

Department of Real Estate, Planning and Geoinformatics

# Green Property Services

Driving Environmental Performance and Customer Value in  
Commercial Buildings

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Eeva Määttänen



**A!**

DOCTORAL  
DISSERTATIONS

# Green Property Services

Driving Environmental Performance and Customer  
Value in Commercial Buildings

**Eeva Määttänen**

A doctoral dissertation completed for the degree of Doctor of Science (Technology) to be defended, with the permission of the Aalto University School of Engineering, at a public examination held at the lecture hall E of the main building 22 August 2014 at 12.

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**Abstract**

The built environment has been recognized as a major contributor to many severe environmental impacts. In particular, the sector's share of the total energy consumption and the resulting GHG emissions is ca. 40% in the developed countries. The majority of these impacts are generated during the operational phase of existing buildings, which highlights the building sector's responsibility to address the issue.

The focus of this thesis is on green property services. The term refers to operational real estate services aimed at both property owner and occupant, and that are aimed at improving environmental performance of the property. Customer value has a special emphasis in the thesis in order to understand the value of green property services for the customer, whether the owner or the occupant of the property.

The aim of this research is to evaluate green property services' ability to enhance building environmental performance, while at the same time creating customer value. The thesis has two main research questions to investigate the issue. The primary focus of study is on green property services' ability to improve the environmental performance of commercial properties. Secondly, the focus is set on how the customers value green property services. These two research dimensions are studied at two property services scopes. First scope is an extensive property services setting. Second scope focuses on one specific service, energy management, which is chosen to be analysed more thoroughly due to its recognized significance to the environmental performance of buildings.

The research is conducted utilizing a mixed method approach, with concurrent embedded strategy and sequential explanatory strategy as research design. Three cases of Finnish commercial properties were studied. The data were collected using multiple methods, both qualitative and quantitative, such as interviews, written documents and numeric data as embedded units of analysis.

Based on the research it can be stated that green property services do have a positive effect on environmental performance of buildings, and they can create value for the customer both on an extensive services setting (green property services concept) and on a narrower, service specific setting (energy management).

It is suggested that a green property services concept would be a viable option for building owners and tenants to improve their environmental performance, especially when they do not have the necessary resources or expertise in-house.

**Keywords** property services, environmental performance, customer value, commercial buildings, operational phase, energy management

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Ympäristösuorituskyvyn ja asiakasarvon parantaminen liikerakennuksissa vihreiden kiinteistöpalveluiden avulla

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Rakennetun ympäristön osuus kokonaisenergiankulutuksesta ja siitä aiheutuvista kasvihuonekaasupäästöistä on noin 40 % kehittyneissä maissa. Suurin osa näistä ympäristövaikutuksista aiheutuu rakennusten käyttövaiheen aikana. Täten kiinteistö- ja rakennusalan toimijoilla on suuri vastuu puuttua asiaan.

Tämä väitöskirjatutkimus keskittyy vihreisiin kiinteistöpalveluihin. Termillä tarkoitetaan operatiivisia kiinteistöpalveluja, jotka on suunnattu kiinteistön omistajille ja käyttäjille ja jotka tähtäävät kiinteistön ympäristösuorituskyvyn parantamiseen. Asiakasarvolla on erityinen paino tutkimuksessa, jotta ymmärretään vihreiden kiinteistöpalvelujen arvo asiakkaalle, sekä omistajalle että käyttäjille.

Tämän väitöskirjatutkimuksen tavoitteena on arvioida vihreiden kiinteistöpalvelujen kykyä parantaa liikerakennusten ympäristösuorituskykyä, ja samanaikaisesti tuottaa asiakasarvoa. Tutkimuksessa on käytetty apuna kahta tutkimuskysymystä. Ensimmäinen tutkimuskysymys tarkastelee vihreiden kiinteistöpalvelujen kykyä parantaa liikerakennusten ympäristösuorituskykyä. Toinen tutkimuskysymys pyrkii selvittämään mikä on vihreiden kiinteistöpalvelujen arvo asiakkaalle. Näitä kahta näkökulmaa tarkastellaan kahden kiinteistöpalvelukokonaisuuden avulla. Ensin tarkastellaan laajaa kiinteistöpalvelukokonaisuutta ja seuraavaksi tiettyä kiinteistöpalvelua eli energiajohtamista.

