Katriina Alhola

Environmental criteria in public procurement
Focus on tender documents
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Yhteenveto: Ympäristökriteerit julkisissa hankinnoissa
Tutkimuskohteena tarjousasiakirjat
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The author was responsible for the collection and analysis of the data as well as the content of the manuscript. The section 'Discussion and conclusions' was written jointly with Dr. Ari Nissinen. Prof. Ari Ekroos commented on the paper.


The author gathered and recorded the data for the year 2005 and re-analyzed and recorded the data for 2003. The author was also responsible for submitting the revised version of the manuscript and re-wrote Chapter 1. Chapter 2 was jointly written with co-authors. The calculation of odds ratios (Chapter 3) was performed and analyzed by Docent (Ph.D) Hannu Rita. Dr. Ari Nissinen was the initiator of the article, and was also principally responsible for outlining the paper and writing Chapter 4.


The author was responsible for gathering and calculating the data as well as writing the manuscript. Dr. Ari Nissinen supported the LCA calculations with his expertise, and both guided and commented on the paper.


The article was written by the author. Dr. Ari Nissinen initiated the subject of the relations between transport, LCA and public procurement, and commented in particular on Chapter 4.


The article was written jointly by the author and Antti Palmujoki, Ph.D. The author coordinated the manuscript. The author gathered the data for the year 2005 and analyzed the calls for tenders for the years 2005 and 2007. Antti Palmujoki, Ph.D, analyzed the contract documents for the years 2005 and 2007. Prof. Ari Ekroos commented on the paper.
List of abbreviations

CO₂ Carbon dioxide
CPV Common Procurement Vocabulary
DfE Design for Environment
EC European Community
ECJ European Court of Justice
EIA Environmental Impact Assessment
EMAS Eco-Management and Audit Scheme
EMM Environmental Management Measures
EPD Environmental Product Declaration
EPP Environmentally Preferable Purchasing
ERPP Environmentally Responsible Public Purchasing
EU European Union
FLEGT Forest Law Enforcement, Governance and Trade
GPP Green Public Procurement (Green Public Purchasing)
IPP Integrated Product Policy
ISO International Organization for Standardization
IT Information Technology
LCA Life Cycle Assessment (Life Cycle Analysis)
LCC Life Cycle Costing
NCM Nordic Council of Ministers
NMHC Non-methane hydrocarbons
NOₓ Nitrogen oxide(s)
OECD Organization for Economic Cooperation and Development
OR Odds ratio
PMₓ Particulate matter (or fine particles), particles of 10 micrometers or less
PP Public Procurement (Public Purchasing)
PVC Polyvinyl chloride
RPS Relevance – Potential – Steerability
TED Tenders Electronic Daily
UNEP United Nations Environment Programme
YmVL (Finnish) Statement of the Environment Committee
YOLL Years of Life Lost
**List of treaties**


**List of cases**


Environmental criteria in public procurement
Focus on tender documents

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Abstract

Green public procurement (GPP) is about setting environmental criteria in the public procurement process alongside the traditional purchasing criteria, e.g. price, quality and technical features of products, services and works. GPP is considered to be one of the key policies that could be used to promote the change of unsustainable patterns of consumption and production.

The use of environmental procurement criteria has increased during this decennium, as it has been promoted by many international and national policies and programmes. Nevertheless, how does this push for greener public procurement comply with the primary aims of public procurement legislation – guaranteeing the best value for taxpayers’ money and the operability of the internal market? The challenge is to combine economic and environmental issues so that purchasing decisions are compliant with law and jurisprudence. In this thesis, this issue is analyzed by examining the relations of environmental and economic aspects as well as environmental and legal aspects in public procurement.

This thesis uses several methods and tools to assess the greenness of public procurement; an analysis of purchasing criteria, life cycle assessment and eco-label criteria. Environmental criteria found in the tender documents are mirrored to the existing European procurement directives and case law. The relation between economy and environment is studied within the concept of the most economically advantageous tender as defined in the EU’s public procurement directives. Its content and applicability in the assessment of economic and environmental performance of a purchase is opened for discussion.

The results of this thesis suggest that economical, environmental and legal aspects can be combined in public procurement, though the linking of green criteria is specific to a single contract. Despite the increased amount of green criteria in tender documents (i.e. calls for tenders and contracts), they mainly focus on those aspects that are undoubtedly covered by the procurement directives – possibly excluding some of the important environmental impacts of the product or service from a life cycle perspective. However, systematically presented green criteria in calls for tenders could give a signal to the manufacturers of the demand for environmentally preferable solutions, and encourage them to invest in developing green products, i.e. eco-design.

Keywords: green public procurement, procurement directives, call for tender, procurement contract, environmental criteria, the most economically advantageous tender, life cycle, eco-label, eco-design
Environmental criteria in public procurement – Focus on tender documents

Ympäristökriteerit julkisissa hankinnoissa
Tutkimuskohteena tarjousasiakirjat

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Tiivistelmä

Julkisten hankintojen vihertämällä tarkoitetaan ympäristönäkököhtien huomioonottamista varauiden, palvelujen ja rakennusurakoiden hankintaprosessissa. Sekä kansainvälisellä että kansallisella tasolla ympäristöystävällisiä julkisia hankintoja pidetään yhtenä kestävän tuotannon ja kulttuurin edistämisen tärkeimmistä keinoin.


Avainsanat: Ympäristöystävälliset julkiset hankinnat, hankintadirektiivit, tarjouspyyntö, hankintasopimus, ympäristökriteerit, kokonaisvaltiovaltion periaatteet, elinkaari, ympäristömerkki, ympäristömyötäinen tuotesuunnittelu
1 Introduction

1.1 Background of the study

The public sector, as a major purchaser of goods, services and works, has gained much attention in recent years in terms of achieving sustainable development through its purchasing operations. Sustainable public procurement means that purchasing agencies take into account the economic, social and environmental pillars of sustainable development in their purchasing process, and public procurement is called ‘green’ when purchasers pay attention to environmental aspects (European Commission, 2007). Green public procurement (GPP), in support of the objectives of sustainable procurement, is thus an important contributor to the initiatives to promote the general goal of sustainable development (Nash, 2009; Walker and Phillips, 2009; United Nations, 2005; McCrudden, 2004; Mastny, 2003; Carter et al., 2000). ‘Green’, on the other hand, can be understood, e.g. as reducing environmental impact across the entire life cycle, setting goals that can be objectively measured and making progress in achieving them while also complying with legislation (Miller and Szekely, 1995).

Green public procurement enables public authorities to respond to current environmental challenges. At its best, green purchasing criteria contribute to those environmental efforts that are considered most important in terms of sustainability including, for example, the reduction of energy consumption and green house gases, prevention of waste creation and chemicalization, use of renewable resources and, on the other hand, promotion of eco-innovations. The large volume of public purchases, covering approximately 18% of the EU gross domestic product (European Commission, 2011a) implies that great potential exists for environmental improvements through public procurement and possibilities to create markets for ecological products and services (European Commission, 2010a; European Commission, 2007; Larsen and Svane, 2005; Erdmenger, 2003). So far, this potential has been only marginally exploited (European Commission, 2010a, p. 16; European Commission, 2008a, p. 6). Greening the public procurement would have both short-term and long-term effects, rapidly decreasing, e.g. energy use in the public sector, and at the same time affecting product design and the environmental characteristics of goods and services over the long run (Swanson et al., 2005). For example, the public purchasing of green electricity could have contributed towards one-quarter of the European Kyoto commitments if it had come from newly constructed renewable energy facilities (ICLEI, 2003).

GPP, focusing on the green purchasing criteria, lies between the objectives of environmental protection and the maintenance of the integrity of the internal market (Kunzlik, 2003). Public procurement practices have been consolidated by the EU legislation in order to maintain and develop the internal market in the EU, and to ensure the efficient use of public money. It is based on public procurement directives, i.e. Directive 2004/18/EC on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts, and Directive 2004/17/EC, which coordinates the procurement procedures of entities operating in the water, energy, transport and postal services sectors. Thus, in effect, all public procurement comes under the auspices of EU single market regulations. Aspects concerning free movement of goods,
promotion of competition, and non-discrimination of bidders have taken a leading role, which has caused environmental considerations to comply with these concerns (Ekroos, 2008; Arrowsmith, 2009). The debate is focused over the justification of taking into account certain environmental considerations in public procurement decision-making, in the light of the EU legislation (see examples in Bouwer et al., 2006, p. 34). Although the historical base for GPP is already provided in the EC Treaties, focusing in particular on the notion of sustainable development\(^3\) and on the requirement to integrate environmental protection into EU policies\(^4\), the green focus in public procurement has so far been on the voluntariness to consider environmental aspects in the purchasing process. Currently, however, a shift can be seen from clear freedom of choice to a slight push for member states to use green procurement power to promote certain policies such as energy efficiency and energy supplied from renewable sources (e.g. Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles; Directive 2006/32/EC on energy end-use and energy services). In practice, especially after the renewal of public procurement legislation in 2004, environmental criteria in public purchases have risen rapidly (Bouwer et al., 2005; Kippo-Edlund et al., 2005; PricewaterhouseCoopers, 2009\(^a\)).

### 1.2 Framework of the study

Public procurement has gained much interest among academics during this decennium as it has emerged as a distinct area for legal study (Murray, 2009; Thai et al., 2004). Given the recent nature of this development, many aspects of public procurement law and policy remain somewhat unexplored by scholars, one of which is the use of procurement as a tool to promote social and environmental objectives, i.e. green public procurement (Arrowsmith and Kunzlik, 2009). Several studies have already measured the ‘greenness’ of public purchases during the years 2003–2008 (Kippo-Edlund et al., 2005; Bouwer et al., 2005; PricewaterhouseCoopers, 2009\(^a\); see also Mägerholm Fet et al., 2011; Michelsen and de Boer, 2009; Palmujoki, 2007) by examining the use of environmental criteria in tender documents. Nevertheless, as for any policy instruments, the progress in GPP needs to be analysed. In this thesis, methods for this are developed and the status of GPP is measured (Articles I and II).

Intense political support for GPP has been provided by many international and national policies and schemes (e.g. European Commission 2008\(^b\); European Commission 2001\(^a\); Finnish Government, 2009). The more in-depth development and setting of environmental criteria and their interrelation and potential use for GPP are core elements of the Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy (European Commission, 2008\(^a\)). Some recent proposals for the revision of a number of EU directives aim at developing criteria that would be more useful for green public procurement. For example, it is suggested that minimum requirements and advanced performance benchmarks should be set within the Directive on ‘Ecodesign for energy-using products’, i.e. the EuP Directive\(^5\) (European Commission, 2008\(^b\), p. 3; see also Leire and Thidell, 2009 and Kautto, 2008). It is the first directive requiring the incorporation of life-cycle-based environmental considerations into the product development process (Kautto, 2007) while ensuring the free movement of energy-using products, increasing energy efficiency and environmental protection, and the security of the energy supply (European Commission, 2003\(^a\)). The design phase is actually the most effective way to decrease environmental impacts and increase product value and utility (Clark, 2007). This is studied in Article IV by examining how the environmental purchasing criteria actually correspond to eco-design objectives of certain

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product group. The Commission will introduce eco-design requirements for fourteen priority product groups during 2007-2012, and these include a number of products commonly purchased by public authorities, i.e. office and street lighting (Kunzlik, 2009).

The exemplary role of public authorities in procurement policy is also explicitly recognized in Directive 2006/32/EC on Energy End-use and Energy Services, that imposes obligations on member states to meet certain energy efficiency targets in the public sector by taking measures listed in the directive, most of which relate to procurement decisions (Directive 2006/32/EC; Kunzlik, 2009). Similarly, directive 2009/33/EC on the Promotion of clean and energy-efficient vehicles, requires that lifetime energy and environmental impacts of vehicles are taken into account in purchases of road transport vehicles (Directive 2009/33/EC). This directive is applied in Article III.

Nevertheless, how does this push for greener public procurement comply with the primary aims of public procurement legislation: to guarantee the best value for taxpayers’ money and the functioning of the internal market? In other words, is it possible to combine economic and environmental issues in a way that the purchase is compliant with the EU legislation? In this thesis, this question is examined by analyzing the relation between environmental and economic aspects, as well as the relation between environmental and legal aspects in public procurement (Figure 1).

The relations between environment, economy and law can be clarified by first examining the meaning of ‘environmental’ or ‘green’ purchase. All the criteria that seem to be ‘green’ in the mind of the purchaser may not be such when studied in more detail. Conversely, for certain product groups, green purchasing criteria may be lacking some important environmental aspect. In an ideal case, environmental criteria should be defined by a comprehensive and detailed Life Cycle

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**Figure 1.** Framework of the study.
Analysis (LCA) (European Commission, 2003b) or by using eco-label criteria\(^6\) (European Commission, 2004a). Several LCAs for the purpose of public procurement have been carried out to assess the environmental impacts of purchases, e.g. road construction (Birgisdóttir et al., 2006; Olsson et al., 2006; Mroueh et al., 2001; Stripple, 2001; Eskola et al., 1999; Pereira et al., 1998), buildings (Tarantini et al., 2011; Li et al., 2009; Lloyd et al., 2005; Sterner, 2002a), defence material (Hochschorner and Finnveden, 2006) and plastics (Baitz et al., 2005). However, the experience of using LCA-based award criteria in a real purchase can still be regarded as surprisingly limited in the literature. In this thesis, the LCA approach is applied in an actual purchase to illustrate the most important environmental aspects of a purchase in detail, and to compare the award decision based on life cycle assessment to the ‘real’ award decision based on the purchaser’s equation (Article III).

The relation between environment and law has been discussed in the literature from the viewpoint of the basic principles and legal framework of public procurement in the EU (Arrowsmith and Kunzlik, 2009; Ekroos, 2008; Ekroos and Nissinen, 2007; Kunzlik, 2003). Although the public procurement legislation allows for requirements on materials, emissions, energy consumption, waste-handling and many other environmental considerations, it may still limit some environmental criteria applied in the call for tender if they are potentially contradictory to the EU principles or are not obviously linked to the subject matter of the contract. At the centre of the debate are purchasing criteria concerning externalities arising from production and consumption of products, services or works supplied, e.g. delivery or production impacts or disposal effects (Kunzlik, 2003; Arrowsmith and Kunzlik, 2009). This issue is often referred to and analyzed through the two exemplary cases of European Court of Justice (ECJ), concerning production process\(^7\) and consumption externalities\(^8\), e.g. the level of noise and NO\(_x\) emissions. In both cases, the Court ratified the benefit of the greener choice. In this thesis, the environmental impacts of transport and transport distance of materials form the core of discussion because they are an inherent part of the scientific method LCA, but – due to the legal framework – it is not obvious that the tenders can be valued in relation to the environmental burdens of transport without potentially discriminating against some bidders (Article V).

Despite the renewal of the EU’s procurement directives (2004), important issues remain unresolved – namely, the use of GPP to promote environmental and social objectives that are not necessarily connected with the procurement’s functional objective. However, award criteria could be an effective approach in promoting environmental and social aspects in public procurement process, as they might sometimes be easier to justify than other mechanisms (Arrowsmith, 2009, p. 190). Environmental award criteria are examined in Article I. Yet another major mechanism for promoting social and environmental policies is the use of contractual requirements related to contract performance (Arrowsmith, 2009, p. 159). Indeed, delivered goods and services may be different than the ones specified in calls for tender and bids, if the contracts agreed between the public authority and the bidder lack certain contract clauses. This issue is studied in Article VI.

The relation between economy and environment is discussed through the concept of the most economically advantageous tender, which is – as defined in the EU’s public procurement directives – a basis for combining environmental aspects, price and other award criteria in the public procurement decision making while providing the best value for taxpayers’ money. It is introduced as a weighted sum of varying value adding parameters preferred by the purchaser, including environmental criteria.\(^9\) The directives do not, however, determine how the purchasers should build the environmental criteria or how to measure and compare the environmental impacts of products and services procured. Indeed, there could be different means to assess the ‘greenness’ of competing

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\(^6\) Eco-label criteria are based on the scientific method of LCA.

\(^7\) Case C-448/01, Wienstrom GmbH (2003).

\(^8\) Case C-513/99, Concordia Bus Finland Oy Ab (2002).

tenders. This thesis illustrates how these various conceptualizations of environmental criteria and measurements of environmental impacts may lead to different assessments in determining the most economically advantageous tender (Article III).

Although economic aspects of public procurement have been the area of interest in many research papers, the content of the most economically advantageous tender has gained only little attention (e.g. Bovis, 2006; Miensch and Erdmenger, 2002; Kalima, 2001) and the research has focused rather on the monetary aspects and economic effectiveness of public purchasing operations (Piga and Thai, 2007; Soudry, 2003) or formulating suitable award systems (Lundberg and Bergman, 2011; Mateus et al., 2010; Meijer and Telgen, 2007). This is surprising due to the fact that the concept of the most economically advantageous tender has been used in the procurement practice since the renewal of public procurement directives in 2004 as an option to award tenders based on ‘lowest price’. This thesis clarifies how the most economically advantageous tender is interpreted among public purchasers (Article I), and discusses whether the metric, i.e. a weighted summation of economic and environmental aspects, could be an appropriate indicator of economic and environmental performance of tenders.

Many academic studies in the field of green procurement and economic performance have been addressed to the private sector organizations (e.g. Björklund, 2010; Leire, 2009) and often the point of interest has been the benefits gained from greening of the supply chain and the firm’s economic performance (Seuring and Müller, 2008; Humphreys et al., 2003; Sarks, 2003; Schaltegger and Synnestvedt, 2002; Zsidisin and Siferd, 2001). The results indicate that procurement is an important factor in greening the value chain (Günther and Scheibe, 2005) and in reporting organization’s environmental performance (Baboulet and Lenzen, 2010). In addition, it is shown that environmental purchasing allows the company’s environmental progress whilst enhancing a firm performance (Carter, 2005; Carter et al., 2000). Recently, similar results have also been received in the public sector. A study carried out on the EU level found out that, in contrast to common perception, GPP can lead to an approximate 1% decrease in costs for the purchasing organization in the public sector10 when using a Life Cycle Costing (LCC) approach in calculating the financial impact of GPP (PricewaterhouseCoopers, 2009a).

