipment – to reduce carbon emissions</li> </ul>	<ul style="list-style-type: none"> <li>- MECs made it necessary for S5 to scout and integrate new suppliers for seeds and plants, who must be SMEs located close to the service delivery locations</li> <li>- For the supply of capital goods and some plants, S5 went through a transition phase: initially it turned to new suppliers (large European companies already certified), then it returned to its traditional Italian suppliers who in the meantime were able to adapt to the MEC requirements</li> <li>- No failure to participate in GPP tenders due to lack of compliant suppliers, despite the initial difficulty in scouting new suppliers</li> </ul>

### ***3.3 Cross-case analysis***

The cross-case analysis, based on established qualitative research methodologies to achieve rigor in inductive research (Gioia et al., 2013) and using a multiple case study design (Yin, 2003), identifies recurring themes across different organizational contexts to provide a nuanced understanding of the implications of GPP. This analysis reveals three general patterns of impact on supply chain dynamics.

Firstly, certifications emerge as a powerful mechanism for supply network reconfiguration. In an environment where reliable information regarding sustainability performance is not uniformly disclosed, third-party certifications and audits play a crucial role in establishing trust and credibility. GPP, often translating into a multitude of certifications, necessitates that first-tier suppliers not only attain these certifications themselves but also cascade this requirement down to their second and third-tier suppliers. This ripple effect significantly impacts cost structures and compels a reassessment of existing supply networks. As observed with S3, achieving certifications can entail substantial costs, particularly for companies that were not previously certified. Even more significant can be the costs associated with requiring and verifying certifications from downstream suppliers. This encompasses increased conformity checks, a practice adopted by all companies in the study, as well as potential investments in supplier training, as reported by S1 and S4, and the need for extensive scouting of compliant suppliers, as experienced by S1 and S5. Furthermore, the quest for certifications fosters new partnerships between suppliers and certification bodies, highlighting the increasingly prominent role of these organizations in shaping green supply networks. The need for second-level certifications, in particular, presents first-tier suppliers with two primary strategies when dealing with non-compliant historical suppliers: investing in training to bring them up to standard, thereby strengthening existing relationships, or scouting and onboarding new, compliant suppliers, leading to a structural shift in the supply network. However, as exemplified by S5, this integration of new suppliers may be temporary. Once historical suppliers achieve certification, first-tier suppliers may revert to their established relationships.

Secondly, a notable pattern emerges in the form of a mismatch between the timing of MECs publication and the overall "sustainability maturity" of specific industries. In sectors such as wood and steel, where sustainability practices were already relatively advanced, the mandatory criteria stipulated by MECs were largely met by industry actors at the time of their implementation. Consequently, these industries experienced minimal supply chain disruptions. Conversely, in industries like vehicles, packaging, and leather materials, the mandatory criteria presented more significant challenges. The required technologies were either only available from a limited number of second-tier suppliers, leading to potential supply chain bottlenecks and lock-ins, or were not yet cost-competitive, impacting the profitability of first-tier suppliers. In essence, what MECs intended as order-qualifiers effectively became order-winners, because only a few players could provide the required solutions. One could argue that GPP was conceived precisely to scale up such greener solutions (Testa et al., 2016). To enable a fair transition, though, policymakers should carefully balance between mandatory and award criteria based on the maturity level of each industry. Only when most industry actors have transitioned to the desired sustainability level should award criteria be turned into mandatory ones.

Thirdly, the analysis reveals that GPP can contribute to the shortening and "fattening" of supply chains through the integration of local SMEs. As previous research suggests (Preuss, 2009), MECs can mandate the inclusion of local SMEs as second-tier suppliers. This requirement has led to significant supply network reconfigurations, as observed in the cases of S4, with local food producers, and S5, with plant producers. Both companies transitioned from relying on a few established national distributors to directly integrating numerous SME suppliers across their operating regions. This shift, driven by the need to meet local sourcing requirements, resulted in a broadening of the supply base but also introduced significant transaction costs, primarily due to the extensive scouting required to identify and vet suitable local SMEs. However, both S4 and S5 have now discovered that their localized supply chains, developed to meet GPP requirements,

have become a strategic advantage in the private market. They are able to offer differentiated products and services by leveraging their extensive local supplier networks.