Tutkimuksessa on hyödynnetty sekä laadullista että numeerista aineistoa. Laadullinen aineisto koostuu muun muassa haastatteluista ja kirjallisesta dokumentoinnista, numeerinen aineisto puolestaan kohdekiinteistöjen toteutuneesta, mitatusta energiankulutusdatasta sekä kyselytuloksista. Aineisto on kerätty kolmen tapaustutkimuksen avulla.

Tutkimuksen perusteella voi esittää, että vihreät kiinteistöpalvelut voivat parantaa kiinteistöjen ympäristösuorituskykyä, ja ne voivat samalla tuottaa asiakasarvoa sekä laajalla kiinteistöpalvelukokonaisuudella, että kapealla, yksittäisellä kiinteistöpalvelulla.

Tutkimuksessa ehdotetaan, että vihreä kiinteistöpalvelukonsepti voisi olla kannattava vaihtoehto kiinteistöjen ympäristösuorituskyvyn parantamiseksi sekä kiinteistönomistajille että – käyttäjille, erityisesti silloin kun heillä ei ole tarvittavia resursseja tai asiantuntemusta omassa organisaatiossaan.

**Avainsanat** kiinteistöpalvelut, ympäristösuorituskyky, asiakasarvo, liikerakennukset, käyttövaihe, energiajohtaminen

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# List of Papers

This doctoral dissertation consists of a summary and of the following five scientific publications, which are referred to in the text by their Roman numerals.

## **Paper I**

Aaltonen, A., Määttänen, E., Kyrö, R., Sarasoja, A-L. & Junnila, S. Facilities Management Driving Green Building Certification – a Case from Finland. *Facilities*, Vol. 31 Iss: 7/8. 2013.

## **Paper II**

Gussander, J-E., Määttänen, E., Kyrö, R., Sarasoja, A-L. & Junnila, S. Facility Management and Corporate Mobility Management – a Case Study. *In Proceedings of Joint CIB W070, W092 & TG72 International Conference*. 22nd – 25th January 2012, Cape Town.

## **Paper III**

Määttänen, E., Jylhä, T. & Junnila, S. Applying the Kano Model to Analyse the Value of Green FM. *Property Management*, Vol. 32 Iss.4. 2014. Forthcoming (accepted 5th December 2013).

## **Paper IV**

Määttänen, E., Kyrö, R., Aaltonen, A., Sarasoja, A-L. & Junnila, S. Remote Energy Management Benefits in Retail Building Portfolios. *Journal of Facilities Management*, Vol. 12 Iss.1 2014.

## **Paper V**

Määttänen, E., Jylhä, T. & Junnila, S. Value Delivery Barriers in Energy Services. *In Proceedings of the European Real Estate Society 19th Annual Conference*. 13th -16th June 2012 Edinburgh.

# Author's Contribution to the Papers

The contribution of the author of this dissertation to the appended research papers I-V is outlined below.

## **Paper I**

The author of this thesis participated in initiating the paper and is responsible for the data collection, analysis and writing the findings section, and shared the main responsibility in writing the paper with the first author.

## **Paper II**

The author of this thesis participated in initiating the paper and had a shared responsibility in writing the paper, data collection and analysis with the first author.

## **Paper III**

The author of this thesis was responsible for initiating this paper and had the main responsibility in writing the paper, data collection and analysis.

## **Paper IV**

The author of this thesis was responsible for initiating this paper and had the main responsibility in writing the paper, data collection and analysis.

## **Paper V**

The author of this thesis was responsible for initiating this paper and had the main responsibility in writing the paper and analysing the data. The second author contributed to the data collection.