Generally, the research in private sector procurement is not directly applicable to public procurement because of the large scale, complexity and legal restrictions and regulations in formulating the public procurement criteria to ensure the solicitation of suppliers in a fair way (New et al., 2002; Hartley, 1991). This means that public procurement is undertaken with considerable attention to procedural detail (Bala et al., 2008; Lian and Laing, 2004; New et al., 2002). Although in recent years, the greening of the public sector has gained more interest in academic studies (Arrowsmith and Kunzlik, 2009; Preuss, 2009; Walker et al., 2009; Walker and Brammer, 2009; Walker and Preuss, 2008; Bala et al., 2008; New et al., 2002), there is only a limited experience on the quantitative analysis on the use and progress of environmental purchasing criteria. Although there have been many national initiatives towards greener public procurement, and many practical guidance and reports resulting from these initiatives, scientific papers concerning the use and state of environmental purchasing criteria have been scarce, and thus green public procurement has remained as a relatively new and unexamined area of interest (Tazelaar, 2008).

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10 There are mainly two product groups leading to cost reductions through GPP – construction and transport (PricewaterhouseCoopers, 2009a, p. 7).
1.3 Objectives of the study

The purpose of this thesis is to clarify some aspects related to the use of green criteria in public procurement. It is in accordance with the environmental integration principle\textsuperscript{11} to support and promote sustainable development by greener purchasing in public organizations in Finland and internationally. This thesis focuses on the use of green criteria in tender documents, especially in the award decision and contract clauses. The quantity and quality of environmental purchasing criteria is examined, as well as the compliance of certain LCA-based environmental criteria to public procurement legislation. A method to measure the present status of GPP as well as progress between years is presented. As motivated by the efforts of the EU on encouraging public sector to use its purchasing power to promote certain policies, e.g. to meet certain eco-design criteria, this study is also extended to assess the potential of green procurement criteria to contribute on environmental product improvements in the long run.

The main research questions of the thesis are:

- To what extent environmental criteria are implemented in the award decision, i.e. in the most economically advantageous tender? (Article I)
- How much progress has occurred in applying environmental purchasing criteria in calls for tenders before and after the issuing of the new public procurement directives? (Article II)
- How do various conceptualizations and measurements of environmental impacts contribute to the assessment of the most economically advantageous tender? (Article III)
- Could LCA-based environmental criteria be applied and justified in public procurement award decision? (Articles III, IV and V)
- Could green purchasing criteria (in calls for tenders) promote greener products in the long run? (Article IV)
- To what extent are environmental contract clauses capable of guaranteeing greener purchases? (Article VI)

1.4 Structure of the study

This thesis consists of two parts, i.e. summary and articles. In the first part, the political and legal background of green public procurement is presented as well as the material, methods, results, discussion and conclusions of the study. The second part is based on six articles. Articles I and II focus on the existence of green criteria in calls for tenders before and after the renewal of the EU procurement directives, and the progress in GPP occurred during this period (between the years 2003 and 2005). They also present the method to measure the current status and progress in GPP. Article I examines the concept of the most economically advantageous tender and article III illustrates the contribution of different measurements of environmental impacts to the ranking of competing tenders based on the most economically advantageous tender (case: purchase of services, i.e. goods transportation). Article IV examines the nature of green criteria that could possibly promote environmental improvements and eco-design solutions in the long run (case: purchase of products, i.e. furniture). Articles V and VI focus more on the jurisprudence on the existing green criteria; article V analyses the suitability of certain environmental criteria, i.e. transport distance as an award criterion (case: purchase of works, i.e. road construction) and article VI examines the relevance of environmental contract clauses in the final contracts in terms of their comprehensiveness and enforceability to guarantee the implementation of ‘green’ purchase.

2 Policy and legal background of green public procurement

2.1 Policy background

Environmental protection has played a role in European Community policy since the EC Treaty (1957) but currently, over 50 years later, it is much more clearly positioned in Community agreements and policies. Particularly since the Rio Conference (1992), the focus has been on the sustainability of actions whilst maintaining the EU’s single market principles of free movement of goods, equal treatment and transparency. In the Maastricht Treaty (1992) sustainable development was taken in article 2 as one of the fundamental aims of the Community, i.e. “to promote throughout the Community a harmonious and balanced development of economic activities, sustainable and non-inflationary growth respecting the environment”. The Amsterdam Treaty (1997), which entered into force in May 1999, further promoted the environmental aims of the Community by stating “…a harmonious, balanced and sustainable development of economic activities, sustainable and non-inflationary growth, a high level of protection and improvement of the quality of the environment…” in article 2 of the Treaty. However, the essential link between sustainable development, including environmental and other aspects and an internal competitive market was, for the first time, provided in the Amsterdam Treaty (article 6). This integration principle specifies that environmental protection requirements must be integrated into the definition and implementation of the Community policies and activities referred to in article 3, in particular with a view to promoting sustainable development. The principle of environmental integration recognizes, however, that environmental policy alone cannot achieve the environmental improvements needed as part of sustainable development (European Commission, 2004b). Thus, the changes required to reduce environmental pressures can be achieved through a process of environmental integration in different sectors, i.e. “inclusion of environmental concerns in processes and decisions of public policy making that are predominantly charged with issues other than the environment” (Hertin and Berkhout, 2003, p. 40). No substantial changes concerning the aim of sustainability was made to the Lisbon Treaty (2007), which states that the Union “…shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment…”.

In the EU, the Fifth Environmental Action Programme (1992 – 1999) emphasized the shared responsibility of consumers and the public and private sectors for environmental protection, so that environmental factors should be integrated into the purchasing decisions of consumers and public bodies (Kunzlik, 2003; European Commission, 1999). Also, the Organization for Economic Co-operation and Development (OECD) provided a recommendation on GPP in 2002 (OECD, 2002). In the USA, the Environmentally Preferable Purchasing programme has guided public purchasers since 1993 (US Environmental Protection Agency, 2006). Another example (among many) was offered by Japan (Erdmenger et al., 2001) where the government adopted the first “Action Plan for the Greening of Government Operations” in 1995, indicating objectives and methods required to achieve a greening of public procurement by the year 2000.

12 Treaty establishing the European Economic Community (1957) Article 36.
16 i.e. Treaty establishing the European Community (1997).
Further, the Sixth Environmental Action Programme, adopted in 2002, identified actions relevant to public procurement (European Commission, 2007). These were communicated in the Green Paper on Integrated Product Policy (IPP), which raised interest towards product-oriented environmental focus (European Commission, 2001a; see also European Commission, 2001b). The aim of IPP is to reduce the environmental impacts of products throughout their life-cycle, also taking into consideration the market and competitiveness concerns (European Commission 2003b, p. 6). Increased demand for greener products by GPP, in competition with the more traditional products, is well-suited to this market-oriented approach of IPP (Rubik and Scholl, 2002; Li and Geiser, 2005). IPP also emphasizes that public authorities must act as ‘leaders’ in the process of green management and ‘in changes of consumption towards greener products’ (see: Kunzlik, 2003). In addition, the member states were encouraged to develop publicly available action plans by the end of 2006, i.e. national action plans for greening their public procurement. For example, the objective in Finland was to take the environment into account in 70% of central governmental purchases by the year 2010, and in 100% by the year 2015. The same figures for municipalities and local governmental purchasers were, respectively, 25% and 50% (Ministry of Environment, 2008; Finnish Government, 2009). Generally speaking, the Commission proposed that, 50% of all tendering procedures should be green by the year 2010, where green means compliant with the common ‘core’ GPP criteria endorsed by the Commission (see: European Commission, 2008b, p. 8).

In summer 2008, the EU Commission published an Action Plan on Sustainable Consumption and Production, focusing on the key policy instruments developed in IPP, in which GPP is seen as one of the key tools (European Commission, 2008a). GPP has been the driving force in the integration of other IPP instruments, namely eco-labelling and extended producer responsibility (Li and Geiser, 2005). Moreover, the Nordic Council of Ministers (NCM) has stressed the importance of GPP in the strategy for sustainable development, and has initiated coordination efforts so that public buyers in all Nordic countries can benefit from each other’s experience (Nordic Council of Ministers, 2004a). In addition, the United Nations Environment Programme (UNEP) actively promotes sustainable procurement by facilitating global consensus on the integration of sustainable development considerations in procurement at all levels and by being a source of practical tools, particularly with regard to contributing to the collection of purchasing criteria respective to sustainability (Clark, 2007).

GPP also plays a key role in many other policy initiatives in the EU level and nationally, e.g. climate change policies and the Environmental Technologies Action plans (European Council, 2006; Mogens, 2006). At the EU level, one of the latest interests has emerged from the use of public demand as a promoter for innovation (Clement et al., 2011; European Commission, 2010a; Hommen and Rolfstam, 2009; Aschhoff and Sofka, 2009; Edler and Georgiou, 2007). Green public procurement is one instrument to stimulate the greening of markets as GPP accelerates the diffusion of eco-efficient products and enhances incentives for more sustainable innovations, in particular through technology procurement21 (Scholl et al., 2010; Rubik et al., 2009). In September 2006, the EU Commission issued a paper on innovation strategy, highlighting the importance of public

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19 At the beginning of 2008 only 14 member states had adopted national action plans (European Commission, 2008b) but in September 2010, already 21 member states had adopted a national action plan or equivalent document (European Commission, 2011b).

20 In 2011, the Commission commissioned a study with the aim of measuring if this target has been met. Although the uptake of Green Procurement in the EU-27 is significant, it appears that the 50% target has not been met. 26% of the last contracts signed in the 2009-2010 period by public authorities in the EU included all surveyed EU core GPP criteria. However, 55% of contracts included at least one EU core GPP criterion, showing that some form of green procurement is being done at a large scale. (Renda et al., 2012, p. vii)

21 Technology procurement is a specific application of green public procurement. It is oriented towards the stimulation of sustainable innovations to develop new technologies pushing suppliers’ innovation processes, in order to develop ‘greener’ products. It gives the possibility of developing and demonstrating new technological solutions that are not yet available. (Rubik et al., 2009, p. 93, 110)
procurement in innovations and in the creation of the leading market, especially in sectors where the public authority is a significant purchaser (European Commission, 2006). In November 2006, the Nordic Council of Ministers also organized, jointly with the Norwegian Ministry of Environment and GRIP, an ‘International Roundtable on Developing Public Procurement policies for Sustainable Development and Innovation’ (Report from the International Roundtable, 2009). Furthermore, in 2010 the EU Commission clearly communicated the call for a fair and transparent internal market that rewards innovation, and the wider use of green public procurement in developing the market for environmental goods and services (European Commission, 2010b, p. 20) revealing at the same time, that major part of public procurement in Europe was still not aimed at innovation, despite the opportunities under the EU procurement directives (European Commission, 2010a, p. 16).

GPP is of crucial importance also in the Europe 2020 strategy\(^{22}\) as one of the market-based instruments that should be used to accelerate the shift towards a resource efficient and low-carbon economy and improve the framework conditions for business to innovate (e.g. European Commission, 2011c; European Commission, 2010a; European Commission, 2010c). Thus, public procurement rules should insist on efficiency conditions to increase energy savings and spread innovative solutions, notably in buildings and transport (European Commission, 2010c). The Europe 2020 strategy also stresses that public procurement policy must ensure the most efficient use of public funds and that procurement markets must be kept open EU wide (European Commission, 2011d, p. 3).

At the same time with the international political support, governmental and non-governmental initiatives for promoting green procurement have been established (European Commission, 2011c; GRIP, 2003). In recent years, Internet-based tools\(^{23}\) have become the most important instrument in many countries to deliver environmental information to purchasers, side-by-side with the work to develop environmental criteria for various product groups (Johnstone, 2001; Bouwer et al., 2005). Currently, a set of common GPP criteria has been established in the EU’s GPP Toolkit (European Commission, 2011c) for 18 sectors, which have been identified as most suitable for implementing GPP.\(^{24}\) The criteria are based on existing European and national eco-label criteria where appropriate, as well as on information collected from stakeholders in industry and civil society (European Commission, 2008b, p. 5). This set of environmental purchasing criteria is complemented by environmental criteria for other 8 sectors issued by the Nordic Council of Ministers (Nissinen et al., 2009). In addition, the EU Commission has published a guidebook in several languages (European Commission, 2004a), and national guidebooks have also been published: e.g. in Finland a guidebook was published in 2004 that took the new public procurement directives into account (Nissinen, 2004). In 2005, two brochures for promoting environmentally friendly procurement were published, one addressing local politicians and leaders, and the other one procurement officers. They were distributed extensively to public organizations in Finland, Norway and Sweden, e.g. in Finland to over 1 200 leaders and purchasers in the public sector (Nordic Council of Ministers, 2004b). In 2011, a practical guide ‘Driving energy efficient innovation through procurement’ was targeted to public authorities in order to assist them in achieving the most innovative, energy ef-


\(^{24}\) The first set of criteria, developed in 2008, includes: 1) Construction 2) Food and catering services 3) Transport and transport services 4) Energy 5) Office machinery and computers 6) Clothing, uniforms and other textiles 7) Paper and printing services 8) Furniture 9) Cleaning products and services 10) Equipment used in the health sector. A second set of GPP criteria was developed in 2010 for 8 new product groups including: 1) Windows, glazed doors and skylights 2) Thermal insulation 3) Hard floor-coverings 4) Wall panels 5) Combined heat and power 6) Road construction and traffic signs 7) Street lighting and traffic signals 8) Mobile phones.
ficient solutions within their procurement actions (Clement et al., 2011). It is evident that internet tools, guidebooks and other GPP information tools have helped the setting of environmental criteria in tender documents during the last few years (see e.g. Tazelaar, 2008; Clark, 2007).

2.2 Legal background

Two essential elements – the aim of sustainable development and the integration principle – can be noted from the early 1990s onwards in the Community environmental policy. Up to the present day it has formed the framework of integrating economic and environmental interests in the decision-making related to EU activities.25 In addition, public procurement is subject to the EU common market principles;26 in particular, the principles of free movement of goods27, freedom of establishment28 and freedom to provide services29 including the principles derived therefrom – such as the principle of equal treatment30 as well as that of non-discrimination31 and the mutual recognition32 of sustainable development in international and national law, the principle of proportionality33 and that of transparency34. These principles are referred to in the public procurement directives and applied in the case law of public procurement.

2.2.1 Public procurement directives

The current legislation on public procurement is based on the European Commission procurement directives renewed and adopted by the European Parliament and Council on 31st March, 2004 including Directive 2004/17/EC coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors and Directive 2004/18/EC on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts.35

The early directives of the 70’s concerning public procurement36 focused on prohibiting hidden protectionism in the form of national public purchasing regimes (McLachlan, 1985) but otherwise were limited in scope and effectiveness (Cox, 1993), applying only to the purchase of works and supplies and excluding services, energy, telecommunications, transport and water sectors (Martin et al., 1999). These early directives were followed by the public procurement directives issued in 1993,37 which also included the important sectors that were earlier excluded, and all public procurement (except defence) was now subject to the EU legislation. Nevertheless, it was not until

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27 Freedom of movement of goods, i.e. barriers to the free movement of goods within the EU may not be caused.
28 Freedom of establishment, i.e. an economic operator (whether a person or a company) is enabled to carry on an economic activity in a stable and continuous way in one or more member states.
29 Freedom to provide services, i.e. an economic operator is enabled, without having to be established, to provide services in one member state on a temporary basis in another member state.
30 Principle of equal treatment, i.e. to ensure equality of treatment for individuals irrespective of nationality, sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation.
31 Principle of non-discrimination, i.e. none of the suppliers shall be discriminated against due to location or nationality.
32 Principle of mutual recognition, i.e. to guarantee the efforts in question without the need to harmonize member states’ national legislation.
33 Principle of proportionality, i.e. any action by the community shall not go beyond what is necessary to achieve the objectives of the Treaty.
34 Principle of transparency, i.e. information regarding forthcoming contracts and the rules to be applied should be readily available to all interested bidders.
35 Both came into force 30th April, 2004.
the renewal of the public procurement directives in 2004 that the directives explicitly provided opportunities to take environmental aspects into account in the various phases of the public procurement process. These current procurement directives (2004/18/EC and 2004/17/EC) refer to article 6 of the Treaty of establishment (1997), which states that environmental protection requirements are to be integrated into the definition and implementation of Community policies and activities, with a view to promoting sustainable development in particular. These directives clarify how contracting authorities may contribute to the environmental aspects of a purchase, whilst obtaining the best value for money for their purchase and prohibiting discriminatory purchasing policies.

Basic rules on setting the award criteria are based on two possibilities: (1) lowest price only or (2) the most economically advantageous tender from the point of view of the contracting authority. If the most economically advantageous tender from the point of view of the contracting authority.

The list given in the directives is not exhaustive, and other criteria can also be used. In practice, the directives leave considerable space for the purchasers’ interpretations in defining and calculating the most economically advantageous tender. In the literature, this concept is also defined as ‘optimal usability of goods for a certain purpose’ or the ‘optimal relation between the price and quality’ (Kalima, 2001). Mielisch and Erdmenger (2002) present a definition according to which the most economically advantageous bid is determined from the ratio: quality / price relationship, in which such specifications could be the technical value, date of delivery, after-sales service and technical assistance or environmentally relevant qualities, among others. HM Treasury (2006) uses the concept ‘value for money’ in the same context defining it as ‘the optimum combination of whole-of-life costs and quality (or fitness for purpose) of the good or service to meet the user’s requirement’ and underlines that it is not the choice of goods and services based on the lowest cost bid (HM Treasury, 2006, p. 7).

The contracting authorities must set out the environmental criteria in the calls for tenders. If a public purchaser uses ‘the most economically advantageous’ as a basis for the award decision, the contracting authority shall specify in the contract notice or in the call for tender, the relative weighting which it gives to each of the criteria chosen to determine the most economically advantageous tender. Weighting can be expressed by providing for a range with an appropriate maximum spread. Where weighting is not possible for demonstrable reasons, the contracting authority shall indicate the criteria in descending order of importance.