Overall, the cross-case analysis shows that, although GPP can be a powerful tool to promote sustainability improvements in supply chains, its implementation requires careful consideration and potential adjustments according to the industry context. Policy-makers and procuring entities should seek a balanced approach that encourages the widespread adoption of sustainable practices without imposing excessive burdens on businesses, particularly SMEs.

### ***3.4 Discussion***

Insights from the internal and cross-case analyses can be read through the lens of established theoretical frameworks. In particular, the observed dynamics of the emergence of certification, supply chain reconfiguration and stakeholder interactions can be better understood through the perspectives of Institutional Theory (IT), Stakeholder Theory (ST), Resource-based Vision Theory (RBV) and Upper Echelons Theory. These theories offer complementary insights into how GPP, as an external force, interacts with organisational motivations, resource capabilities, stakeholder influences and strategic decision-making processes to shape the trajectory of SSCM.

Institutional Theory is a cornerstone of organisational sociology and offers a powerful framework for understanding how organisations adapt and respond to external pressures. IT suggests that firms take steps to gain legitimacy within society (González-Benito et. al., 2006) influenced by three isomorphic institutional pressures: regulatory pressures, coercive pressures and mimetic pressures (DiMaggio et. al., 1983). Regulatory pressures derive from the expectations of external stakeholders, such as customers who demand environmentally responsible practices. Coercive pressures derive from the influence of powerful entities, such as government agencies enforcing environmental regulations. Mimetic pressures

push organisations to imitate successful competitors, often through benchmarking practices, where organisations emulate best practices. These institutional pressures have been identified in some studies as the main drivers to the adoption of SSCM practices (Tate et al., 2011; Zeng et al., 2017).

In the context of sustainable supply chain management, institutional pressures are increasingly recognised as powerful drivers of organisational change, shaping how companies address environmental and social considerations along their supply chains (Wilhelm et al., 2016).

One of the most recent studies on SSCM has shown that companies undertake SSCM practices mainly due to government pressure that has a significantly greater impact on SSCM practices than customer and competitive pressures (Dai et al., 2021). Furthermore, studies have highlighted the role of institutional pressures in fostering the diffusion of environmental certifications. Certifications such as ISO 14001 and eco-labels, help companies manage environmental issues (Qi et al., 2011), inform consumers that products meet green requirements (Cai et al., 2017) and signal to society the company's commitment to the environment (Darnall, 2006). These certifications improve internal efficiency, communication, corporate image (To et al., 2014) and provide competitive advantages (González et al., 2008; Yang et al., 2010), positively influencing companies' environmental, economic, financial, market, operational and social performance (Berghoef et al., 2013; Eng Ann et al., 2006; Feng et al., 2016; Treacy et al., 2019; Prajogo et al., 2012).

The results of the within-case and cross-case analyses reveal how GPP, acting as a powerful institutional force, creates an irresistible incentive for companies not only to adopt sustainable practices, but also to reconfigure their supply chains to align with institutionalised expectations of environmental responsibility. Certifications emerge as the dominant mechanism for demonstrating companies' compliance with GPP criteria. Furthermore, environmental certifications help companies gain and maintain a competitive advantage by signalling their adherence to recognised sustainability standards. The results also highlight a notable tendency of companies



to integrate local SMEs into their supply chains, often based on GPP requirements for local sourcing or the desire to promote regional development. Additionally, the findings highlight how GPP reshapes traditional power dynamics within supply chains, as buyers pressure first-tier suppliers to adopt sustainable practices and demonstrate compliance, and in turn these first-tier suppliers pressure their supplier base accordingly, highlighting the double agency role (Wilhelm et al., 2016) of first-tier suppliers. Thus, the role of institutional forces in driving change is explicit not only within individual organizations, but also across entire industrial ecosystems.

Stakeholder Theory offers another lens through which to examine the results of the analysis. ST, as highlighted in the study by Touboulis and Walker (2015), argues that organisations that effectively identify, understand and respond to the needs and expectations of their stakeholders are more likely to achieve long-term success. Stakeholders can include a wide range of actors and can belong either to society at large (e.g., non-governmental organisations) or to the more immediate economic arena of a company (e.g., shareholders).