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# 1 Introduction

## 1.1 Background and motivation of the study

Climate change is commonly considered as one of the most severe global environmental problems at present and it will continue to be a major topic for years to come. The built environment is right at the centre of discussion. UNEP (2014) has stated that the building sector has earned “the dubious honor of being the Earth’s biggest contributor to greenhouse gas (GHG) emissions”. With a share of roughly 40% of both the total energy consumption and the consequent greenhouse gas (GHG) emissions in Europe (UNEP, 2007), this certainly calls for development in the sector to reduce energy consumption. In response, many international and national programs have already set out to rise up to the challenge, for example The EU Energy Performance of Buildings Directive (European Union, 2010) and a Finnish programme ‘ERA17 for an energy-smart built environment 2017’ (Martinkauppi, 2010).

In Finland the built environment is responsible for 42% of the total energy consumption and 38% of GHG emissions (Martinkauppi, 2010). Furthermore, the amount of climate impacts generated during the operational phase of building life-cycle is significant. Traditionally, up to 80-90% of the impacts have been shown to result from the use phase of buildings (Junnila and Horvath, 2003; Scheuer, 2003; Suzuki and Oka, 1998). Also, more recent studies have shown, that at the issue of modern buildings, even as the impact of operational phase seems to decrease, it is still considerable (Dutil et al., 2011; Gustavsson and Joelsson, 2010; Säynäjoki et al., 2012). In addition, sustainability cannot be achieved without addressing the existing building stock. Even if every new building was a zero-energy building, their impact on sustainability as a whole will remain minimal far into the future as only about 1.5% to 2% of buildings are replaced annually. In the developed countries at least, most of the buildings that will exist in even 50 years’ time, are here already (Wood, 2006). It seems obvious, that the way buildings are operated and managed holds much potential for development in the existing building stock.

In literature, the role of the built environment in the sustainability agenda has been addressed for example by raising energy use and building operations in the discussion. The majority of climate impacts of buildings originate from energy use. Accordingly, the main objective for sustainable and green building practices usually is to reduce energy consumption and, as such, reducing burning of fossil fuels to generate electricity (Hodges, 2005). In addition, Rosen (2009) and Hennicke and Fishedick (2006) propose that addressing energy

use and its links to climate change can help provide a foundation for the supply of sustainable energy services and by extension sustainable development.

In addition, Hodges (2005) suggests that there are many strategies that facility managers can implement in existing buildings to improve their environmental performance. For example energy efficient retrofits, recycling programs, green cleaning and preventative maintenance can help facility to run more efficiently, reduce the negative impact on the environment, and provide cleaner, safer, more productive environments for employees. Examples of green building operations include for example resource and energy efficiency, waste and pollution prevention, operations and maintenance cost reductions and environmental management systems. In addition, occupant health issues, such as a decrease in building-related illnesses and increases in the comfort and productivity of occupants are also significant benefits of sustainable and green building practices and can promote the implementation of green facility management (Hodges, 2005; Roper and Beard, 2006).

Previous research has also shown that building occupants expect green services from the real estate sector companies (Nousiainen and Junnila, 2008). It has been suggested that green buildings and services benefit customers for example by reducing operational costs, energy costs and improving occupant comfort. The driver for energy and environmental efficiency improvements in commercial building has often assumed to be cost savings generated from improvements. During the recent decade environmental responsibility has also emerged as a deciding factor in these efforts. Thus, the customers' motives and perspectives for energy and environmental improvements may have changed. Also, facility management has often been considered as management of mainly operational services, but considering the concept of added value, facility management has been recognized as a strategic tool for organisations' core businesses (Jensen et al., 2012). However, customer value is determined by customers' perception not by suppliers' assumptions (Woodruff, 1997). Thus, it is important to understand what kind of customer value greening the building operations and management processes would create and how to improve customer satisfaction in order to increase the use of these types of services and by extension improve environmental performance of buildings. Understanding customer value is necessary in order to be able to respond to the needs and desires of customers who become even more demanding (Munnukka et al., 2013).

In this thesis the focus is on green property services. The term refers to operative real estate management services, which in literature are usually divided into property and facility management, and related services. The term "green property services" includes both of these two commonly used service scopes, and in particular, the green aspects of the services. Green property services can be described as services that reduce negative impacts to the environment and human health while fulfilling the needs of the occupants and maintaining the property's conditions and characteristics. European standard EN 15221-4 on taxonomy, classification and structures in facility management (CEN, 2011) defines a sustainability product as a policy development for the reduction of

resources, economic use of facilities like buildings and areas as well as enhancement of health and welfare of people. Environmental protection has not been standardized as a product; however, they are described as activities, services and means that are focused on the implementation and controlling of the environmental policy for the organisation and the execution of legal obligations and improvements for the environment.