Using environmental criteria elsewhere in the bidding process than in the award phase makes it possible to use the bid price as the only award criterion but still prefer the ‘green’ product. They can, for example, be specified in technical specifications that are detailed prescriptions of the characteristics that the product or service must perform or otherwise the tender will be rejected (European Commission, 2004a). These may include, e.g. material selection, chemical content and functional characteristics of products (Bouwer et al., 2005). Technical specifications shall afford equal access for bidders and should not create unjustified obstacles to open competition. For example, requiring such an environmental certificate that is barely used and is purely national may be discriminatory at least towards bidders from other EU states. Thus, the contracting authorities

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40 The Finnish version of the directive describes the environmental characteristics in direct translation as ‘environmental friendliness’.
42 Directive 2004/18/EC, Article 53(2).
may, e.g. indicate that the products and services bearing the eco-label are presumed to comply with the technical specifications laid down in the contract documents, but they must also accept any other appropriate means of proof as well. (Directive 2004/18/EC43; European Commission, 2004a; Guidelines on Greening Public Procurement by Using the European Eco-label Criteria, 2001). According to the procurement directives, the opportunity to require environmental characteristics in technical specifications or award criteria exists only when these requirements are linked to the subject matter of the public contract in question.44 In particular, it is the meaning of the subject matter of the contract that may prove to be of most analytical importance for assessing the legality of procurement (McCrudden, 2009, p. 308).

Environmental performance demands, i.e. aspects that are included in, e.g. the environmental management system or the quality system or similar, can be presented as qualifications for contractors, i.e. qualitative selection criteria. Evidence of the economic operator’s technical abilities may be furnished by the indication of the environmental management measures that the economic operator will be able to apply when performing the contract.45 Directive 2004/18/EC46 accepts EMAS47 and environmental management standards based on the relevant European or international standards,48 but other evidence of equivalent environmental management measures should be accepted as well.

Environmental criteria can also be indicated already in the definition of the contract, e.g. ‘energy-saving bulbs’. This can even be seen as “the desire to develop new ‘green’ products” (Arrowsmith, 2009, p. 159). They can also be present in the contract clauses,49 which may, in particular, concern relevant additional environmental and social considerations (European Commission, 2004a). Environmental contract clauses can involve the level and execution of environmental protection in the performance phase of the goods or services. The contracting authority can, e.g. specify the way the goods are to be supplied and even the method of transport, or may require that the supplier takes back and recycles or reuses any packaging that comes with the product (European Commission, 2004a). Contract clauses can also be general in form concerning, e.g. the environmental management system of the supplier (Lusser and Willsher, 2009). Contract requirements might also require compliance with applicable legal norms laid down by another member state or a third country in cases when the contract is performed outside the awarding state (Arrowsmith, 2009, p. 161). Contracting clauses should not, however, play a role in determining which bidder gets the contract – so any of the bidders should, in principle, be able to follow them.

Public bodies are constituted with the domestic legal and constitutional order of member states. Their purchaser autonomy is constrained by domestic law in order to ensure, for example, that they operate within the scope of their lawfully constituted functions and comply with budgetary and good governance requirements (Arrowsmith and Kunzlik, 2009). National legislations vary in detail, though procurement directives do not leave much space for national peculiarities or interpretations (Ekroos, 2008). One of the examples of a national modification or amendment is section 2 of the ‘Public Procurement Act’ of Finland, which came into force June 1, 2007 (Public Procurement Act of Finland, 2007). It requires authorities to organize their public procurement so that purchases can be carried out as economically and systematically as possible and in the appropriate completeness, taking the environmental aspects into account. This section, entitled “principles that should be taken into account in public procurement”, is not binding but “principled provision” – meant

43 Article 23(6).
44 Directive 2004/18/EC, Article 53.
45 Directive 2004/18/EC, Article 48(2) (f).
46 Article 50.
48 This refers e.g. to the ISO 14001 environmental standard series.
as a guide for the authorities. Indeed, it seems to be the only ‘progressive’ provision in the Public Procurement Act of Finland. The Act in all other respects follows the directive. (Ekroos, 2008)\(^{50}\)

In Sweden, the new public procurement legislation came into being on January 1st, 2008 (Public Procurement Act of Sweden, 2007). The previous act stated as a fundamental principle on public procurement in Sweden that all public procurement shall be made in the spirit of good business practice (“affärsmässighet”). This principle was given the same content in Swedish jurisprudence as the fundamental EU principles regarding public procurement. This term has now been abandoned in the new Act and has been replaced with an enumeration of all the fundamental EU principles. (Public Procurement Act of Sweden, 2007\(^{51}\); Hane and Bergqvist, 2008). Interestingly, this principle of ‘affärsmässighet’ used to be repeatedly referred to in the complaints and legal reasoning of public procurement decisions in Sweden (Carlsson and Åström, 2008). However, the government has stated that no material change is intended by this change (Hane and Bergqvist, 2008; Regeringens Proposition, 2006/07:128, p. 156-157).

### 2.2.2 Case law

The preparation of the EU’s procurement directives between 2001 and 2004 stimulated active debate on the possibility of adopting environmental characteristics in public purchasing. Nevertheless, it was the case law that actually paved the way for GPP. Although the European Court of Justice (ECJ) is not directly charged for setting the procurement regulations, their decisions in GPP have become an important source of procurement practices and policies (e.g. Ekroos, 2008; Kunzlik, 2003). From an environmental perspective, the milestone ECJ cases have been the Helsinki Bus case\(^{52}\) and the Wienstrom Renewable energy case\(^{53}\). In the Helsinki Bus case (2002), the Court, for the first time, confirmed the possibility of taking environmental award criteria into consideration when assessing the most economically advantageous tender. Referring to article 6 of the Treaty establishing the European Community (1997), the Court emphasized that environmental requirements, in the manner of other requirements, have to comply with the general principles of the EU. An important statement was that environmental requirements should be linked to the subject matter of the contract and should not give the contracting authority unrestricted freedom of choice. In addition, this case showed that in practice, the definition of the most economically advantageous tender does not limit the non-price award criteria to direct economic benefit to the procuring entity, but the economic advantage could include advantages affecting society as a whole. It is not necessary for each individual award criterion to give an economic advantage to the contracting authority, but taken together (i.e. economic, quality, environmental, etc.) the award criteria must allow for the determination of the best value for money. (European Commission, 2004a)

The Court’s decision has been considered important from the environmental point of view because it diminishes, for example, the demand that environmental aspects should be economic by nature (e.g., Kunzlik, 2003). Also in the Wienstrom case\(^{54}\) (2003), concerning the procurement of renewable energy, the Court found that it was acceptable to make use of environmental award

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\(^{50}\) In the legislative process in the parliament, the environment committee proposed in its statement to the economic committee that the draft would be modified (YmVL 29/2006 p. 4) as follows: section 2.1 should be modified to more strongly direct that environmental aspects should be taken into account. They suggested deleting, at the end of sub-item 2, “taking into account environmental aspects” whilst adding a new sentence: “In public procurements, environmental aspects must always be taken into account when possible”. The committee argued that, modified as proposed, the section would direct the inclusion of environmental aspects into procurement more effectively. (Ekroos, 2008, p. 437)

\(^{51}\) Public Procurement Act of Sweden, Chapter 1, Articles 9-12 (General provisions).

\(^{52}\) Case C-513/99, Concordia Bus Finland Oy Ab (2002).

\(^{53}\) Case C-448/01, Wienstrom GmbH (2003).

\(^{54}\) In this case, the bidders had to prove that they would supply at least a minimum amount of electricity per year from renewable energy sources equivalent to the estimated annual consumption of the federal services.
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Criteria, even if they did not provide an immediate economic benefit to the contracting authority. The Court also decided that it was clearly admissible to establish an award criterion that was related to the production method of the purchased product, if this was relevant for the product. This also included the possibility to set contract standards relating to social and environmental matters that were higher than those in non-mandatory European standards or in directives. (Arrowsmith and Kunzlik, 2009)

Despite the Wienstorm case, the production process has still remained as a problematic area in public procurement due to its uncertainty in terms of ‘linked to the subject matter of the contract’ (Ekroos, 2008). Authorities may not include requirements which relate to the production processes and methods by which a product is made, unless they affect a characteristic of the end-product in use (Kunzlik, 2009). In most cases, environmental requirements are clearly linked to the product itself, its performance or disposal, but in some cases this ‘linking’ may need some kind of argumentation from the environmental point of view. In some cases, the distinctiveness of products according to their environmental characteristics will not be possible without criteria that go into the production process as well. (Ekroos, 2008, p. 435, 438). Examples are renewable energy, organic food and sustainable and legally logged timber. Also paper products may contain many invisible and potentially harmful environmental substances. (European Commission, 2009, p. 23-24). Moreover, the environmental impact of production cannot be neglected in the case of green buildings (Tarantini et al., 2011). It is suggested, however, that production process-related requirements are possible in technical specifications that are obligatory requirements, as long as they realize the general principles – e.g. equal treatment, transparency and proportionality (Ekroos, 2008; Ekroos and Nissinen, 2007). The possible violation of these principles depends on the facts of each case.

These two ECJ cases are good examples of enabling the consideration of environmental aspects in public procurement, as long as the criteria are adequately specified and objectively quantifiable (European Commission, 2004a, p. 35). Consequently, the use of general and immeasurable environmental criteria is restricted in order to follow the EC principles of transparency and non-discrimination of bidders.

3 Research methods and data collection

3.1 Methods in the research of green public procurement

The research area of public procurement has developed into a research discipline in itself during this decennium, when it was recognized as separate and different from that of the private sector (Murray, 2009) and the first international conference on public procurement was organized in 2004 (Thai et al., 2004). However, during this relatively short period, several qualitative and quantitative methods have already been used in the research of public procurement and applied to also measure the use of green purchasing criteria. These methods include e.g. questionnaires, interviews, analysis of tender documents and case studies.

Before 2003, the state and progress in GPP was measured by questionnaires (e.g. EuroFutures Ab, 2002; Ochoa & Erdmenger, 2003) and interviews (GRIP, 2001). However, Kippo-Edlund et al. (2005) reviewed several questionnaire studies and found that the response rate had been low

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55 See: Directive 2004/18/EC, Article 23; Directive 2004/17/EC, Article 34; the Public Procurement Act of Finland, Section 44. Also, the guidance related to the directive allows for technical specifications on production processes (European Commission, 2004a).
in all of them. In addition, such studies obviously give insight for the most part to the practice of green purchasers (e.g. EuroFutures Ab, 2002; Ochoa and Erdmenger, 2003), and public purchasers may over-estimate their actual environmental focus (Michelsen and de Boer, 2009). For example, respondents often reply ‘implemented’ also on issues that are only in the planning stage, perhaps as an attempt to appear more proactive than they really are (Bowen et al., 2001). As it relies considerably on a single group of information sources, i.e. procurement managers, public procurement research has suffered from an in-built bias (Murray, 2009).

To overcome this potential bias, researchers have used several complementary methods in addition to questionnaires. Kippo-Edlund et al. (2005) used a new method to measure the state of GPP in Nordic countries in 2003. This method was based on ranking the environmental criteria in the calls for tender according to a prepared list. Later, Bouwer et al. (2005) used both a questionnaire and this new method to study the situation in 2005 in the EU countries. In 2008, the status of GPP in the EU was again measured by questionnaires, which were formulated so that the relationship between the behaviour and the results of respondents was examined by first asking questions concerning environmental policy, procurement policy and the implementation of green procurement in the organization, and then asking questions about the use of green criteria (based on the GPP training toolkit) within the most recent procurement contract (PricewaterhouseCoopers, 2009b, p. 47-59). In addition, the study provided additional indicators to measure the greenness of public procurement – including, for example, the calculation of CO₂ and the financial impacts of GPP (PricewaterhouseCoopers, 2009b; see also Pierrard, 2003; Cadman and Dolley, 2002, for assessing the potential of GPP). Questionnaires were used again in 2011 when the EU Commission commissioned a study on monitoring the uptake of core GPP criteria for ten priority product/service groups in the EU-27 (Renda et al., 2012). The questionnaire included a general section that contained questions on the respondent’s role in the public sector, level of government, estimated level of GPP uptake, etc. and another section focused on each of the ten product groups concerning the last contract that a given procurement authority signed in the period 2009-2010. In addition, the respondents were asked to provide general information on their total procurement in the 2009-2010 timeframe for the certain product group. (Renda et al., 2012, p. 28)

At the same time, Michelsen and de Boer (2009) have done comparison between the intent of the purchasers and the actual implementation of environmental procurement criteria by sending questionnaires in 2008 to purchasers in Norwegian municipalities and, in addition, to the potential suppliers, in order to see to what extent suppliers and purchasers agree on the importance of environmental demands in the selection of suppliers. They found that there were discrepancies between the degree to which the public purchasers say they focus on environmental aspects in the final selection of suppliers, and the perception of the potential suppliers suggesting a much lower focus on environmental aspects than the purchasers claim (Michelsen and de Boer, 2009). This reflects the assumption that the information gained is filtered through the views of the respondents (Creswell, 2009).

Case studies have also been used in the research of GPP in scientific research as well as in non-academic papers (e.g. Tarantini et al., 2011; Bala et al., 2008; Hochschorner and Finnveden, 2006; Sterner, 2002b; EcoProcura, 2006; Ecosmes, 2004). Often the rationale for selecting a case study is to obtain more detailed information about the contextual conditions of a phenomenon (Yin, 1994). Within the context of green public procurement, this could be e.g. to examine a single purchase of a specific product group and its environmental impacts. The outcome of case studies could be, for instance, the introduction of best green practices in the market to the purchasers (e.g. ICLEI, 2006; Swanson et al., 2005).

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56 Similar results have been obtained from the research of green procurement in the private sector (see: Leire, 2009, p. 45).
Case studies have often been carried out by a scientific method – LCA. Formerly, LCA has been applied into public procurement mostly on a conceptual or simplified level (European Environment Agency, 1997) without doing a highly quantitative analysis, or by using standard modules for data. The aim of the simple assessment has been to understand the relative advantages, disadvantages and uncertainties for various products (Hirschhorn, 1993; Christiansen, 1997). However, interest in applying LCA-based information in more detail in green procurement decision-making and environmental management has increased in recent years (e.g. Tarantini et al., 2011; Baïz et al., 2005; see also Svensson, 2006; Olsson et al., 2006; Hochschorner and Finnvenden, 2006; Petkovic et al., 2004; Mrroueh et al., 2001).

The research of legal aspects in public procurement includes methods that can be classified into doctrinal legal methods, interdisciplinary legal studies and comparative law research (Hasson et al., 2009). **Doctrinal legal methods** use interpretative methods to examine cases, statutes and other sources of law in an attempt to seek out, discover, construct or reconstruct rules and principles turning much of law, legal reasoning and legal studies into a formal activity (Banakar and Travers, 2005, p. 7). These methods are widely used in the analysis of public procurement (e.g. Bovis, 2008; Bailey, 2007; Bovis, 2006; Caldwell et al., 2005; Arrowsmith, 2004; Soudry, 2003; Kalima, 2001) and to some extent also in the research of green public procurement focusing – however, mostly on analyzing the Court decisions and the further implications of case law (Arrowsmith and Kunzlik., 2009; Wedin, 2009; Carlsson and Åström, 2008; Kunzlik, 2003) and less on analyzing the environmental criteria in tender documents and contracts (e.g. Palmujoki, 2007).

**Interdisciplinary legal studies** draw on the other disciplines – in particular, other social sciences such as political science, economics or sociology, or humanities such as history – taking many different forms in which the ‘legal’ elements of the research may even become incidental (Hasson et al., 2009). Using, e.g. economic arguments in the interpretation of law is possible; bearing in mind, however, that the strongly binding sources of justice, such as the law and national regulation and the weakly binding sources of justice – such as the preparation of law and case law – will take precedence over the arguments based on e.g. economics (Määttä, 1999). In green public procurement research, at least the ‘law and economics’ and ‘law and environment’ approaches explaining current law on the basis that it reflects economic and environmental thinking can be found (Arrowsmith and Kunzlik, 2009; Ekroos, 2008; Ekroos and Nissinen, 2007; Kunzlik, 2003). Also the approach of ‘law and history’ has been used when examining the role of environmental protection in EC competition law and policy (Kingston, 2009).

**Comparative law research** is a theoretical study of legal systems by comparison with each other, and has gained practical importance due to the increased globalization of world trade and the move towards harmonization of laws, e.g. within the European Union (Norman, 2006). Comparative law research has been commonly used in the field of public procurement (e.g., Bianchi and Guidi, 2010; Comba, 2009; Rubach-Larsen, 2009; Timmermans and Buyinicke, 2009; Treuner, 2009; Yukins, 2006; Schwartz, 2002) and has recently gained more interest also in the field of GPP (e.g. Zang, 2011; Caranta and Trybus, 2010).\(^{57}\)

### 3.2 Analysis of the data

In this thesis, several methods, i.e. qualitative, quantitative and mixed methods (Creswell, 2009) are applied in the analysis of the data. The *analysis of calls for tenders and contracts* (presented in more detail in Chapter 3, Section 3.2.1) is used to study the quantity and quality of environmental

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\(^{57}\) In addition, a comparative study about norms and regulations across various legal systems (EU vs USA) was undertaken as part of the ‘Environment and Law Research Programme’ of the Academy of Finland (Hietanen, 2009; Hietanen, 2007).
procurement criteria. It is based on the method used in the studies of Kippo-Edlund et al. (2005) and Bouwer et al. (2005) and was selected because it is not affected by the potentially subjective views of the purchasers. In articles I, IV and VI the recording and assessment of the environmental criteria in the calls for tenders is based on this method, and also the data that is re-analyzed in article II was initially recorded as based on this method. In article I, the method is modified to also cover the other elements of the most economically advantageous tender, in addition to the environmental aspects. The method is also modified in article IV to assess the environmental aspects of furniture in more detail, and in article VI where contract clauses of actual purchases are examined. In article II, the method is referred to as Green Public Purchasing - record method (GPP – record method) as it is developed further to measure the progress of GPP and the statistical differences between the countries, years and product groups studied. This GPP - record method is explained in Chapter 3, Section 3.2.2.