In the field of SSCM, ST takes on a special significance, emphasising the importance of considering the environmental and social impacts of supply chain operations on various stakeholders. The results of the within-case and cross-sectional analyses of this study reveal how GPP acts as a catalyst for stakeholder engagement, in contrast to the results of the study by Roy et al. (2020) that did not find a significant relationship between external stakeholder pressures and SSCM practices.

GPP often introduces new environmental performance requirements, such as local sourcing or the use of recycled materials, and these requirements create new demands from buyers who are obliged to comply with GPP criteria. These demands can then cascade down the supply chain, influencing practices and relationships with the supply network. In addition, GPP can encourage greater collaboration, transparency and open communication between organisations and their stakeholders to meet stakeholder expectations and find mutually beneficial

solutions, in line with what has been outlined in the literature (Touboulic et. al.; 2015).

In addition to the insights provided by IT and ST, the Resource-Based View Theory (RBV) offers another valuable lens for understanding the findings from within-case and cross-case analysis. The RBV, as articulated by Barney (1991), views a firm as a collection of resources and assumes that sustainable competitive advantage derives from its valuable, rare and imperfectly imitable resources. This theory argues that firms possess tangible resources (e.g. physical assets, financial capital) and intangible resources (e.g. knowledge, brand reputation, organisational culture) that can be used to create value and outperform competitors.

According to RBV logic, the heterogeneity of companies in engaging in SSCM practices, and their responses to institutional pressures, are mainly influenced by their sustainability capabilities. Within the context of SSCM, RBV suggests that firms can leverage their unique resources and capabilities to develop and implement sustainable practices that improve their environmental and social performance while enhancing their competitiveness (Shibin et al., 2020).

The results of the Within-case and cross-case analysis of this study reveal that companies that successfully responded to GPP initiatives often leveraged existing resources and capabilities. Indeed, companies with established and collaborative relationships with their suppliers were better positioned to implement sustainable sourcing practices and meet GPP requirements. In addition, companies with certifications, such as ISO 14001, were more likely to have processes and capabilities in place to monitor and improve their environmental performance.

Finally, taking into consideration the Upper Echelons Theory and Top Management Support (TMS), the impact of various factors on the implementation of green supply chain practices can be analysed. According to the Upper Echelons Theory, top managers formulate corporate strategies in response to external pressures based on their values and cognitions (Carpenter et al., 2004; Hambrick et. al., 1984). This

theory suggests that it is not only market forces or competitive pressures that drive a company's actions; the lens through which managers perceive the world, their tolerance for risk and even their unconscious biases play a powerful role in determining the strategic direction pursued by the company. When applying this theory to the field of sustainability, the Upper Echelons Theory suggests that companies led by executives who possess a deep-seated commitment to environmental and social responsibility are much more likely to proactively embrace sustainable practices and integrate them into the core of their business operations (Shibin et al., 2020).

The TMS is not just a passive endorsement of sustainability, but an active and dynamic force driving tangible change within an organisation. To fully understand its impact, we need to delve into two key dimensions of TMS: top management participation (TMP) and top management beliefs (TMB).

TMP focuses on the concrete actions taken by top managers to promote sustainability within the organisation. This includes setting ambitious but achievable sustainability goals, allocating resources for the development and implementation of sustainable technologies, and actively engaging with suppliers to improve environmental performance throughout the supply chain (Ma et al., 2020).

TMB, on the other hand, reflects the extent to which top managers integrate sustainability into their personal values and leadership philosophy. This deep-seated belief system spreads throughout the organisation, influencing the organisational culture, shaping employee behaviour and guiding the company towards a sustainable future business.

Within-case and cross-case analysis results of this study show that companies where top management actively supported sustainability initiatives, demonstrating both strong TMP and TMB, were significantly more successful in responding to GPP initiatives and incorporating sustainable practices into their operations.

Overall, analysing the findings of this study through the lens of the theories outlined above provides an understanding of the factors that enable companies to successfully respond to GPP initiatives and improve their sustainability performance.