Another perspective is also added to the research topic by linking customer value into the research. Three types of customer can be identified according to European standard EN 15221-1 Facility Management Part 1: Terms and definitions (CEN, 2006); first, the client, with whom the service provider has a contract (e.g. building owner) and second, the customer, who acts on a tactical level (organisational unit that specifies and orders the services) and the end-user, who receives the services. In this thesis a narrower definition is used and customer refers both to contract client and the tactical customer. End-user is referred as occupant.

## 1.2 Research questions and scope

As existing buildings offer huge potential for improving energy and environmental efficiency of the built environment, this study aims at adding to the knowledge of existing building operations' contribution to sustainability. **The aim of this research is to evaluate green property services' ability to enhance the environmental performance of buildings, while at the same time creating customer value.** Moderately simple measures can be effective in improving the energy and environmental efficiency when applied professionally and with sufficient justifications. As suggested by literature, property service companies could contribute to building environmental performance by providing these services. Emphasis is also placed on customer value connected to green property services, in order to understand their significance for customers as well.

First, in order to understand the connection between environmental performance and customer value in the real estate business, it was necessary to find out how green property services can contribute to the environmental performance of commercial buildings. The first research question is accordingly:

### **RQ 1: How can green property services enhance the environmental performance of commercial buildings?**

For the purpose of the first research question, green property services were studied both as an extensive concept and service specific approaches. The scope of property services was even expanded to cover potentially new services, which could add to environmental performance of property users and could be provided by the property services organisation, but traditionally are left outside of the scope.



After exploring green property services' contribution to building environmental performance, focus is set on the customer value of green property services. Customer value has become an important strategy and marketing tool in recent years (Khalifa, 2004) and customer-perceived value is recognized as the driving force behind marketing (Vargo and Lusch, 2004a). Several value creation and marketing strategies have been developed, such as service-dominant logic (Vargo and Lusch, 2004b) and customer-dominant logic (Heinonen et al., 2010) indicating the customers' role is increasing. Also, researchers have already pointed out a gap in knowledge in understanding the added value of green facility management (Jensen et al., 2012).

The second research question strives to find out customers' perceptions on green property services, and is as follows:

**RQ 2: How do customers value green property services?**

The second research question seeks to understand green property services as a business area. It is important to understand what the customer expects and values before attempting to green the property services' processes.

In summary, first this thesis concentrates on green property services in improving the environmental performance of buildings. Then, attention is given on the customer value in green property services. Finally, the thesis concludes in discussing the connection between these two research areas, to gain an understanding of green property services enhancing building environmental performance while creating value for the customer.

The scope of the research is limited to the operational phase of existing commercial buildings. The research is also divided and limited in two property service scopes; an extensive concept approach and a narrower service specific approach. In other words, green property services are studied in an extensive property services setting, where the green property services are studied as a concept on delivering services. In addition, one specific service, energy management, is chosen to be analysed separately and more thoroughly due to its recognized significance to the environmental performance of buildings. Table 1 presents the papers' relation to research questions and the two property services scopes.