In articles III, IV and V – which are case studies – several methods are combined to examine the environmental impacts and aspects of products, services and works. The product groups under the case analyses, i.e. office furniture, transportation and road construction, were selected due to the fact that they are recognized among the key sectors suitable for GPP in the EU having significant environmental impacts and large volume in the public procurement (e.g. European Commission, 2011e). In article III, published LCA studies and the Environmental Product Declaration (EPD) developed by the Volvo Group are used to assess the environmental impacts of tenders (quantitative study). Qualitative analysis in article V is also based on the life-cycle approach, where the role of LCA in determining the award criteria is analyzed by putting the LCA results into the legal framework of public procurement in the EU. Life cycle assessment – including the EPD Calculator tool – is presented in Chapter 3, Section 3.2.3. In addition, a method proposed by the EU Commission to calculate the costs of environmental impacts (Directive 2009/33/EC) is applied in article III. This Environmental cost calculation method is explained in a more detailed manner in Chapter 3, Section 3.2.4.

In article IV, a mixed approach is used. A product group of furniture was selected under a qualitative case study examination, and the quantitative analysis of the green criteria in the furniture calls for tenders is applied, i.e. Chapter 3, Section 3.2.1. However, the method is completed to cover all the environmental aspects (and apparent environmental criteria) of furniture by using the information of several eco-labels and environmental product declarations for furniture. In addition, an RPS method (Nordic Ecolabelling Steps, 2001) is used to assess the relevance, potential and steerability of each environmental criterion in promoting eco-design strategies (defined by van Hemel and Cramer, 2002; Besch, 2005). This Relevance – Potential – Steerability -measurement tool, which is the qualitative part of the examination, is explained in Chapter 3, Section 3.2.5.

Although the results from case studies provide little basis for scientific generalization (Yin, 1994), a case study approach is seen as essential in this thesis in order to illustrate the most economically advantageous tender and environmental impacts of tenders (Article III) as well as examine some specific issues, such as the applicability of using life cycle assessment in the award process (Articles III and V), and the contribution of GPP to eco-design (Article IV) in certain product group.

The analysis of legal aspects, i.e. the applicability of certain LCA-based award criteria in the light of the EU’s legal framework is considered throughout the articles but especially focused in articles IV, V and VI. The following requirements as based on the procurement directives and Treaty principles are considered in the analysis:
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1) A link to the subject matter of the contract (Directive 2004/EC/18, Article 53).

2) The principle of the free movements of goods, services and capital (EC Treaty, Article 3; Directive 2004/EC/18, Article 53), i.e. barriers to the free movement of goods, services and capital within the EU cannot be imposed.

3) The principle of non-discrimination (EC Treaty, Article 3; Directive 2004/EC/18, Article 53), i.e. none of the suppliers shall be discriminated against due to location or nationality.

In addition, in the assessment of environmental criteria in the calls for tenders (Articles I, II, IV and VI) – i.e. whether they are well-defined or not – transparency is concerned with regard to the environmental criteria being clear and understandable, and the availability of information on which the decisions are based is considered in accordance with:


In article VI, the analysis of environmental criteria in calls for tenders is extended to the final contracts to examine to what extent the green criteria of calls for tenders could be implemented and assured by contract clauses. The analysis of the environmental criteria in article VI is completed by the same method (i.e. Chapter 3, Section 3.2.1) as in articles I and IV, but in addition, contract clauses are considered in some detail. This includes the assessment of the existence and applicability of environmental criteria in the contracts in the light of EU legislation (i.e. issues 1-4 stated above). But as with the contract requirements, issues relating to the proportionality principle and national legislation are of special importance. Also, the comprehensiveness and enforceability of the drafted terms and conditions in the contracts are discussed in article VI, highlighting contract practices that could be the most functional and practical from the procuring authorities’ point of view.

### 3.2.1 Analysis of calls for tenders and contracts

The ‘greenness’ of each call for tenders is assessed by reading through the whole document and recording all the environmental criteria that exist in the document (method used in Kippo-Edlund et al., 2005 and Bouwer et al., 2005). A pre-done list of possible environmental criteria is used as an aid to this work (Table 1). This list is used for the analysis of the data in articles I, IV and VI whilst meanwhile searching for possible new kinds of criteria as well.

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58 Article 26 in the Consolidated version of the Treaty on the Functioning of the European Union (2010).

59 Article 18 in the Consolidated version of the Treaty on the Functioning of the European Union (2010).

60 Transparency is concerned with the quality of being clear, obvious and understandable without doubt or ambiguity (C-110/03 Belgium v. Commission, point 44. In: Prechal and de Leeuw, 2008, p. 202). Transparency means that “the process through which public authorities make decisions should be understandable and open, the decisions themselves should be reasoned and as far as possible, the information on which the decisions are based should be available to the public” (European Ombudsman FIDE Report 1998. In: Prechal and de Leeuw, 2008, p. 202).

61 Article 15 in the Consolidated version of the Treaty on the Functioning of the European Union (2010).

62 Treaty of Amsterdam (1997) Article 3 states: “Any action by the Community shall not go beyond what is necessary to achieve the objectives of this Treaty”. More specifically, the principle of proportionality means that any measure by a public authority that affects a basic human right must be appropriate, reasonable and necessary in order to achieve the intended objective (LawEuropa, 2007).

63 Contractual requirements might also require compliance with applicable legal norms laid down by a state other than the one awarding the contract (Arrowsmith, 2009, p. 161).
Table 1. A pre-done check list of environmental criteria in the calls for tenders

<table>
<thead>
<tr>
<th>Environmental criterion</th>
<th>Description of the criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition of subject matter</strong></td>
<td></td>
</tr>
<tr>
<td>the product/service is specific to environmental technology</td>
<td>It is already clear from the definition of the subject matter that the subject of the purchase is respective to environmental technology. List of examples: solar cells, fuel cells, gas buses, etc.</td>
</tr>
<tr>
<td>the product/service is clearly specific to environmentally sound products/services/works other than environmental technology</td>
<td>The subject of the purchase is clearly an environmentally sound one. List of examples: cleaning service performed with ecologically sound cleaning agents, accommodation service fulfilling the criteria of the European ecolabel for tourist accommodation services or the Nordic ecolabel for accommodation services, reused products (e.g. old copiers that have been repaired and serviced).</td>
</tr>
<tr>
<td>environment mentioned in subject matter</td>
<td>E.g. environmental cleaning products, etc.</td>
</tr>
<tr>
<td><strong>Qualitative selection criteria (i.e. technical capability of the supplier)</strong></td>
<td></td>
</tr>
<tr>
<td>EMM, specified environmental management measures</td>
<td>Specified environmental management measures are required (dealing with waste collection, proper use of chemicals, eco-driving, etc.).</td>
</tr>
<tr>
<td>environmental policy</td>
<td>Environmental policy is required.</td>
</tr>
<tr>
<td>environmental programme</td>
<td>An environmental programme is required.</td>
</tr>
<tr>
<td>EMS</td>
<td>An environmental management system is required.</td>
</tr>
<tr>
<td>EMM of subcontractors</td>
<td>Specified environmental management measures are required of subcontractors.</td>
</tr>
<tr>
<td>environmental training and knowledge</td>
<td>Training of the personnel about environmental aspects in their work, and/or related knowledge of personnel is required (may overlap with EMM above).</td>
</tr>
<tr>
<td>waste, energy and water data</td>
<td>The supplier must be capable of delivering information on waste amount, energy use and water use and emissions.</td>
</tr>
<tr>
<td>other, well-defined</td>
<td></td>
</tr>
<tr>
<td>other, not well-defined</td>
<td></td>
</tr>
<tr>
<td><strong>Technical specifications (i.e. obligatory requirements)</strong></td>
<td></td>
</tr>
<tr>
<td>product/service specific to environmental technology</td>
<td>The requirements have been presented so that the subject of the purchase is specific to environmental technology. List of examples: solar cells, fuel cells, gas buses, etc.</td>
</tr>
<tr>
<td>energy use</td>
<td>Requirement is presented for energy use (fuel, electricity, etc.) of a house, vehicle, machine, office equipment, etc.</td>
</tr>
<tr>
<td>emissions to air or water</td>
<td>Requirement is presented for emissions of a vehicle, machine, appliance, etc.</td>
</tr>
<tr>
<td>noise</td>
<td>Requirement is presented for the noise emissions of a vehicle, machine, appliance, etc.</td>
</tr>
<tr>
<td>machine norm or standard</td>
<td>Requirement is presented for machine (or some parts of it, e.g. catalyzer), appliance, etc. that must fulfil a certain norm or standard dealing with energy use, emissions and/or noise (note: not energy labels or ecolabels).</td>
</tr>
<tr>
<td>fuel, hydraulic oil, spare parts</td>
<td>Requirement is presented for a machine, appliance, etc., that it must be able to use environmentally sound fuel (e.g. ethanol-based fuel), lubricant or hydraulic oil (biodegradable and/or biobased oils) or spare parts (refilled ink-cassette for a laser-printer, etc.).</td>
</tr>
<tr>
<td>material choice</td>
<td>Requirement is presented for the material choice of the product (note: not choice of recycled material).</td>
</tr>
<tr>
<td>material amount</td>
<td>Requirement is presented for the material amount in the product.</td>
</tr>
<tr>
<td>recycled material</td>
<td>Requirement is presented for the material choice so that a certain fraction of recycled material is required (e.g. recycled fibres in copying paper).</td>
</tr>
<tr>
<td>chemical content</td>
<td>Requirement is presented for the chemical content of the product.</td>
</tr>
<tr>
<td>long guarantee</td>
<td>Requirement is presented for the length of guarantee (which is an important indicator of the assumed durability and service life of the product).</td>
</tr>
<tr>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>recycling/reuse system</td>
<td>Requirement is presented for existing recycling or reuse system for the product.</td>
</tr>
<tr>
<td>recyclable</td>
<td>Requirement is presented for product being recyclable (in principle).</td>
</tr>
<tr>
<td>packaging material</td>
<td>Requirement is presented for the packaging material choice (e.g. not PVC).</td>
</tr>
<tr>
<td>package recycling/reuse system</td>
<td>Requirement is presented for existing recycling or reuse system for the package.</td>
</tr>
<tr>
<td>recyclable package</td>
<td>Requirement is presented for package being recyclable (in principle).</td>
</tr>
<tr>
<td>LCA-based EPD</td>
<td>Requirement is presented for existing LCA and/or LCA-based environmental product declaration (e.g. Swedish EPD, <a href="http://www.environdec.com/">www.environdec.com/</a>).</td>
</tr>
<tr>
<td>criteria-based EPD</td>
<td>Requirement is presented for environmental product declaration that is based on environmental criteria (i.e. questions and answers).</td>
</tr>
<tr>
<td>EU ecolabel or criteria</td>
<td>Fulfilment of EU ecolabel criteria (all or part of them) for a specific product/service is required.</td>
</tr>
<tr>
<td>other ecolabels or criteria</td>
<td>Fulfilment of other ecolabel criteria (all or part of them) for a specific product/service is required.</td>
</tr>
<tr>
<td>EIA</td>
<td>As part of the planning/designing of a city plan/other plan/system, an environmental impact assessment (EIA) and a plan to diminish environmental effects are required.</td>
</tr>
<tr>
<td>production energy</td>
<td>Requirement is presented for the energy use in the production process of a product.</td>
</tr>
<tr>
<td>production emissions</td>
<td>Requirement is presented for the emissions in the production process of a product.</td>
</tr>
<tr>
<td>production chemicals</td>
<td>Requirement is presented for the chemicals used in the production process of a product.</td>
</tr>
<tr>
<td>production recycling</td>
<td>Requirement is presented for the recycling of waste in the production process of a product.</td>
</tr>
<tr>
<td>production material efficiency</td>
<td>Requirement is presented for the amount of material used in the production process of a product.</td>
</tr>
<tr>
<td>environmental effects of transport per km</td>
<td>Requirement is presented for the environmental effects of transport, regarding only the type of transport (flight/boat/truck/train etc.), emissions and/or energy use per transport km.</td>
</tr>
<tr>
<td>vehicle drive distance in service/work contracts</td>
<td>Requirement is presented for vehicle drive distances in performing service or work contract.</td>
</tr>
<tr>
<td>environmental effects of transport</td>
<td>Requirement is presented for the environmental effects of transport, regarding both transport distance and unit emissions/energy use.</td>
</tr>
<tr>
<td>transport distance of products</td>
<td>Requirement is presented for the transport distance of products.</td>
</tr>
<tr>
<td>other, well-defined</td>
<td>Record if the environmental requirements are compulsory for all tenders, or if they are compulsory only for some variants.</td>
</tr>
<tr>
<td>other, not well-defined</td>
<td>Record if the environmental requirements are compulsory for all tenders, or if they are compulsory only for some variants.</td>
</tr>
<tr>
<td>Award criteria</td>
<td></td>
</tr>
<tr>
<td>energy use</td>
<td>Low energy use (fuel, electricity, etc.) of a house, vehicle, machine, office equipment etc. is considered as a positive aspect for the award.</td>
</tr>
<tr>
<td>emissions to air or water</td>
<td>Emissions of a vehicle, machine, appliance, etc.</td>
</tr>
<tr>
<td>noise</td>
<td>Noise emissions of a vehicle, machine, appliance, etc.</td>
</tr>
<tr>
<td>machine norm or standard</td>
<td>Machine (or some parts of it, e.g. catalyzer), appliance, etc., fulfilling a certain norm or standard that deals with energy use, emissions and/or noise (note: not energy labels or ecolabels).</td>
</tr>
<tr>
<td>fuel, hydraulic oil, spare parts</td>
<td>A machine, appliance, etc., that is able to use environmentally sound fuel (e.g. ethanol-based fuel), lubricant or hydraulic oil (biodegradable and/or biobased oils), or spare parts (refilled ink-cassette of laser-printer, etc.).</td>
</tr>
<tr>
<td>material choice</td>
<td>Material choice of the product (note: not choice of recycled material).</td>
</tr>
<tr>
<td>Material amount</td>
<td>Material amount in the product.</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>recycled material</td>
<td>Material choice, so that a certain fraction of recycled material is required (e.g. recycled fibres in copying paper).</td>
</tr>
<tr>
<td>chemical content</td>
<td>Chemical content of the product.</td>
</tr>
<tr>
<td>long guarantee</td>
<td>Length of guarantee (which is an important indicator of the assumed durability and service life of the product).</td>
</tr>
<tr>
<td>recycling/reuse system</td>
<td>Existing recycling or reuse system for the product.</td>
</tr>
<tr>
<td>recyclable</td>
<td>Product being recyclable (in principle).*</td>
</tr>
<tr>
<td>packaging material</td>
<td>Packaging material choice (e.g. not PVC).</td>
</tr>
<tr>
<td>package recycling/reuse system</td>
<td>Existing recycling or reuse system for the package.</td>
</tr>
<tr>
<td>recyclable package</td>
<td>Package being recyclable (in principle).*</td>
</tr>
<tr>
<td>LCA-based EPD</td>
<td>Existing LCA and/or LCA-based environmental product declaration (e.g. Swedish EPD, <a href="http://www.environdec.com/">www.environdec.com/</a>).</td>
</tr>
<tr>
<td>criteria-based EPD</td>
<td>Environmental product declaration that is based on environmental criteria (i.e. questions and answers).</td>
</tr>
<tr>
<td>EU ecolabel</td>
<td>Fulfilment of EU ecolabel criteria (all or part of them) for the specific product/service.</td>
</tr>
<tr>
<td>other ecolabels</td>
<td>Fulfilment of other ecolabel criteria (all or part of them) for the specific product/service.</td>
</tr>
<tr>
<td>EIA</td>
<td>As a part of planning/designing of a city plan/other system, environmental impact assessment (EIA) and a plan to diminish environmental effects.</td>
</tr>
<tr>
<td>production energy</td>
<td>Energy use in the production process of a product.</td>
</tr>
<tr>
<td>production emissions</td>
<td>Emissions in the production process of a product.</td>
</tr>
<tr>
<td>production chemicals</td>
<td>Chemicals used in the production process of a product.</td>
</tr>
<tr>
<td>production recycling</td>
<td>Recycling of waste in the production process of a product.</td>
</tr>
<tr>
<td>production material efficiency</td>
<td>Amount of material used in the production process of a product.</td>
</tr>
<tr>
<td>environmental effects of transport per km</td>
<td>Environmental effects of transport specific only to the type of transport (flight/boat/truck/train etc.), emissions and/or energy use per transport km.</td>
</tr>
<tr>
<td>vehicle drive distance in service/work contracts</td>
<td>Vehicle drive distances in performing service or work contract.</td>
</tr>
<tr>
<td>environmental effects of transport</td>
<td>Environmental effects of transport specific to both the transport distance and unit emissions/energy use.**</td>
</tr>
<tr>
<td>transport distance of products</td>
<td>Transport distance of products.**</td>
</tr>
</tbody>
</table>

The following criteria should be presented in selection criteria, but in practice they have often been presented in award criteria, and that is why are also recorded here:

| EMM, specified environmental management measures | Specified environmental management measures (dealing with waste collection, proper use of chemicals, etc.). |
| environmental policy | Environmental policy. |
| environmental programme | Environmental programme. |
| EMS | Environmental management system. |
| EMM of subcontractors | Specified environmental management measures of subcontractors. |
| environmental training and knowledge | Training of personnel concerning the environmental aspects in their work and/or related knowledge of personnel. |
| other, well-defined | |
| other, not well-defined | |

**Contract clauses**

| recycling/reuse system | Contract clauses require existing recycling or reuse system for the product. |
| package recycling/reuse system | Contract clauses require existing recycling or reuse system for the package. |
**Environmental criteria in public procurement – Focus on tender documents**

<table>
<thead>
<tr>
<th>Recycling/Reuse Service</th>
<th>Contract clauses require that the supplier takes care of product collection and recycling when it becomes waste.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package Recycling/Reuse Service</td>
<td>Contract clauses require that the supplier takes care of package collection and recycling as well as delivering the product.</td>
</tr>
<tr>
<td>Reused Packages</td>
<td>Contract clauses require that supplier uses reusable packages and takes them away when delivering the product.</td>
</tr>
<tr>
<td>Reporting and Monitoring of Environmental Data</td>
<td>Contract clauses require that the supplier and manufacturer records and monitors and reports, e.g. energy use, possible emissions to water and air, as well as waste amounts.</td>
</tr>
<tr>
<td>Other, Well-Defined</td>
<td></td>
</tr>
<tr>
<td>Other, Not Well-Defined</td>
<td></td>
</tr>
</tbody>
</table>

* Concerning products with regard to which a recycling system exists in any part of the three Nordic countries (Finland, Sweden and Denmark).