## *Conclusion*

In conclusion, green public procurement is increasingly recognised as a strategic lever for governments to promote sustainable development and mitigate the environmental impact of public spending (Cheng et. al., 2018; Sönnichsen et al., 2020). By incorporating environmental criteria into their procurement processes, governments can incentivise companies to adopt sustainable practices, ultimately helping to reduce greenhouse gas emissions, resource depletion and pollution. Furthermore, GPP plays a crucial role in promoting the circular economy, as highlighted by Sönnichsen and Clement (2020), by encouraging the purchase of products and services that minimise waste and maximise resource efficiency.

Despite the recognised potential of GPP, existing research has mainly focused on analysing the level of GPP adoption in different regions and sectors and identifying barriers to its widespread implementation (Cheng et. al., 2018). This focus has led to a significant gap in understanding the actual effectiveness of GPP in driving tangible environmental improvements and the wider knock-on effects it generates along supply chains. In particular, there is a paucity of research exploring the experiences and responses of suppliers beyond the first tier, limiting the understanding of how the influence of GPP permeates through complex supply networks. This lack of empirical evidence from public sector suppliers operating in different contexts further hinders a comprehensive assessment of whether and how GPP achieves its overall goal of promoting sustainable practices across sectors.

This master thesis seeks to fill this critical gap in the literature by shifting the focus to the perspective of first tier suppliers and examining how the adoption of GPP criteria by public organisations affects their operations and supply relationships, providing crucial empirical evidence directly from public sector suppliers operating in various contexts. Moreover, this research is part of a larger three-year collaborative project between the University of Padua and the Veneto Region, investigating the effects of PAN GPP within public administration supply networks.

By analysing the experiences and responses of these suppliers, the research aims to provide a nuanced understanding of how the adoption of GPP by public organisations affects their operations, supply chain relationships and overall sustainability performance.

Through the methodology of multiple case studies (Yin, 2003) and by triangulating the data collected from the semi-structured interviews with additional documentation provided by the suppliers themselves (e.g. their sustainability reports) or by the public partner organisations working with them (e.g. tender and contract documents related to tenders awarded to the supplier), intra- and inter-case analyses were developed for each supplier interviewed (Voss et al., 2002). The results were then read through the lens of established theories to provide subtle insight into the factors that enable companies to successfully respond to GPP initiatives and improve their sustainability performance (Dai et al., 2021). The results of this study show that GPP policies have had multiple and nuanced impacts on the operations and supply networks of first tier suppliers of public organisations.

Although this study can make a significant contribution to understanding the impact of GPP on supply chains, it is important to recognise its limitations. The analysis on green procurement carried out by a single institution and the focus on the Italian context may limit the generalisability of the results and the identification of potentially influential moderating variables.

It is worth noting that further research is needed to fully understand the impacts of GPP and identify key factors, including supplier-, purchaser-, and procurement-specific factors, that may influence the effects of GPP on supply chains. This would enable the formulation of testable propositions to guide the ongoing academic discourse in this area.

Future research could extend the scope to other supplier organisations and other countries to investigate how different contextual conditions shape the observed impacts.

## *Appendix*

### **Interview Protocol**

#### Company profiling

1. What does your company deal with? (Turnover-employees)
2. Historically, what % of your turnover comes from the public sector? What are the public entities with which you work most?
3. When did you start participating in MEC-regulated tenders? How many tenders regulated by MEC have you participated in?
4. What sustainability certifications did you hold prior to participating in MEC-regulated competitions? Which ones did you subsequently obtain to become MEC-compliant?
5. How is your supplier base structured? Do you operate with a network of suppliers or do you have a System Supplying, or Sourcing Providing, or General Contractor that manages the majority of supplies?

#### Impact of MEC on processes and supply network

1. What were the most challenging MECs to implement?
2. For each of these MECs, what was the impact on your manufacturing and purchasing? (e.g., impact on lead time, impact on inventory management, impact on cost of production)

3. For each of these MECs, what was the impact on your supply network? (e.g., reduction in supplier base, creation of strategic partnerships, current supplier development programs)
  
4. In your experience, the lack of an adequate second-tier supplier base to meet the new requirements created by MEC has created difficulties for you in matching the tender requirements, even to the point of being unable to participate or be excluded from it?



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