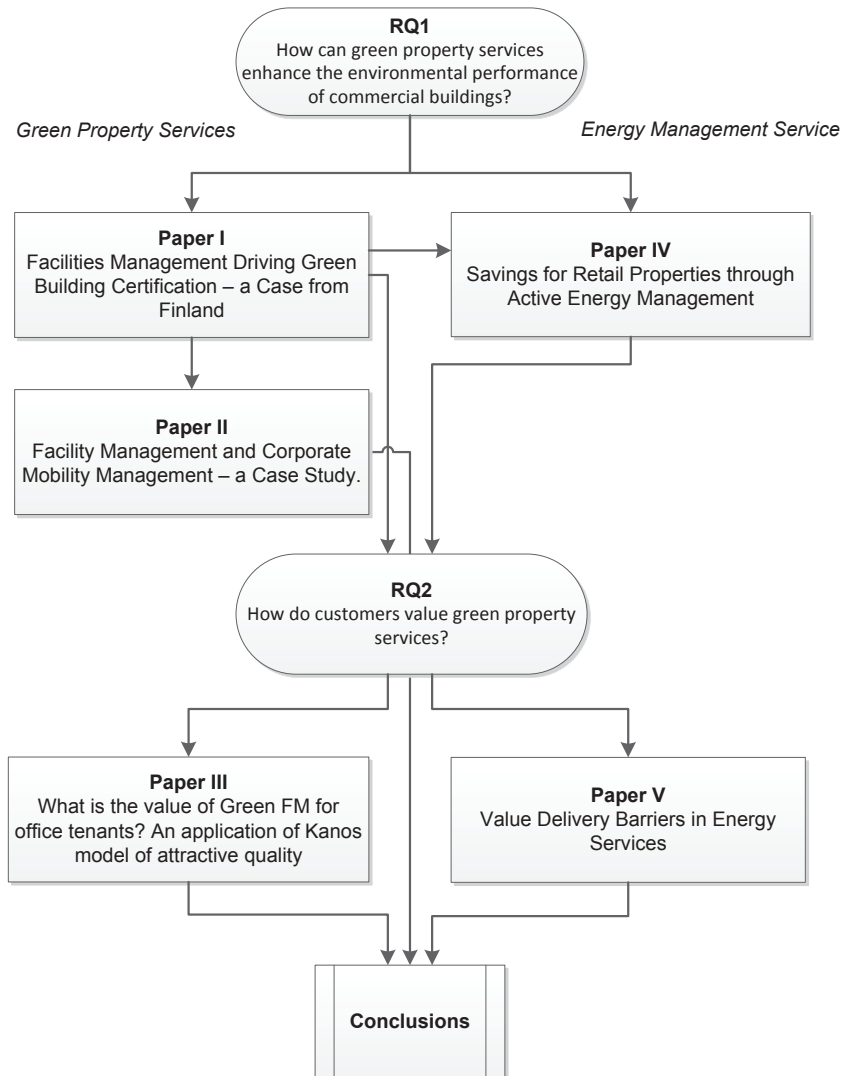
**Table 1 Research questions and related papers.**

	<b>Extensive concept: Green Property Services</b>	<b>Service specific: Energy Management Service</b>
<b>RQ 1: How can green property services enhance the environmental performance of commercial buildings?</b>	Paper I: Facilities Management Driving Green Building Certification – a Case from Finland.  Paper II: Facility Management and Corporate Mobility Management – a Case Study	Paper IV: Remote Energy Management Benefits in Retail Building Portfolios
<b>RQ 2: How do customers value green property services?</b>	Paper III: What is the Value of Green FM for Office Tenants? An Application of Kanos Model of Attractive Quality.	Paper V: Value Delivery Barriers in Energy Services.

As can be seen from Table 1, both research questions are addressed across the two property services scopes; green property services and a more specific energy management service. The green property services are first evaluated on how they can enhance the environmental performance of commercial buildings, and second on how customers value them. Similarly, energy management service's contribution to environmental performance of commercial buildings and its customer value is studied.

### **1.3 Structure of research and thesis**

The research structure is presented in Figure 1. It illustrates the research questions, papers, research scope and the logic with which the outcomes and conclusions of this dissertation thesis are drawn.



**Figure 1** Research structure.

Figure 1 depicts how the research process commenced by addressing green property services and their contribution to building environmental performance, both as an extensive concept approach, and a narrower service specific approach. After addressing the contribution to environmental performance, it was deemed relevant to study the potential for creating customer value on the same service scopes.

This dissertation consists of five appended research papers and this summary. Three papers are published or accepted to be published in academic journals and two are published in scientific conferences.

This summary comprises four sections. The first, introductory section describes the motivation and background of the study, as well as discusses the relevant literature around the field. Also, the section presents the research aim, questions, and scope of the thesis. The second section describes the methodological approach utilized in the thesis, and presents the research de-

sign. Summaries of the appended papers with their main findings are included in the third section. Finally, the fourth section discusses the conclusions and contribution of the dissertation, as well as evaluates the quality of the research and gives suggestions for further research.