** These criteria can be contradictory to the EU procurement law, which states that only requirements having a link to the subject matter of the contract can be taken into account in the technical specifications and award criteria.

### 3.2.2 Green Public Purchasing - record method

The analysis of the green purchasing criteria is expanded in this thesis to measure the progress in GPP between the years, referred to as the GPP - record method (Figure 2). In addition to the analysis of calls for tenders, i.e. collection of the empirical material and examining the existence of environmental criteria (and assessing whether each criteria is well-defined or not) and recording the criteria found, three other subtasks are added: assessing the apparent greenness of product groups, analysis of the statistical significances of the apparent differences between countries and years, and presenting the results of the green calls for tenders in each country as well as the progress from one year to the next (Article II and Figure 2).

Calls for tenders are classified into product groups based on the CPV numbers given in each call for tender, due to the fact that the product groups differ with respect to their apparent greenness. For example, good sets of environmental criteria for paper products are offered by eco-labels (e.g. Nordic Swan and EU Flower) and by GPP web tools. On the other hand, there are no criteria sets for services such as insurance. Consequently, there are considerable differences between the product groups with respect to their eco-labels and other bases for green purchase, and the proportion of green calls for tenders varies between the product groups. The ‘apparent greenness of product groups in public purchasing’ respective to each product group is assessed on two basis. First, whether environmental criteria exist for the product group, either in eco-labels or GPP web tools

**Figure 2.** The GPP record method for measuring the environmental soundness of public purchasing (Article II).
(with a view to the European eco-label and Nordic Swan eco-label as well as the GPP web tools). If yes, the apparent greenness of such product group is at least on the medium level. If not, it is at a low level. If environmental criteria exist for the product group, the next step is to check whether there are well-known (e.g. eco-labeled) ‘green’ products fulfilling the environmental criteria on the market. If yes, the value of apparent greenness is at a high level. A rationale for this is that if such products existed on the market, this would increase the apparent greenness of the product group in the eyes of purchasers.

Generally, the non-existence of eco-label criteria for a product group does not necessarily mean that the environmental performance of the products in this group is poor. For example, the development process of eco-label criteria for a certain product group may confront opposition and blocks across the industry, and thus the eco-label will not obtain validity, though there would be potential eco-label criteria for such a product group (Nadaï, 1999). For some reason, there may be green products on the market in product groups with existing eco-label criteria but no eco-labeled products. However, this method tries to develop an indicator that would reflect the greenness as seen by the public purchaser and assumes that the existing environmental criteria and eco-labeled products would serve as a basis for such an indicator.

The statistical analysis in article II is carried out using logit models, where the effects of the explanatory factors are summarized as odds ratios (Collet, 1991). This method is applicable to the sample due to the fact that each of the individual findings can be categorized in one of the given groups, i.e. ‘green’ or ‘non-green’ tenders. The odds ratio is the ratio of the odds of a condition occurring in one group to the odds of it occurring in another group.

Example of odds ratio (applied and modified from Westergren et al., 2001):

If the probabilities of the condition in each of the groups are \( p/(1-p1) \) (first group) and \( q/(1-q1) \) (second group), then the odds ratio (OR) is:
\[
\frac{(p1 * (p1+p2))}{(p2 * (p2+p1))} / \frac{(q1 * (q1+q2))}{(q2 * (q2+q1))}
\]
\[
= \frac{(p1 / p2)}{(q1 / q2)}
\]
\[
= p1q2 / p2q1
\]

<table>
<thead>
<tr>
<th>Table 2. Example of odds ratios.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>Group 1</td>
</tr>
<tr>
<td>Group 2</td>
</tr>
</tbody>
</table>

Odds of group 1 = 100/120 = 0.83333
Odds of group 2 = 80/130 = 0.61538
OR = 1.35417 (Group 1 has an increased probability to be green compared to Group 2)

An odds ratio of 1 indicates that the condition under study is equally likely to occur in both groups. An odds ratio greater than 1 indicates that the condition is more likely to occur in the first group. Consequently, an odds ratio less than 1 indicates that the condition is less likely to occur in the first group. (Westergren et al., 2001). The odds ratio must be greater than or equal to zero if it is defined (Westergren et al., 2001; Collet, 1991; Rita, 2004).

In article II, the explanatory factors in the logit models are country, year and product group. The three countries (Denmark, Finland and Sweden) and the two years (2003 and 2005) are compared with respect to the proportion of green calls for tenders. As the product groups differ with respect to their apparent greenness, and as the distribution of calls for tenders into product groups vary between the countries, product group is also taken into account in the analyses. This enables the separation of the impact of country and product group as determinants of the proportion of green calls for tenders.
One part of the statistical analysis in article II is to calculate the statistical significance of the results. It is essential to examine that the condition (greenness of calls for tenders) has not arisen by chance due to the difference in product groups of three countries and two years. The p-value is the frequency or probability with which the observed condition would occur if the null hypothesis was true. If the obtained p-value is smaller than the significance level, then the null hypothesis is rejected. If \( p > 0.1 \), there is said to be no evidence to reject the null hypothesis, i.e. it is not statistically significant, whereas if \( p < 0.05 \) some statistical significance exist. Statistical significance is strong if the p-value is less than 0.01 but greater than 0.001, and overwhelming if \( p \leq 0.001 \).

Generally, the difference found in the data is statistically significant when its probability to occur by chance is less than 5%. (Collet, 1991, p. 26-29)

3.2.3 Life cycle assessment

Life cycle assessment (LCA) is a methodological framework for estimating and assessing the inputs, outputs and potential environmental impacts of a product system throughout its life cycle (ISO, 2006a). Environmental life cycle assessment is becoming an increasingly effective tool for determining ecological impacts (Hutchins and Sutherland, 2008). The goal of LCA is to identify and quantify environmental impacts of products and services, which then assists in comparing the environmental performance of products or services in order to choose the most environmentally preferable choice regarding e.g. climate change, tropospheric ozone formation, eutrophication, acidification, depletion of natural resources and human health impact. In public procurement, LCA could help to learn about the environmental aspects of the product, fulfill customer requirements, define environmental criteria for GPP and choose between alternatives (Hochschorner and Finnveden, 2006; Tarantini et al., 2011). More generally, life cycle assessment provides possibilities to introduce innovations as well as methods and systems where the performance requirements can also favour competition for environmental development (Sterner, 2002a). In this thesis, LCA was selected as a tool to measure the environmental impacts of tenders because it provides the best framework for assessing the potential environmental impacts of products, and thus is an important tool supporting IPP (European Commission, 2003b). In article III, LCA is conducted in order to analyze the environmental impacts of three competing tenders. In article IV, the potential of environmental award criteria based on eco-labels is assessed, and in article V, the use of LCA-based environmental criteria in the actual purchase of road construction is analyzed and discussed.

In article III, life cycle assessment is carried out by following the LCA framework provided in the ISO 14040 and ISO 14044 standards (ISO, 2006a; ISO, 2006b). The main stages include the definition of goal and scope, life cycle inventory analysis, impacts assessment and interpretation of results. The inventory analysis in article III is based on the data from an Environmental Product Declaration (EPD) Calculator (www.volvo.com/trucks), which provides the exact inventory data, i.e. the emission end energy consumption rates for the three competing tenders. The EPD Calculator is an environmental impact calculation programme developed by the Swedish truck manufacturer Volvo, in which the environmental data is based on LCA screening studies on the relevant trucks and parts, carried out during product development as well as later (Mårtensson, 2008). The European Commission DG Environment has evaluated several EPD schemes, and has designated the Volvo EPDs (e.g. Volvo Cars EPD and Volvo Trucks EPD) as among those EPD schemes that fulfilled a number of selection criteria derived from the standard ISO TR 14025 (Environmental labels and declarations – Type III environmental declarations): e.g. the life cycle

---

64 Null hypothesis is the description of data treated as valid unless the actual analysis of the data contradicts this assumption, e.g. assumption that no variation occur in the data (See: Collet, 1991, p. 26).

65 Eco-label criteria are based on the scientific method of LCA.
basis is in conformity with the ISO 14040 (Environmental management – Life cycle assessment) series (Bogeskär et al., 2002).

The impacts assessment phase includes the selection of impact categories, classification, characterization, normalization and weighting. In article III, characterization factors for emissions in each impact category are taken from earlier studies, i.e. characterization factors for climate change, eutrophication, acidification and depletion of tropospheric ozone (referred to in Nissinen et al., 2007) and for human health impact (van Zelm et al., 2008 and Krewitt et al., 2001). Characterization factors for the European region (van Zelm et al., 2008) are adjusted with the country-specific damage factors (YOLL per kt of pollutant) for Sweden (Krewitt et al., 2001), so that the variation in impacts resulting from the same tonne of pollutant emitted in various regions with varying population distributions would be eliminated. For example, the PM$_{10}$ damage factor (YOLL per kt) for Sweden is 7.3 compared to the EU-15 average of 56.7 (Krewitt et al., 2001). For the purposes of normalization, the reference value for the impact categories is calculated on the basis of the total Swedish emissions and energy use in 2006 (Statistic Centralbyrå, 2008; Energy Information Administration, 2008). Weights are based on Seppälä et al. (2009).

3.2.4 Environmental cost calculation

Environmental cost calculation method is used to calculate the monetary costs of environmental impacts of tenders (Article III). The environmental loads that resulted in the inventory phase of the LCA (by the Volvo EPD Calculator) are monetized as based on a method proposed by the EU Commission’s Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles, which aims at promoting and stimulating the market for clean and energy-efficient vehicles and improving the contribution of the transport sector to the environment, climate and energy policies of the Community.

The directive establishes a harmonized methodology for calculating the lifetime cost of pollutant emissions and fuel consumption, in order to monetize the environmental impacts for inclusion in the purchasing decision. This calculation method enables comparison of the performance of vehicles under the categories of energy consumption, CO$_2$ emissions, NOx, PM and NMHC emissions, which together make up the total operational costs. It also enables comparison on the basis of total lifetime costs plus the initial capital cost of a vehicle$^{66}$. The calculation highlights the relative strengths and weaknesses between different vehicles, which may help to make the purchasing decision. However, for the transportation services, the cost calculation method provides the cost of energy consumption doubled, considering that the cost of fuel is already included in the bid price. Thus, this method is appropriate as such in the purchase of a vehicle, but for the purchase of transportation services it may need some adjustment, e.g. including only the costs of emissions. Complementary to the legislation on Euro norms, which sets maximum emission limits, this approach monetizes the actual pollutant emission and does not require any additional standard setting.$^{67}$ However, the directive does not comment on the weights that the environmental impacts should have in the final decision.

According to the directive 2009/33/EC, the lifetime cost of energy consumption for the operation of a vehicle can be calculated by multiplying the lifetime mileage by the energy consumption per km and by the cost per unit of energy, i.e. per unit of diesel (or petrol) before tax. The lifetime cost for the CO$_2$ emissions resulting from vehicle operation is obtained by multiplying the lifetime mileage by the CO$_2$ emissions in kg/km and by the cost per kg. The lifetime cost of the pollutant emissions for the operation of a vehicle can be calculated by adding up the lifetime costs for NO$_x$,$^{66}$ Clean and energy-efficient vehicles initially have a higher price than conventional ones (Directive 2009/33/EC).

$^{67}$ Directive 2009/33/EC (20).
NMHC and PM emissions. The lifetime cost for each pollutant can be calculated by multiplying the lifetime mileage by the emissions in g/km and by the respective cost/g given in the Annex of the Directive 2009/33/EC.

3.2.5 Relevance – Potential – Steerability -measurement tool

In article IV, the contribution of environmental procurement criteria to environmental improvements of products, i.e. eco-design is discussed. Eco-design (or design for environment, DfE) is understood as “The integration of environmental aspects into the product development process, by balancing ecological and economic requirements. Eco-design considers environmental aspects at all stages of the product development process, striving for products which make the lowest possible environmental impact throughout the product life cycle” (European Environment Agency Glossary, 2009). Environmental product design can have a decisive effect on, e.g. material selection, product structure, the manufacturing and finishing techniques applied to the product, packaging and product labelling, the functional properties of a product and the efficiency of the end-of-life treatment (Kärnä, 2002).

The potential of environmental purchasing criteria to promote certain eco-design solutions is assessed in this thesis by using the RPS measurement tool (or RPS selection tool). The method was first developed to determine whether eco-labelling is a suitable instrument for a certain product group (Nordic Ecolabelling Steps, 2001). In the method, three dimensions, Relevance (R), Potential (P) and Steerability (S) of eco-label criteria are assessed. Relevance (R) is associated with the importance and scope of certain environmental impact of a product. Potential (P) refers to the possibilities and reality of manufacturers to reduce this environmental impact. The third dimension, steerability (S), measures the degree to which eco-label criteria can influence the environmental impact under assessment, i.e. is it possible to determine criteria that the manufacturers are able to fulfil and that can be verified from the product or production chain. (Nordic Ecolabelling Steps, 2001)

In this thesis, the relevance, potential and a steering effect of GPP criteria to product eco-design are assessed by this same method (Article IV, case furniture). The level of relevance (R) of each environmental criterion in the calls for tender is assessed on the basis of the importance and scope of the environmental impact, i.e. is there an environmental impact related to such criterion and how great is the impact? If so, then potential (P) is evaluated against the existing environmental improvements and experience of the technical solutions in the industry, i.e. can anything be done about the environmental impact within the near future? If yes, then the steerability (S) – the measurement of the degree to which GPP criteria can affect the environmental impact – is also assessed.

The RPS value (high, medium, low) for a product can be calculated by R x P x S. If, e.g. the product has high R but low P – indicating that the relevance of the environmental impact is remarkable but there does not exist a solution to the impact (there is a lack for alternative technological solution) – the RPS is low (Nordic Ecolabelling Steps, 2001). An example of high RPS is the energy consumption of a personal computer having high R and high P, and in addition, the criteria that would direct the product development towards a less energy-intensive direction has been developed and can easily be verified from the product; thus, the steerability is also high (Nissinen, 2004).

The assessment of green procurement criteria by RPS is descriptive in nature, and the availability of information determines how precise the assessment can be. In this thesis, the information to assess relevance (R) of environmental impacts of furniture is taken from scientific articles, databases and eco-labelling criteria documents. Eco-label information is comprehensive due to the extensive research and testing of the furniture in its life-cycle in the labelling scheme. The relevance is considered high or medium based on whether eco-label criteria exist for the environmental aspect. The potential (P) and also the relevance (R) of environmental criteria were also
discussed and supported by a group of experts\cite{68}, who did have an insight to the latest developments in the industry. Steerability is expected to be high or medium if a certain criterion is included in the eco-label schemes. This represents an expression of the extent to which manufacturers are able to control their production (choice and documentation of subcontractors, processes, raw materials, etc.) (Nordic Ecolabelling Steps, 2001). Steerability of eco-label criteria is not, however, directly applicable to GPP criteria, since the restrictions of the public procurement directives can contribute to the steering effect of the criteria when used in GPP, and thus these restrictions are taken into consideration.

### 3.3 Collection of material

The empirical material for this thesis contains documents of tender competitions, i.e. calls for tenders and the subsequent contracts between the purchasers and winning bidders. In the collection of material, the calls for tenders were identified from the TED database\cite{69} in the order they were published during the collection period, and the organizations were asked to send the documents. Public organizations such as those of the central government as well as local authorities, bodies governed by public law and organizations from special sectors – e.g. public water and energy supply – were included.

The empirical material of the analysis in articles I and II covers 180 calls for tenders over EU-threshold values in Finland, Sweden, and Denmark (i.e. 60 from each country), the calls for tenders being published at the time interval 21.7. – 29.9. 2005. For the comparison of the years of 2003 and 2005 (Article II), also the material for the year 2003 that was used in Kippo-Edlund et al. (2005) was re-analyzed\cite{70}.

The material of the analysis in article VI covers 156 document sets, i.e. calls for tenders with subsequent public procurement contracts between the purchasers and winning bidders. The first part, i.e. 78 sets of documents, were collected regarding calls for tenders that were published between April and September 2005, and the second part, i.e. another 78 sets of documents, were collected regarding calls for tenders that were published between May and October 2007 in the TED database.

In articles III, IV and V, the data from actual procurement cases is analyzed in more detail. The cases represent the different categories of purchases, i.e. products (furniture), services (goods transportation) and works (construction). These groups were selected for deeper analysis, as they contribute to the particularly important sectors\cite{71} that could stimulate the supply of greener purchases (European Commission, 2008c). The case study in article III concerns a procurement of a goods transportation service in a Swedish municipality in 2006, and it was selected as based on two specific conditions: environmental aspects were included as award criteria and the award decision was based on the most economically advantageous tender. The material for article III consists of the call for tender and three bids that participated in the tender competition. Additional

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\[68\] The Finnish furniture panel, a group of 20 members including experts in the furniture industry, retailing, recycling, purchasing, furniture testing laboratories, etc. (Nissinen and Parikka, 2007). Members of the panel were consistent in their view about the importance and scope of certain environmental impact.

\[69\] Available at: http://ted.publications.eu.int. TED (Tenders Electronic Daily) is an electronic database that contains all active calls for tenders published in the Official Journal (OJ S), and in addition gives access to the OJ S archives for the past five years (Europa Publications Office, 2007). The Supplement to the Official Journal (OJ S) includes calls for tenders for products, services and works meeting specific threshold values according to the procurement directives that must be informed throughout the European Union.

\[70\] The sampling period for the year 2003 had included two weeks in March and two weeks in May (Kippo-Edlund et al., 2005).

\[71\] In certain sectors, such as construction, transport, office equipment and cleaning services, public purchasers could give strong signals to the marketplace by asking for greener goods, thereby stimulating the supply of more environmentally friendly goods and services (European Commission, 2008c, p. 3).
information was obtained from the purchaser and bidders from their internal data sources, e.g. environmental reports. This additional data was requested by email or phone conversations, and received by email.