## 2 Research Methodology and Design

The study uses a mixed method approach. It is an approach to inquiry that combines both qualitative and quantitative forms of data collection (Creswell, 2003). This research combines two of Creswell's mixed method strategies: *concurrent embedded design* and *sequential explanatory design*. The strategies are utilized in three case studies that are the basis for data collection in the thesis. Case studies aim at understanding the dynamics present with a single setting (Eisenhardt, 1989). Furthermore, the case study approach allows for studying real-life phenomena in their real-life contexts (Eisenhardt, 1989), as it has been done in this dissertation research. The cases were chosen based on theoretical sampling. This means that the Cases were particularly suitable for illuminating the research topic, and relevant examples from real-life settings (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). The Cases cover examples from the green property and energy management services in Finland at the time of the research. Availability of actual, typically sensitive business data was another factor in data selection.

Case studies classically combine various data sources, such as archives, interviews, surveys and observations, which help to improve the validity of the results. The data may be qualitative, quantitative or both in the case study method (Eisenhardt, 1989; Yin, 1994). As this thesis utilizes the mixed method approach, both qualitative and quantitative data are collected, and this provides the advantages of both types of data (Creswell, 2003). In this thesis, data is collected through various methods, such as interviews, workshops, annual report reviews as well as numeric data from building automation systems and a questionnaire.

In *concurrent embedded strategy* both qualitative and quantitative data are collected simultaneously (Creswell, 2003). In cases A and B, the primary data is qualitative, but supporting quantitative data is nested in the analysis (see Figure 2). The embedded quantitative data is used to illustrate the qualitative results (Metsämuuronen, 2006) and forms quantifiable evidence for analysis.

*Sequential explanatory strategy* is utilized in Case C. In sequential explanatory strategy quantitative data are collected and analysed first and qualitative data collection and analysis builds on the results of the first quantitative phase (Creswell, 2003, p. 211), as illustrated in Figure 2. Mixing of the data occurs as the initial quantitative results inform the secondary qualitative data collection. Even though, according to Creswell (2003), weight is typically given to the

quantitative data, in this thesis qualitative analysis and interpretation is given the primary focus.

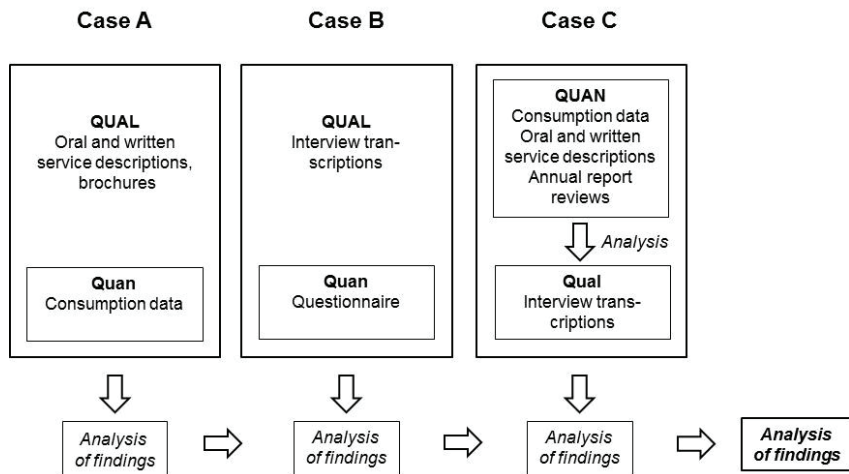


Figure 2 Research strategy (adapted from Creswell, 2003).

Mixed method approach is ideal for gaining a broader perspective of the research topic. Figure 2 illustrates the research strategy in the thesis. The cases are individual research projects but the findings and analysis of each case are connected to each other. In Case A, green property services and their contribution to environmental performance of buildings are analysed by comparing the services to a green building criteria and forming quantifiable evidence by analysing the energy and water consumption as an embedded unit. This forms a basis for Case B where green property services are analysed from the point of view of customer value. There a questionnaire forms the quantifiable evidence as an embedded unit. Case C focuses on one specific service and comprises both perspectives; environmental performance and customer value, in a singular case. Energy consumption analysis forms the primary data in Case C. From there, the analysis narrows down to a smaller unit and value delivery analysis is deeper and qualitative. This process forms the research approach and final integrating analysis for this thesis.

Next, a description of each case study is presented. The cases comprise two property services scopes; an extensive concept (Cases A and B), and a specific service (Case C). Also, two perspectives to customer (occupant and contract customer) are included in the case studies.

### Case A

Case A involves a green property services concept provided by a global facility and property services company. The customer is a user-owner organisation in an office building. All major real estate services are provided by the same service provider in the building. The services were developed to meet a green building rating system criteria, and verified by an achieved green building certification.

Data included written and oral service descriptions, brochures and energy and water consumption data from building automation systems. Together they form the basis for the qualitative analysis. Research includes comparison and analysis of green property services against environmental performance criteria and also the services' contribution to commuting. Papers I and II are based on Case A.

### **Case B**

A separate green property services concept is studied in Case B. The service provider is a Finnish facility and property management company. Customers of the service are the tenants of a multi-tenant office building, i.e. occupants. An investor owns the building and has the service contract with the facility and property management company. Individual property services, such as cleaning and maintenance, are provided by separate service providers. The property services are managed according to a developed green property services concept.

A Kano-questionnaire was conducted with the case building tenant representatives, which provided numeric evidence on customer satisfaction by calculated frequencies and percentages of the results. The questionnaire was followed by a semi-structured interview on the organisations' views on the importance of energy and environmental issues for premises. Even as the questionnaire results form numeric evidence, qualitative interpretation and analysis are given the primary focus. Green property services that affect customer satisfaction were identified in the analysis. Paper III is based on Case B.

### **Case C**

Case C involves an energy management service, provided by a global facility and property services company. The customers of the service are in this case two retail chain operators. The service agreement is signed between the service company and the retail chain, however, the individual retailers benefit from the service also, so they too are regarded as customers of the service. In the case, the service is provided to several retail buildings and its effects followed.

Case C includes two separate data sets. First, a large data set comprising two retail building portfolios is analysed based primarily on quantitative data, namely, the energy consumption of several retail buildings. The research identifies the benefits of energy management. Then, the second data set narrows down and analyses one these portfolios more deeply in a qualitative setting and identifies the benefits and barriers in value delivery of energy management. Papers IV and V are based on Case C.

Table 2 presents a summary of each case study.

**Table 2 Summary of the case studies**

	<b>Case A</b>	<b>Case B</b>	<b>Case C</b>
<b>Service</b>	Green property services concept 1	Green property services concept 2	Energy management service
<b>Customer of the service</b>	User-owner of an office building	Tenants of an office building	Retail chain operators and retailers
<b>Service provider</b>	Global facility and property services company	Facility and property management company	Global facility and property services company

As presented in Table 2, the research includes two separate green property services concepts and one specific service, namely, energy management. Customers of the included services comprise both building owners and occupants. The service providers comprise facility and property services and management companies.



## 3 Summaries of the research papers

This chapter presents a brief summary of each research paper. The summaries highlight only the main findings relevant to this thesis. More insight on the literature review, detailed analysis and results can be found in the respective papers.

### 3.1 Paper I: Facilities Management Driving Green Building Certification – a Case from Finland

The first paper sets out to understand how green property services could enhance the environmental performance of commercial buildings. The aim is to analyse green property services against a green building framework. The framework provides an indicator to which the services could be measured against. To do this, a case study was selected to study the green building certification process. An office building, where all major property services were provided by the same facility management organisation, and were seeking green building certification were selected for the study. The studied green building certification system was the U.S. based LEED® EB (Leadership in energy and environmental design for existing buildings, operation and maintenance).

As LEED® EB is especially tailored to existing, operational buildings, most of the criteria were connected to property service processes. The researchers compared the property service processes against the LEED® criteria and the services at the case building were modified if needed. The full certification process was followed through to get critical and genuine feedback and results. The project finally received Gold level certification, i.e. the second highest level certification.

Based on the analysis, four categories were identified that describe the level of influence the property services have on the environmental performance of an office building. The following Table 3 presents the categories and the property services in the case that influence the green performance of the building.