Material for article IV consists of calls for tenders concerning office furniture. A total of 40 calls for tenders of furniture during the time period 10. November 2005 – 31. January 2006 from Finland and Sweden were identified in the TED database and requested by email, 31 of which were received, covering 15 calls for tenders from Finland and 16 from Sweden.

The case analyzed in article V represents an example of purchase of construction work. The article is an analysis of the road construction procurement project known as ‘The improvement of Highway 9 between the towns of Turku and Lieto’, also known as the ‘Highway 9’ –pilot project, carried out in the year 2004 by the Finnish Road Administration (Finnra). This specific case was selected in order to assess the use of environmental award criteria that were based on life cycle assessment of road construction work.

Table 3. Summary of material collection and research methods.

<table>
<thead>
<tr>
<th>Articles</th>
<th>Sources of primary data</th>
<th>Research methods</th>
<th>Nature of the outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article I</td>
<td>- Calls for tenders (TED database)</td>
<td>Analysis of calls for tenders (Ch. 3, Sec. 3.2.1)</td>
<td>Qualitative and quantitative information on the use of GPP criteria and the content of the most economically advantageous tender. Comparison between Finland, Sweden and Denmark.</td>
</tr>
<tr>
<td>Article II</td>
<td>- Calls for tenders (TED database) - Kippo-Edlund et al., 2005</td>
<td>Analysis of calls for tenders (Ch. 3, Sec. 3.2.1) GPP –record method (Ch. 3, Sec. 3.2.2): - assessing apparent greenness (eco-labels) - statistical analyses (logit models)</td>
<td>Quantitative information on the use of green purchasing criteria during the years 2003 and 2005. Statistic significance of the differences in green purchasing criteria between countries (Finland, Sweden, Denmark), years (2003 and 2005) and different product groups.</td>
</tr>
<tr>
<td>Article III</td>
<td>- Call for tender and three tenders - EPD (Volvo) - Swedish Statistics Central - Scientific articles (e.g. Seppälä et al., 2009; van Zelm et al., 2008; Nissinen et al., 2007; Krewitt et al, 2001)</td>
<td>Case study on a single purchase: - LCA (including EPD Calculator -tool) (Ch. 3, Sec. 3.2.3) - Environmental cost calculation method (Ch. 3, Sec. 3.2.4)</td>
<td>Numeric rates for environmental impacts, calculated by LCA and costs of environmental impacts. Discussion on the contribution of different measurements of environmental impacts to the ranking of the most economically advantageous tender.</td>
</tr>
<tr>
<td>Article IV</td>
<td>- Calls for tenders (TED database) - Eco-label criteria - Scientific articles, (e.g. van Hemel and Cramer, 2002; Besch, 2005)</td>
<td>Case study on purchases of a certain product group: - Analysis of calls for tenders (Ch. 3, Sec. 3.2.1) - RPS method (Ch.3, Sec. 3.2.5) - Analysis of legal aspects (Ch. 3, in Sec. 3.2)</td>
<td>Descriptive qualitative assessment of the potential, relevance and steerability of GPP criteria to promote eco-design of products.</td>
</tr>
<tr>
<td>Article V</td>
<td>- Call for tender - LCA data (Korkiala-Tanttu et al., 2005)</td>
<td>Case study on a single purchase: - Analysis of legal aspects (Ch. 3, in Sec. 3.2)</td>
<td>Qualitative analysis on the use of certain environmental criteria in the award process.</td>
</tr>
<tr>
<td>Article VI</td>
<td>- Calls for tenders (TED database) - Final contracts</td>
<td>- Analysis of calls for tenders and contracts (Ch. 3, Sec. 3.2.1) - Analysis of legal aspects (Ch. 3, in Sec. 3.2)</td>
<td>Quantitative information on the existing environmental criteria in the calls for tenders and contracts. Qualitative assessment of the applicability of environmental clauses and comprehensiveness and enforceability of drafted terms. Comparison between Finland and Sweden.</td>
</tr>
</tbody>
</table>
4 Results

4.1 Environmental award criteria in public procurement

The content of the most economically advantageous tender and environmental award criteria as a part of it were examined in article I. In the tender documents (from Finland, Sweden and Denmark in 2005), about 90% of the procurement decisions were based on the most economically advantageous tender, one third of which included environmental criteria. The weight for environmental award points was about 5%, the highest weight being 20%. As proportioned to the total sample, the average weight for green criteria in the award decisions was only 3.3%. The dominant award criteria were price (51% of weight) and quality (37% of weight) leaving less weight to delivery terms (7%) and social issues (1.7%).

Environmental award criteria that were often used included environmental policy, environmental management system, material choice, chemical content, guarantee, recycling and reuse system (Table 4). However, the use of environmental criteria varied between product groups. They were more often presented for product groups such as transportation services, vehicles, paper products, cleaning services, office machines and furniture, construction works and chemical products. It is evident that for product groups like education or consultancy services, health and social services and many IT-related services such as software, there have not been obvious existing environmental criteria, which was reflected in the low number of environmental criteria found in these product groups.72

4.2 Progress in the use of environmental purchasing criteria

A purchase can be green even if environmental aspects among the award criteria did not exist. In these cases, environmental criteria may be written into the description of the contract, technical specifications, selection criteria or contract clauses. Taken these into account, 55% of the Finnish and 80% of the Swedish calls for tenders included some kind of environmental criteria in the year 2005.73 This data was used in article II, where the ‘greenness’ of public procurement in Finland, Sweden and Denmark was compared to an earlier study from the year 2003 (Kippo-Edlund et al., 2005) to measure the progress in GPP before and after the issuing of the new procurement directives (in 2004).

In 2003, there were significantly (p < 0.05) more environmental criteria in the calls for tenders in Denmark and Sweden than in Finland, and this difference was even clearer when the analysis for product groups was done, i.e. taking into account the distribution of the calls for tenders into product groups with different apparent greenness. In 2005, the Swedish calls for tender were ‘greener’ than the Finnish ones, but there was no longer any significant difference between Finland and Denmark. Looking at the comparison of the years 2003 and 2005, i.e. the progress in ‘greenness’, both Finland and Sweden showed an increase in the use of environmental criteria, but Denmark did not. In Table 5, the values of odds ratio above one indicate the increase in probability of a green call for tender; values below it, decrease.

72 However, the situation may change when the relations between greenhouse gas emissions of buildings and production of services are more generally understood.
73 Respectively, the average rate for the EU was 45% (Bouwer et al., 2005).
Environmental criteria in public procurement – Focus on tender documents

Table 4. Environmental award criteria in the calls for tenders (N=162)

<table>
<thead>
<tr>
<th>Environmental award criteria</th>
<th>Finland n_E,FI=53</th>
<th>Sweden n_E,SE=54</th>
<th>Denmark n_E,DK=55</th>
<th>N=162</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental policy</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Environmental management system</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Other: Environmental issues (not well-defined criteria)</td>
<td>7</td>
<td>1</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>EU eco-label or other eco-label</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Chemical content</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Recycling / reuse system</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Packaging material</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Noise</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Environmental programme</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Material choice</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Machine norm or standard</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Energy use</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Environmental certificates</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Environmental training (Eco-driving)</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Recyclable</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Fuel, hydraulic oil, spare parts</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Environmental management of subcontractors</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Environmental training and knowledge</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Regular information about environmental issues</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Recycled material</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>“Environmental class” of the product</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Environmental laws</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Environmental reporting</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Actions towards environmental protection</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Specified environment management measures</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Biogas, ethanol, electricity or hybrid</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Information on the material used for certain purposes</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>LCA-based EPD</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Production energy</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Production recycling</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Production chemicals</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Criteria that were also checked but not found in the award criteria of the tenders:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emissions to air or water</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Material amount</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Package recycling / reuse system</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Recyclable package</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Criteria-based EPD</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Environmental impact assessment</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Production emissions</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Production material efficiency</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Environmental effects of transport per km</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vehicle drive distance in service / work contracts</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Environmental effects of transport</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Transport distance of products</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*) Total sample: 180 calls for tenders in 90% (162) of which the purchasing decision was based on the most economically advantageous tender.
Table 5. Comparison of countries and years with respect to the proportion of green calls for tender among all calls for tender, using a logit model with the proportion of green calls for tender as response (Article II).

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Adjustment for product category distribution</th>
<th>Comparison of countries</th>
<th>Comparison of years&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
<td>No</td>
<td>1.00&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.00&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>Yes</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Finland</td>
<td></td>
<td></td>
<td></td>
<td>3.36*</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td></td>
<td>3.94*</td>
<td>5.21*</td>
</tr>
<tr>
<td>Sweden</td>
<td></td>
<td></td>
<td>3.81*</td>
<td>5.29*</td>
</tr>
</tbody>
</table>

1 Denmark and Sweden are compared to Finland.
2 2005 is compared to 2003.
* The comparison (between countries or years) is statistically significant, p < 0.05.

4.3 Most economically advantageous tender and determination of the environmental impacts

In article III, the contribution of different measurements of environmental impacts to the ranking of the most economically advantageous tender was examined. A comprehensive LCA study and a cost calculation method (Directive 2009/33/EC) were conducted to see how close in ‘greenness’ the competing tenders actually were. The cost calculation method was used in two ways: firstly, to calculate the costs of energy and emissions and secondly, only the costs of emissions. The case study of a transport service indicated that the difference in the environmental impacts between the three competing tenders was, in reality, not as great as the purchaser had experienced by using his own equation for environmental award points. In the actual procurement case, the purchaser awarded only the ‘greenest’ option highly for environmental award points, giving the two others only half of that or zero environmental award points. However, these two tenders were quite close to the greenest one in environmental impacts when the award points were calculated by the LCA and cost calculation method.

The most economically advantageous tender was defined by the purchaser, consisting of only two award criteria: bid price with 70% weight and environment with 30% weight. In the case study, the winning bid (A) was the most economically advantageous tender whatever the method of calculating the environmental award points was, whereas the order of tenders B and C would have changed according to which method was used for the calculation of environmental award points (Table 6).

Table 6. The ranking of the most economically advantageous tender, i.e. award points of bids determined by three different methods regarding environmental impacts.

<table>
<thead>
<tr>
<th>Tender</th>
<th>Purchaser’s award system</th>
<th>LCA</th>
<th>Cost calculation method (Directive 2009/33/EC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cost of energy and emissions (€)</td>
<td>Cost of emissions (€)</td>
</tr>
<tr>
<td>A</td>
<td>85</td>
<td>87.03</td>
<td>97.5</td>
</tr>
<tr>
<td>B</td>
<td>79.63</td>
<td>66.98</td>
<td>75.97</td>
</tr>
<tr>
<td>C</td>
<td>57.30</td>
<td>70.44</td>
<td>80.05</td>
</tr>
</tbody>
</table>

In article III, the application of LCA in the transportation service clearly showed the most important environmental impacts of the service, which the procuring authority should focus on, i.e. set the award criteria so that they promote fuel savings and cleaner vehicles. The LCA showed that climate
change impact was the most important environmental aspect, followed by the health effect caused by primary (PM10) and secondary particles (affected by NOx). It appeared that fuel consumption was the most important factor influencing the results of LCA, in addition to emissions of NOx and PM. The results also indicated that relatively small actions, such as eco-driving and the selection of a reasonable vehicle for a certain purpose as well as the requirements for new technology, could have a significant effect on the environmental impacts of the service – e.g. the eco-driving component would have lead to about 10–13% less environmental impacts.

The results of the environmental impact assessment showed that tenders A and B were the most environmentally preferable choices; winning bid A having only 2% more environmental impacts than tender B, whereas tender C clearly showed more environmental impacts (Figure 3). Compared to tender C, the environmental impacts of ‘best practice’ – i.e. the Euro 5 truck – would be approximately 44%. During its one-year operation, tender A would cause about 0.000005% of total annual environmental impacts in Sweden (Figure 3).

The awarding system that the purchaser used for calculating environmental impacts had, of course, a major impact on ranking the tenders according to their ‘greenness’, giving a high environmental preference to tender B, which indeed was shown to be the most environmentally preferable, also by reference to the LCA and environmental cost calculation method. However, the weight for bid price turned the alternative A as the most economically advantageous. The analysis of the weights showed that the weight for environmental award points should be meaningful; the 30% weighting, although high, did not have an impact on the order of superiority in the actual case. The weight for the environment should have been about 37% in order to change the ranking of tenders in the actual competition in favour of tender B.

Figure 3. Environmental impact assessment of the tenders and a reference vehicle, Euro 5.

A hypothetical ‘best practice’ case concerning the environment (the Euro 5 truck) based on the trucks meeting Euro 5 norms as available on the market which could, in principle, be used for such services was determined, in order to compare the results of the tenders.

In many transportation service contracts, weight for environment is below 10% (Palmujoki, 2007). Also, if the monetized environmental costs are proportioned to the bid prices of the tenders, it shows that the share of environmental costs is only 10–13% of the bid price, which is low compared to the actual weighting of 30%.
4.4 Justification and applicability of LCA-based environmental criteria to public procurement

Life cycle assessment, as a scientifically grounded method to identify the most important environmental aspects to be awarded in the tender competition, was applied and analyzed through case studies in articles III, IV and V. In article III, the application of LCA in the transportation service clearly showed the usefulness of LCA as finding out the most important environmental impacts of the purchase which the procuring authority should focus on (Chapter 4, Section 4.3). In addition, in article IV, the applicability of LCA-based criteria (i.e. eco-label criteria) for furniture were analyzed from the viewpoint of procurement rules, and the results are presented in Chapter 4, Section 4.5 in more detail, whilst also discussing their supportiveness for eco-design strategies.

In article V, the use of LCA-based environmental criteria in road construction procurement was focused. In the centre of the debate was transport distance, which was used among the award criteria in this specific case. Several LCAs have been carried out to assess the environmental impacts related to road construction (e.g. Mroueh et al., 2001, Stripple, 2001, Olsson et al., 2006, Eskola et al., 1999 and Pereira et al., 1998), which all show the significance of the environmental impacts of transportation in road construction works, i.e. the emissions and energy consumption. However, it has been considered that transport distance cannot be taken into account in the evaluation of tenders as such, because it could be regarded as a discriminatory criterion (European Commission, 2004a). According to the Treaty principles of free movement of goods and services and the principle of non-discrimination, the purchasing authorities are not free to impose requirements, e.g. on transportation, unless they think carefully about their linking to the subject matter of the contract (Directive 2004/18/EC).

In the analysis of the road construction case (Article V), it was considered that in a large construction work project, the origin of bidders and the transport distances of materials are not directly linked to each other. Due to the high costs of transportation (Infra, 2004), it seems obvious that all the bidders – regardless of the location of the company – would use the shortest possible distance to provide the aggregate and other materials and, if possible, prefer to use materials that are from the region nearby if the criteria for materials is not strictly imposed in the contract. Transport distance is thus important not only from the environmental point of view but also from the economic perspective.

It was considered in article V that the transport distance was an acceptable criterion in this case, as the environmental award criteria were based on a scientific method LCA and transport distance was an essential component in it, and thus could not be excluded from the assessment. The rationale for this was that the focus was not actually on the transport distance but on the units that were used for the environmental loads of modes of transport. However, it could be recommendable not to state ‘transport distance’ as such in the award criteria, but rather to include transport distance in the calculation of the environmental impacts of transportation by asking for the data for the determinants of the environmental impacts of the transport in the work contract, i.e. data on transport distance, mode of transport and type of vehicle, and the units of environmental load for these. For example, by using CO$_2$ emissions as a criterion, the idle time of trucks and machinery would also be included in the assessment.

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4.5 Green public procurement as a promoter of eco-design

Paper IV analyzed (as a case study of furniture) to which extent the most important characteristics of environmentally sound furniture were taken into account in procurement criteria, and whether the environmental criteria found in the calls for tenders were relevant from the perspective of eco-design strategies (defined by van Hemel and Cramer, 2002; Besch, 2005) (Figure 4).

Environmental criteria in the calls for tenders of office furniture fell into three main categories, covering product-related criteria, corporate level environmental performance and recycling facilities. In the calls for tenders, green criteria focused on the toxicity of furniture, e.g. the use of fewer chemicals in the furniture, and the use of chemicals that are less damaging to health and environment. In addition, reducing the depletion of natural resources was focused. Requirements on these aspects seemed to support eco-design strategies such as the ‘selection of low-impact materials’, ‘optimization of lifetime’ and ‘waste management optimization’. As assessed by the RPS tool, these environmental impacts were relevant, also having the potential to be influenced through new technological solutions, and steerability by eco-labels and standards. However, if only one (or few) suppliers that are able to provide the required technology exist, this may become an obstacle from the discriminatory point of view, and thus is not legally trouble-free in every case.

There are also eco-design strategies related to the production processes and distribution of furniture that GPP cannot support at the moment. Although these are aspects with high relevance and potential, they now have fairly low steerability by GPP. Due to the fact that the criteria must be product-specific (Directives 2004/18/EC and 2004/17/EC), only requirements that have a link to the subject matter of the contract can be taken into account in the technical specifications and award criteria, and thus issues promoting eco-design strategies but defined rather loosely – such as ‘optimization of production techniques’ and ‘distribution optimization’ – cannot be directly steered by GPP. Although there are some furniture eco-label criteria for production processes, it is not straightforward to what extent the production processes can be taken into account in the procurement of furniture.

None of the criteria existed in the calls for tenders that would pose requirements for the distribution either. Setting criteria concerning the transportation distance could be regarded as discriminatory. Criteria for the company’s logistics systems can only be used if the logistics is a main part of the service. It could be possible to add contract clauses concerning the method of delivery: however, this requires taking into consideration the non-discrimination of various suppliers (European Commission, 2004a).

The appearance of environmental procurement criteria in the calls for tenders can make positive contributions to the design and manufacturing of environmentally improved products in the furniture industry. The successful promotion of eco-design by GPP requires, however, that the green criteria presented in the calls for tenders are relevant with respect to environmental impact and that they may have influence on the impact. The RPS selection tool seemed to be an appropriate way to assess the relevance, potential and steerability of the criteria in the calls for tenders. The assessment showed that though there are comprehensive eco-label criteria for furniture, all the criteria may not have similar steerability if presented as GPP criteria. In GPP, the steerability was low, e.g. for the criteria concerning distribution and production processes. In addition, environmental criteria presented in the calls for tenders must be well-defined, and a proof of fulfilment of the criteria should be required: otherwise, the environmental requirements may not be understood and documented by the bidder, and the criteria will not gain a desired effect.
### 4.6 Use of contract clauses in green public procurement

The material studied in article VI implied that the use of environmental criteria in public procurement contracts has increased to a certain extent between 2005 and 2007, being more common in the Swedish procurement contracts as compared to the Finnish ones. In 2005, only about half of the ‘green’ purchases\(^7\) included environmental criteria in the contract clauses as well; whereas in 2007 the rate was approximately two thirds. Especially in the procurement of transportation services, Swedish purchasers used environmental criteria almost without exception. Still, the use of environmental criteria only in calls for tenders remains a much more common practice than stipulating them in the contract clauses, too.

The examined contract clauses differed from each other, especially in their accuracy. One distinctive feature between the countries (Finland and Sweden) was that the environmental criteria stipulated in the Swedish calls for tenders and final contracts were set out in more detail. From a contract law point of view, the transport related contracts, in particular, were comprehensive and skillfully drafted so that the procurement authorities would be able to ensure in most circumstances that the agreed environmental criteria would be met. On the other hand, many of the analyzed

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\(^7\) i.e. purchases that include environmental criteria in the calls for tenders.
procurement contracts stipulated that the contractor must comply in all activities with the prevailing environmental laws. For example, several contracts included referrals to the procuring municipalities’ own environmental programmes, without clear stipulation with regard to the extent to which the environmental programme should be followed.

The enforceability of environmental terms and conditions in procurement contracts was also examined to discover whether the agreed environmental criteria could be supervised by the procuring authority and could, in such terms, be effectively enforced in the case of a breach of contract. In this respect, many terms and conditions regarding environmental criteria in the procurement contracts were vague. In many cases, the procurement authority had not reserved the right to inspect the compliance with the agreed environmental criteria. However, few contracts in which the option to monitor and inspect the activities of the contractors was included also had clearly drafted contract terms according to which the contractor was obliged to pay liquidated damages if there was a breach of the environmental criteria it had agreed upon. The amount of the liquidated damages varied between 500 - 1000 €, which seems, in terms of the principle of proportionality, a reasonable amount to ensure compliance. This kind of formulation of procurement contract enables the procurement authority to react to possible breaches of contract with efficient means – since with a preset sanction, the procurement authority does not have to deal with the frequently difficult question of the assessment of damages caused by a breach of contract.

Breach of environmental criteria may not cause any direct damages to the procuring authority, so claiming for damages or even verifying a breach of contract might prove to be a difficult exercise, since such a breach could be considered insignificant from the procurement authority’s point of view. In this case, the question relates to defining a disruption in execution: can the contract be considered correctly fulfilled, even if the execution differs somewhat from the description of obligations? Finnish contract law and jurisprudence, for example, does not expect perfect performance in fulfilling the contract. If the performance of the contractor is flawless in its detectable qualities but the environmental criteria of the manufacturing process have not been met, it can be argued with merit that the contractor has nevertheless delivered the agreed goods or services, and the failure to comply with the agreed environmental criteria is a secondary concern and thus can in some cases be considered insignificant or irrelevant from the buyer’s point of view. This might well be the case when the procurement authority cannot provide any evidence that the possible breach has had any direct impacts.

Figure 5. Main research questions and some key results of the articles.

**Article I**
- 90% of decisions was based on the most economically advantageous tender in 2005.
- Green criteria were considered as part of the most economically advantageous tender in 1/3 of award decisions.
- Weight for green criteria was 5-20%.

**Article II**
- Progress in GPP was found in Finland and Sweden between 2003 and 2005.
- Year – country interaction was statistically significant.
- Adjustment for product groups was relevant for results.
- Logit models is a suitable tool to measure progress by comparing shares of green purchases.

**Article III**
- LCA and the cost calculation method gave more comprehensive results in awarding the tenders than the purchaser’s award system in relation to environmental impacts.
- Weight for environment should be significant in order to change the superiority of tenders.

**Article IV**
- 74% of furniture GPP criteria concern product and quality issues, e.g. chemicals durability, guarantee.
- GPP criteria could support eco-design strategies such as: ‘selection of low impact materials’, ‘optimization of life time’ and ‘waste management optimization’.

**Article V**
- Environmental impacts of transport play a crucial role for certain purchases, e.g. construction.
- Transport distance as an award criterion is not necessarily discriminative; in the case the focus is on the environmental loads of transport (not on the distance).

**Article VI**
- Green criteria are more common in calls for tender than in actual contracts.
- Green contract clauses are often general in nature.
- It might be difficult to show the consequences of a breach of environmental contract clauses and require compensation.
- Good examples: right to monitor regularly, moderate monetary sanction.
5 Discussion

Consensus that environmental objectives should be incorporated in public procurement may be relatively easy to achieve (Snider and Rendon, 2008). However, integrating green criteria into the most economically advantageous tender whilst obtaining adequately high quality purchases at a low cost and complying with the EC legal principles – notably of the free movement of goods and non-discrimination of the bidders as well as the overall limits of the procurement directives – may not be straightforward in practice. This thesis identifies the contexts – environment, economy and law – and illustrates the relations between them, highlighting the possibility of economical and green public purchases to be implemented in compliance with the EU procurement law.

5.1 Relation between environmental and legal aspects in public procurement

Studies of calls for tenders showed that the purchasing decision is frequently based on the most economically advantageous tender, which implies that there are expectations to also include environmental criteria into the award decision. This study supports the views of the previous studies on GPP (Kippo-Edlund et al., 2005; Bouwer et al., 2005 and PricewaterhouseCoopers, 2009a) that public purchasers in Finland and Sweden seek to consider environmental aspects quite often. Despite the difference between the research methods used in Bouwer et al. (2005), PricewaterhouseCoopers (2009b) and Renda et al. (2012), similar results can be found with regard to the top countries in the EU presenting most environmental criteria. Indeed, the countries studied in this thesis – Finland, Sweden and Denmark – are among the top seven EU countries in implementing elements of GPP, meaning that they consistently have more calls for tenders with green criteria than other EU countries (Bouwer et al., 2005; PricewaterhouseCoopers, 2009a; see also: Brammer and Walker, 2011). In addition, there has been a notable progress in the use of green criteria after the renewal of public procurement directives in 2004, especially in Finland and Sweden. The large increase in the proportion of green calls for tenders between the years 2003 and 2005 in Finland and Sweden seems logical, due to the active work and guiding efforts for GPP in these countries during that time period, supported by the EU Commission.

EU’s procurement directives require that public purchasers must specify the weights for price and other award criteria in advance. It can be easily agreed that the scoring system for the most economically advantageous tender must be published beforehand, but the question arises whether these scoring systems including weights will ensure effective bidding, i.e. provide competitive, transparent and optimal or best value tenders. In fact, it has been argued at least in the Swedish context that assigning values to quality characteristics is not the same as assigning weights and, in practice, it is not apparent how to design a good scoring rule (Lundberg and Bergman, 2011). Identifying suitable criteria and relevant weights, all of which are likely to vary as a function of many factors, is perhaps one of the most critical issues directly related to the procurement success (Watt et al., 2010). It is almost intuitive to think that the weight of each criterion reflects its relative importance (Mateus et al., 2010).

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80 In the recent survey on the GPP uptake in the EU-27 (Renda et al., 2012) Finland featured a relatively low GPP uptake compared to other ‘top countries’. However, due to the low response rate, these results have to be read with caution (Renda et al., 2012, p. iv, 40, 49).

81 The extent and nature of sustainable procurement practices varies significantly across regions internationally. For example, in Scandinavia, the emphasis is greater on environmental aspects of procurement whereas other areas of sustainable procurement are focused around the world being most developed among the UK organisations and in Eastern Europe (Brammer and Walker, 2011).
In many studied calls for tenders, though the important environmental criteria were found, the weighting for environmental criteria was fairly low, mostly below 10%.\textsuperscript{82} This relatively low weight makes it possible to win a contract without providing any environmental efforts.\textsuperscript{83} Also, in the analyzed case study, the environmental criteria had no influence on the order of superiority of the tenders, and the bid price dominated the results. Generally, as a result of the ‘lowest price dominance’, the long-term effects of a purchase may be overlooked by the short-term goal of achieving a low-cost purchase. On the other hand, this may also illustrate the difficulties that the purchaser faces when deciding upon the methods and weights to use for the evaluation of the tenders (Varnäs et al., 2009). The low weighting for environmental criteria also contributes to the implementation of the purchase, i.e. a breach of contract does not exist if it does not have a significant or substantial meaning to the buyer. If the environmental criteria have been awarded a 3 - 5% weighting in the evaluation of the tenders, such criteria could be regarded as secondary obligations in the procurement contract, which can be considered insignificant or irrelevant with respect to the contract. Thus, it is quite possible that, given a court case, such damages would not be compensated.

In principle, the environmental aspects of purchases should be defined by a detailed life cycle analysis or by using eco-label criteria (European Commission, 2008b; European Commission, 2003b; Siemens, 2003; Kunzlik, 2003). It is suggested that the relevance of eco-labels for green procurement will increase, and the possibilities of using eco-labelling in green purchasing in the public sector are evolving (Leire and Thidell, 2009). In addition, this study indicated that several GPP criteria could promote eco-design of products, and thus, consequently, certain eco-design criteria of products could be applicable as procurement criteria and lead to remarkable reductions in environmental impacts of purchased products. Due to the EuP Directive (2005/32/EC), there already are adopted eco-design implementing measures for 12 energy-using products, and eco-design preparation studies are being undertaken for other 10 energy-using products (European Commission, 2011f). In addition, there are efforts in many other industries to create eco-design measurements, for example in the automotive sector (Muñoz et al., 2006), fashion and textiles industry (Niinimäki, 2006) and furniture industry (Bovea and Vidal, 2004). These eco-design measurements – either formally implemented or still under preparation – could have a steering effect towards more environmentally sound products in the market when used as GPP criteria.

In the light of several EU directives, Community policies and schemes as well as national efforts, public purchasers are strongly encouraged to apply for more environmental criteria in their procurement. It is interesting to which extent the EU’s legal framework complies with this push to promote certain EU policies. At the moment, the public procurement directives underline the linking of each criterion to the subject matter of the contract, and the principles of non-discrimination and free movement of goods, which may still question the suitability of certain LCA-based environmental aspects to be used as purchasing criteria, notably criteria concerning transport distance and production process (Ekroos, 2008; Ekroos and Nissinen, 2007; Kunzlik, 2003; Arrowsmith and Kunzlik, 2009). However, in some cases, the most direct environmental benefit may come from focusing on environmental concerns that go beyond the legal requirements or regulations (Marron, 2003). Thus, these two very interesting legal issues in public procurement should not be avoided completely if purchasers seek to achieve most environmental benefits.

In this thesis, the transportation issue was discussed in more detail and it was seen as an acceptable criterion for certain purchases (i.e. construction work), as long as the true aim of setting such criterion was to obtain environmental targets instead of discrimination of bidders. Indeed, in

\textsuperscript{82} The Commission suggest that in order to be effective and give a clear signal to the market, the environmental award criterion needs to be given a significant weighting, for instance 15% (European Commission, 2008d, p.7).

\textsuperscript{83} However, quality was given a significant weight among the award criteria in the studied calls for tenders, and often a green product could be rated highly in quality performance as well and vice versa (see e.g. Manget et al., 2009).
the case of procurement of products the discriminatory nature of this criterion of environmental impacts of transportation can evidently be justified. But in a major construction work, the origin of bidders and the transport distances of materials are not directly linked to each other. It can also be considered that the transport distance was an essential component in the scientific method LCA which was used to determine the environmental impacts in the most economically advantageous tender, and thus could not be excluded from the assessment. Then the focus would not actually be on the transport distance but on the units that are used for the environmental loads of transport modes. Thus, a criterion referring directly to the distance travelled, rather than the actual environmental impacts of transportation, might not be acceptable. This conclusion is compliant with the statement that the linking of the criterion to the subject matter of the contract is specific to a single contract, and it should be made clear beforehand with explicit specifications in order to follow transparency in the procurement (Ekroos and Nissinen, 2007).

Nowadays, it seems that public procurement politics allow somewhat more widespread interpretations to implement the life cycle thinking into the most economically advantageous tender, especially the production related issues as far as they are relevant when defining the contract item from a life cycle perspective (European Commission, 2008b). The Commission has further clarified how to take the production process and other life cycle-based environmental impacts into account in the tendering process, by stating that all production process related criteria (of eco-labelling schemes for instance) can be considered as appropriate for defining a product in a tendering procedure provided that the criteria have to be measurable / verifiable so as to treat bidders in the same way and allow effective verification of bids against tender documents, and that the criteria concern the production of the products which are to be supplied to the purchasing authority (European Commission, 2011e; European Commission, 2011e84; European Commission, 2008f85; European Commission, 2008d). Arrowsmith and Kunzlik (2009) interpret the EC law even more widely, giving considerable flexibility to member states not merely to favour energy supplied from renewable sources but also to favour the purchase of products that are themselves made with green energy. For example, it is suggested that green energy measures are not solely production measures but relate to the characteristics of the product itself, and it is in the light of the integration principle86 that authorities sometimes consider the overall environmental impact of a product across all stages of its life when implementing environmental objectives through procurement (Arrowsmith, 2009, p. 173).

Except the analyzed case study of the Finnish road construction procurement, the purchasing criteria in the studied calls for tenders were formulated so that they were compliant with legal requirements. This means that the environmental criteria used in public purchases focus on those purchasing criteria that are undoubtedly covered by the directives, and thus the environmental award criteria are often based on the environmental performance of the use phase and exclude the production phase. For example, no contract was found that would have contained clearly legally conflicting environmental clauses. In addition, environmental criteria in the calls for tenders were often quite straightforward and easy to assess, i.e. asking for environmental programme or management system. It is somewhat questionable whether some of these criteria really make a difference in the environmental profile of the tenders and promote the award of greener choice. For example, in some cases, environmental policy was asked in the award criteria, and the bidders were awarded

84 In technical specifications and in award criteria, contracting authorities should be allowed to refer to a specific production process, a specific mode of provision or services, or a specific process for any other stage of the life cycle of a product or service, provided that they are linked to the subject-matter of the public contract (European Commission, 2011a, p. 10, 24, Article 40 in the proposal).

85 Stating that GPP is “a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured” (European Commission, 2008b, p. 4).

equally if only the environmental policy existed despite the contents and scope of it. Instead, the correct place for asking for the environmental policy would be in the selection criteria, and the award criteria could have been targeted to product or service features that could better progress the greenness of the purchase. This brings up the question as to whether or not green criteria will lead to any actual environmental benefits in many purchases. This is, however, considerably dependent on the product group in question. In this thesis, some of the studied purchasing documents were such that efforts to include environmental criteria into the purchasing criteria of these product groups would not necessarily lead to true environmental benefits or make the procurement more environmentally friendly, e.g. procurement of consulting or accounting, etc., not having apparent green criteria. However, there were also several product groups that concerned products or services with apparent environmental criteria, but in which the bid price was the decisive factor and environmental criteria were not included at all. This indicates that a great deal of unexploited greening potential still exist in the field of public procurement.

Overall, the criteria in the calls for tenders and contracts were such that they are not proactive enough to respond to the aim of more life-cycle based purchasing criteria underlined in the Community policies (e.g. European Commission, 2008b; European Commission, 2008d). Although the results of this study are in accordance with the numeric GPP target of the EU Commission that by the year 2010, 50% of all tendering procedures should be green (European Commission, 2008b) many of the environmental criteria in the examined calls for tenders, and especially in the contracts do not meet the quality requirements of the Commission’s target, i.e. they are not compliant with the common ‘core’ criteria defined by the Commission (see: European Commission, 2011e). Also, according to the most recent study on the uptake of GPP in the EU-27, only 26% of the last contracts (of the surveyed ten product/service groups) signed by public authorities included all the EU core GPP criteria. However, the percentage of last contracts that included at least one EU core GPP criterion was 55% (Renda et al., 2012).

Although the previous studies (Kippo-Edlund et al., 2005; Bouwer et al., 2005 and PricewaterhouseCoopers, 2009a) and the latest study (Renda et al., 2012) on GPP in the EU show that the use of environmental criteria is increasing, the uptake of EU GPP criteria varies significantly across the EU-27 countries as well as across product groups (Renda et al., 2012). Thus, it seems that public authorities need guidance and practical help to facilitate the GPP criteria. One challenge for the purchasers is to know what types of environmental information a supplier is able to provide; i.e. if criteria are too strict no suppliers are able to meet them, and if too low, these environmental requirements may loose credibility (Leire, 2009). In addition, some of the environmental criteria that are often presented in the calls for tenders, notably concerning chemical content, are already substantially addressed by legal regulations, and one could say that GPP criteria concerning them bring no extra benefit to the environment. However, these are not necessarily controlled at the moment, and thus it may be beneficial to explicitly state them in the call for tender. For example, though the majority of the EU timber trade is with countries having effective enforcement of forest legislation, illegal logging is a serious problem in some countries and regions from which the EU imports timber products. In this respect, as public authorities are important consumers of timber-based products, they could have a significant impact in reducing the demand for illegally logged timber. (European Commission, 2004a)87

87 For example, the UK Government has had a timber procurement policy since 2000, which requires that all timber and wood-derived products procured by central government departments, their executive agencies and non-departmental public bodies must be from independently verifiable legal and sustainable or FLEGT-licensed (Forest Law Enforcement, Governance and Trade, the EU FLEGT Action Plan http://www.euflegt.efi.int/portal/home/flegt_intro/flegt_action_plan/) or equivalent sources, or recycled timber (The UK public procurement policy on timber, 2010; see also: Scholl et al., 2010, p. 46).
In this thesis, it became evident that environmental aspects have often been considered of particular importance in the call for tender but their formulation in drafting the contract has received no special attention, or the contractual terms are drafted in a general form. From a contract law perspective, it is difficult to see any advantages in drafting very general terms where the practical meaning is vague and indefinite, and enforceability is unclear. On this account, it may be presumed that the consequences of possible breaches of terms of contract relating to environmental issues will, in reality, remain insubstantial. It is suggested, however, that with contract requirements, criteria relating solely to individual contracts would not be hindrances to trade (Arrowsmith and Kunzlik, 2009, p. 132-136, 178) and thus, there could be further potential in the use of contractual clauses to make purchases greener. In addition, as concluded in this study, the possibility of monitoring the contractor and imposing immediate and predetermined sanctions for breach of contract might be a useful method to guarantee that agreed green criteria will be honoured.

Currently, the public procurement legislation enables the consideration of environmental criteria in the tendering process, and the concept of the most economically advantageous tender is relatively open for the development of various kinds of environmental criteria. However, the results of this thesis comply with the conclusions of earlier studies that uncertainty regarding the legislation contributes to risk-averse behaviour among procurement officers, meaning that they make decisions that reduce the risk of legal conflict especially when it comes to the execution of the free trade principle (Carlsson and Waara, 2007; Mielisch and Erdmenger, 2002). The complexity of public procurement tends to favour past practices and avoiding risks (Borg et al., 2006). This may also be one reason why procurement has remained reactive in nature, i.e. focused mainly on practical means rather than strategic ends (Leire, 2009; Snider, 2006).

The need to simplify and update the European public procurement legislation is recognised in the Green Paper on the modernisation of EU public procurement policy which calls for a review of the EU public procurement system to increase its efficiency and effectiveness (European Commission, 2011d). The existing tools and methods should be modernised in order to increase the efficiency of public spending, to make better use of public procurement in support of common societal goals, e.g., protection of the environment, higher resource and energy efficiency and combating climate change, promoting innovation and social inclusion, and ensuring the best possible conditions for the provision of high quality public services (European Commission, 2011d). The revisions should result in simpler and more flexible procurement procedures for contracting authorities and provide easier access for companies, especially SMEs, leading to more environmentally sustainable, socially responsible and innovative goods, services and works (European Commission, 2011g).

The proposal for the new EU directive on public procurement is based on enabling approach providing contracting authorities with the instruments needed to contribute to the achievement of the Europe 2020 strategic goals (European Commission, 2011a, p. 9). It gives public purchasers for example the possibility to base their award decisions on life-cycle costs of the products, services or works to be purchased, including costs from raw material acquisition or generation of resources until disposal, clearance and finalisation. The costs to be taken into account do not only include direct monetary expenses but also external environmental costs if they can be monetised and verified (by e.g. using a common European Union methodology for the calculation of life-cycle costs) (European Commission, 2011a, p. 10, 24, Article 67 in the proposal).
Also some other recent proposals for the revision of a number of EU directives aim at developing criteria that would be more useful for green public procurement. This puts pressure on public authorities to demand for products with lower carbon footprint and more eco-efficiency during their life cycle. It is thus surprising that the legal boundaries are still not straightforward. This may be due to the fact that legal disputes and court decisions in the area of GPP are scarce. Indeed, so far the EU public procurement legislation itself has shown basically only good examples of balancing the environment and the market (Ekroos, 2008, p. 429) and thus the conclusion is that so far legislation has not posed a problem in taking environmental aspects into account in public procurement. So, public purchasers at all level have a crucial role in implementing and monitoring the GPP criteria in calls for tenders and actual contracts. So far they have been free to choose whether, and which environmental criteria they use in the purchasing process but could it be more efficient if the use of environmental criteria would become legally binding? Mandatory GPP criteria could be enforced, for example, to the purchases of the ‘priority sectors’ defined by the EU including product groups that are most suitable for GPP and for which common GPP criteria have been established (European Commission, 2011e). Then it would also be possible to objectively measure the outcome of the purchase and to compare the situation between member states. Mandatory measurements are also proposed in the Commission Communication (European Commission, 2008a) that suggests that the implementing measures under the Labelling Directive will identify one of the labelling classes as a level below which public authorities would not be allowed to procure. This level will be set on the basis of the outcome of impact assessments for relevant product groups (European Commission, 2008a, p. 6). Generally, the mandatory nature of the environmental criteria could be expressed in the public procurement legislation, and the product groups that it concerns could then be specified in the Government Resolution. This would be the next step from voluntariness and pressure to mandatory measurements that would be likely to stimulate the progress of GPP.

5.2 Relation between environmental and economic aspects in public procurement

The economic and environmental aspects of public procurement were studied through the concept of the most economically advantageous tender. As presented in the EU procurement directives, it is a basis for combining the economic and non-economic criteria, e.g. environmental criteria in the public procurement decision making. In this thesis, it was examined how well this concept, i.e. a weighted sum of various aspects formulated by the purchaser, would actually illustrate the economic and environmental performance of a purchase.

Environmental criteria as part of the most economically advantageous tender were presented in one-third of the examined calls for tenders. Green criteria as such do not, however, guarantee that the purchasing authority succeeds to implement green procurement options. In an ideal case, environmental purchasing criteria should be based on life cycle thinking (European Commission, 2008b; European Commission, 2003b; Siemens, 2003; Kunzl, 2003). In this thesis, a compre-
hensive LCA study and the cost calculation method (Directive 2009/33/EC) were applied to a real public procurement case in order to calculate the environmental impacts of three competing tenders. The results were then compared to the purchaser’s equation of the most economically advantageous tender, which used a single environmental criterion favouring new environmentally sound technology. The results showed that the measurement of environmental impacts of the tenders may have a contribution to the ranking of tenders in terms of the most economically advantageous tender. This is of course also affected by the purchaser’s scoring system for award criteria. These scientifically grounded calculation methods would, however, position the competing tenders on a more equal level, or at least on a continuum of environmental award points compared to the purchaser’s equation. On the other hand, placing the tenders in a continuum of environmental impacts would not necessarily amply reward those service providers that have really put some effort into green technology and environmental product characteristics. Thus, instead of ranking the tenders proportionally in a continuum, should we significantly compensate those small steps that could more quickly lead to eco-improvements in products and services? This ‘compensation for best practice’ could be seen as a way to promote environmental product improvements. Thus it seems to be fair enough to select the most important criteria, set the weighting for the criteria at moderately high and award the most progressive tender in that area the most. Of course, there is always the possibility to use environmental criteria in the technical specifications and then compete solely on price, and the outcome could still be both economical and environmentally friendly. In this case, however, the purchaser would settle for a decent level of greenness but fail to reward for better environmental performance and to promote opportunity for possible best green practices and environmental innovations.

It seems that the use of LCA in actual purchases is not likely to take place as a practical tool in the comparison of purchasing choices unless the system for environmental impacts and the weights for different impact categories is solid (see e.g. Gloria et al., 2007 for developing software for weight set in applying LCA to real world decisions based on panelists view for the US markets). Although it is time consuming and probably so far impossible for the purchaser to use LCA in their daily work, this scientific method gives a good basis for developing guidance for public procurement bodies, e.g. providing information on how to target the environmental focus in the award decision. For example, this case study indicated that few carefully selected environmental criteria in the call for tender were sufficient enough to bring up the purchasing options that were the greenest ones also in other, probably less significant, environmental aspects. The results also indicated that relatively small actions, such as eco-driving, the selection of a reasonable vehicle for a certain purpose, and requirements for new technology could have a remarkable effect on the environmental impacts of the service with moderate or no added costs. There already exist many LCA-based practical tools that provide guidance on environmental aspects of products and services, e.g. the EU’s Internet-based GPP toolkit (European Commission, 2011e), eco-labels and other check lists, which are often based on life cycle thinking.

In addition to applying green procurement criteria, the public purchaser confronts a challenge to incorporate economic (and other non-economic) criteria into the most economically advantageous tender. Discussion about the relation of green, economic and quality issues in public procurement is accurate, and the question arises where the balance should be drawn. There does not exist a uniform practice as to how to measure the economic efficiency of a purchase, or how to define the quality of it. The public procurement directives do not clearly define the concept of the most economically advantageous tender, either. However, when other than economic targets for public procurement are also regarded, i.e. environmental issues, competitive concerns and social issues,
the purchasing decision may not be purely economic in nature (Bovis, 2006) and due to the case law\(^91\) it does not even need to be so.

The interpretations of the most economically advantageous tender leave much space for purchasers’ preferences and thus subjectivity of award criteria. The preferences and award systems of different purchasers were indeed not consistent in the examined calls for tenders. The award system, i.e. how the most economically advantageous tender is calculated may hinder the transparency of the awarding procedure in practice (Chen, 2008; Meijer and Telgen, 2007). These risks and shortcomings are due to the relative award system.\(^92\) If an award system was fully transparent, the bidders would be able to calculate their scores and thus optimize their tender while they are drafting it, without having knowledge of the other tenders (Chen, 2008). Many award systems in the examined calls for tenders used relative scores, which imply that the winning bid would not be truly the most economically advantageous as the purchaser’s award system was not fully transparent.

Thus, it appears that due to several shortcomings, e.g. difficulties in identifying suitable award criteria and setting weights (Watt et al., 2010; Mateus et al., 2010) and inconsistent scoring rules and non-transparent rating systems (e.g. Chen, 2008; Meijer and Telgen, 2007; Lundberg and Bergman, 2010) which may further lead to a submission of non-optimal tenders by the bidders (Lundberg and Bergman, 2011) the concept of the most economically advantageous tender does not necessarily indicate which of the purchasing options provides the best economic utility whilst also being an environmentally preferable option. It seems that the usefulness of the concept ‘the most economically advantageous tender’ in public procurement lies at the moment in formulating green (and other non-economic) purchasing criteria into procurement decision, and legitimizing (green) purchasing options that are not based solely on price. But in order to assess the relation of economic and environmental aspects of purchases, we would need another – more objective – measurement.

One measurement for the relation of economic efficiency and greenness of a purchase could be eco-efficiency. Generally, the concept of eco-efficiency indicates how many environmental impacts are borne in exchange for the value of the unit. Theoretical interpretations of eco-efficiency suggest that it can be used to compare products and services in their economic and environmental performance (e.g. Ehrenfeld, 2005; Kobayashi et al., 2005). Although eco-efficiency is widely examined and used in business life (see, e.g. Lehni, 2003; Ehrenfeld, 2005; Kobayashi et al., 2005; Brattebo, 2005; Daly, 1996) it has so far only been theoretical within the context of public procurement and not applied as a common practice. Eco-efficient purchasing has been introduced by GRIP (1998) as: “maximizing the value added, including usefulness, pleasure, user satisfaction, satisfaction of needs, contribution to efficient operations, while minimizing the environmental impact”. This broad definition thus covers the aspects that can be included in the most economically advantageous tender. However, a standardized formula or method for calculating comparable eco-efficiency rates in public procurement would need to be developed.

For eco-efficiency calculations, the scientific grounded data about environmental impacts of various products and services is currently increasingly available in the form of e.g. eco-labels, GPP toolkit and standards, which would help to calculate the environmental impacts of these purchases. However, the interpretation of the economic performance could pose a problem, as it

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\(^91\) ECJ case: C-513/99 Concordia Bus Finland Oy Ab (2002).

\(^92\) Example from Chen, 2008, p. 409: “The number 50 (points) is the maximum score that can be obtained for the price criterion. If the maximum score for the other criteria equals 50 points, the maximum total score will be 100 points. If we have three tenders, for example, A, B and C with prices of 40 €, 50 € and 80 € respectively, the scores will be 50 points; 50 x 40 / 50 = 40 points; and 50 x 40 / 80 = 25 points. The difference between the scores of B and C is therefore 40 – 25 = 15 points. If, however, tender A is declared invalid afterwards, the lowest price is raised to 50 € and now the score of B will be 50 points, and the score of C will be 50 x 50 / 80 = 31.25 points. So the difference between the scores of B and C has grown from 15 points to 50 – 31.25 = 18.75 points and it would be possible that the ranking between B and C is changed by declaring tender A invalid.”
can be wide-ranging; from a monetary unit (price) to overall user satisfaction (e.g. Lehni, 2003; Verfaillie and Bidwell, 2000; GRIP, 1998; Honkasalo, 2001; see also Braungart et al., 2007, p. 1339 for different variations). In public procurement, the economic benefit actually results from the lower price, i.e. the lower the bid price the higher the award points for price. Thus, one could say that the higher bid price\(^{93}\) could lead to a distorted eco-efficiency rate in case where all the tenders fulfil the quality criteria (i.e. technical specifications) set by the purchaser, and compete mostly on price. In real life, however, products and services are rarely that similar in quality that only the criteria defined in the call for tender could be used as an objective indicator of the product or service value. There is no common set of criteria for quality, either. It is understood as the capability to exceed customers’ expectations (Berry et al., 1988), representing elements of technical and functional quality of products and services, responsiveness to the customers’ needs, timely delivery of products, among others (Stanley and Wisner, 2001). It may also include other determinants, such as safety, consumer protection, hygiene, environmental and health concerns (Wright, 1997; see also Maignan et al., 2002). In addition, for many products the higher purchasing price is compensated by lower lifecycle costs (LCC), i.e. acquisition costs, operational costs and end of life costs (Leire and Thidell, 2009).

Thus, could we think that the bid price (in competitive markets) could still explain differences in the real quality of the products, and that the higher bid price reflects this additional quality exceeding the criteria valued by the purchaser? So, if we think that the bid price reflects the true overall customer satisfaction – taken, of course, that the markets is competitive – then the bid price could be considered as an objective measurement of the product or service value in the eco-efficiency rate, although in the ranking of the most economically advantageous tender it would get less award points (i.e. least benefit to the buyer). On the other hand, it is suggested that if bids are to be evaluated according to a combination of price and quality related issues, then the procuring authority should put a monetary value on quality that can be added to or subtracted from the actual bids, rather than transform bid prices into scores that can be added to a quality score (Lundberg and Bergman, 2011). In a public purchase this kind of valuation might be appropriate if the monetary value of quality (and other determinants)\(^{94}\) could well be estimated, and thus the weighting of the determinants would not pose a problem in order to assess the economic value of the purchase in the eco-efficiency rate.

Despite these challenges, eco-efficiency could be one of the methods that provide environmental comparisons in relation to the economic aspects in public purchases. Still, it is unlike that a standardized or systematic eco-efficiency formula could be developed for all purchases, but the eco-efficiency calculations in public procurement should rather focus on certain product and service groups, and should be performed by specialists that prepare examples and national or EU level recommendations of environmental criteria for specific products groups.

### 6 Conclusions

Green public procurement has progressed a long way in the EU history from principles into practice. However, today the debate of the importance and significance of GPP is probably the most topical as ever. Despite the intense political pressure, development of practical tools, and more precise interpretations of the procurement directives due to Community Communications and case law, which have helped to identify and address the most debatable issues in green public procurement, the formulation of clear, detailed and proactive environmental purchasing criteria remains as a challenge especially in the implementation of contracts but also to some extent in formulat-
ing the calls for tenders. This may be partly because, for some requirements, e.g. transportation and production, there is no clear vision on how they should be treated in the light of procurement directives or jurisprudence.

This study identified three areas of importance in fostering the environmental performance of a purchase, i.e. defining the environmental criteria in the calls for tenders, formulating a transparent scoring system for the most economically advantageous tender with a moderately high weight for environment, and controlling the fulfilment of green criteria by contract enforcement mechanisms. The attributes of the most economically advantageous tender could provide a more realistic indicator of the value of the product or service to the purchaser than the bid price if the award criteria were defined clearly and comprehensively. Several well-defined elements in the award criteria, e.g. costs, quality criteria, functional characteristics and environmental and social issues could make the ‘maximum value added’ or ‘user satisfaction’ of the tenders more comparable, and render the bid price less crucial in determining the winner.

The study showed that the environmental criteria used by the purchasers are weighted to a relatively low degree in order to contribute the final selection of suppliers. In addition, they are relatively easy to fulfil, and the follow-up of the criteria needs more attention in the contracts. Thus, there could be potential for further progress in GPP by adding more detailed environmental criteria with the weight of a higher degree that would promote actual environmental benefits, and to develop general contract clauses and various kinds of framework contracts that include environmental clauses. In addition, there could be possibilities for further progress in generating legislation related to GPP, for example, by enforcing mandatory GPP criteria to some key product groups.

The implementation of green procurement criteria may work as a signal to the suppliers and encourage them to continuous environmental improvements, and the fulfilment of the criteria implies a greater probability of environmentally preferable purchase. However, setting green purchasing criteria or adding more environmental criteria do not necessarily mean that the purchase is more environmentally friendly than other variants of the same product or service. GPP criteria may vary a lot depending on the products, services and works being purchased. For many product groups, only a few key criteria cause the greatest environmental impacts, which should be recognized in the purchasing process and separated from those that are secondary from the environmental point of view. So, implementing green procurement criteria requires expertise on environmental, economic and legal issues as well as the technical features of the product. Thus there is a call for developing and promoting more standardized methods and tools to help public purchasers to facilitate the use of environmental criteria in such a complex framework.

Studying green procurement criteria could have practical implications in the field of public procurement. For the procurement practitioners, this thesis provides an insight into the important environmental aspects of products and gives the list of environmental criteria that could be considered in their purchasing process, as well as explains the legal challenges in formulating and integrating environmental criteria in public procurement. The methods and tools used in this thesis provide good material and guiding information which could be used to ground decisions for greener choices. For policymakers, this study gives the overview of the issues that would need most ‘greening’, and for academic research it offers insights in measuring the state and progress of GPP as well as its potential to contribute to sustainable production and consumption.

As this study provided an insight into the comparison between the subjective choices of decision makers, i.e. the most economically advantageous tender and the quantitative results of environmental impact assessment, a further study could be applied in developing a more objective measurement of the relation between economic and environmental aspects of products and services, i.e. eco-efficiency of public purchases. It would not try to replace the concept of the most economically advantageous tender, but could be used as a tool to help public purchasers to
formulate economic, quality and green award criteria that would be better balanced in the most economically advantageous tender.

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