**Table 3 Levels of influence to environmental performance of commercial building**

<b>Levels of influence</b>	<b>Definition</b>	<b>Services</b>
Direct influence, fully attainable with property service organisations internal policies and processes	Property services organisation readily holds the information or documentation required meeting the criteria, or has full control over the processes included in the criteria. Meeting the criteria is independent of the site characteristics and occupant.	<ul style="list-style-type: none"> <li>– Outdoor Maintenance</li> <li>– Energy Efficiency Practices</li> <li>– Refrigerant Management</li> <li>– Existing Building Commissioning</li> <li>– Waste Management Processes</li> <li>– Green Cleaning Programs</li> <li>– Indoor Air Quality Programs</li> </ul>
Partly direct influence, property service organisation has operational impact and can influence the points achieved	Property service organisation plays a central role in meeting the criteria via operating the systems, equipment or processes in question and can produce the required documentation. However, meeting the criteria also depends on the site characteristics and occupant.	<ul style="list-style-type: none"> <li>– Indoor Plumbing Efficiency</li> <li>– Landscaping</li> <li>– Energy Efficiency Performance</li> <li>– Enhanced Refrigerant Management</li> <li>– Emissions Reduction Reporting</li> <li>– Lamp Procurement</li> <li>– Waste Management Goals</li> <li>– Indoor Air Quality Goals</li> <li>– Occupant Surveys</li> <li>– Daylight and Views</li> <li>– Green Cleaning Goals</li> </ul>
Indirect influence, property service organisation has operational impact, but cannot influence the points achieved	Property service organisation has no impact on whether the systems, equipment or processes in question are in place, but can implement the required changes and produce the necessary documentation. Meeting the criteria depends on the site characteristics and occupant.	<ul style="list-style-type: none"> <li>– Site Development</li> <li>– Stormwater Management</li> <li>– Building Automation Systems</li> </ul>
Advisory influence, property service organisation can act as an expert advisor	Property service organisation can perform tasks, such as occupant surveys, required by the green building system, or advice on the best practices. Meeting the criteria depends on the site characteristics and occupant.	<ul style="list-style-type: none"> <li>– Alternative Commuting Transportation</li> <li>– Sustainable Purchasing</li> </ul>

It can be seen in Table 3 that the four influence categories of property services were identified as direct, partly direct, indirect and advisory influence. The services included in each category are also listed in the table. The first three categories (direct, partly direct and indirect influence) comprise the majority of services that were included in the certification process. Only two services are included in the advisory category, and no green building criteria were discovered as not being included or possible to be included in property service processes.

As the majority of climate impacts of buildings are known to result from energy use, it, as well as water consumption, were given additional consideration in the study. It was deemed important to see what kind of actual measurable results the property service organisation driven greening process would bring. Electricity, heating energy (district heating) and water consumption were monitored during the study. It was found that during and after the implementation process of green property services the consumption levels decreased. A total of 373 MWh was saved in electricity consumption during the first year after the process, corresponding to -9% compared to the previous year. The weather corrected heating energy savings were 680 MWh, i.e., -27%. Water consumption savings were 1,046 m<sup>3</sup>, i.e., -18%. Thus, it can be concluded that green facility management practices contributed meaningfully to the environmental performance.

As the first paper looked into the impact potential of green property services in the environmental performance of an office building on an extensive traditional property service scope, the second paper focuses on one aspect in the case, namely, commuting, which is traditionally outside of property service scopes, but provides an insight what an extensive green property services concept could include in future.

### **3.2 Paper II: Facility Management and Corporate Mobility Management – a Case Study**

The first paper focused on green property services' contribution to environmental performance of commercial buildings mainly from the traditional property services point of view. In the second paper, a potential new property service for improving the environmental performance is presented.

In addition to the environmental impacts of energy use of buildings, traffic has also a significant impact on the environment. In Finland, traffic is responsible for 17 % of the energy consumption and 19% of the consequent GHG emissions (Martinkauppi, 2010). This can be linked directly to property services as commuting and other traffic directly related to workplaces form a significant portion of the total traffic.

This second paper presents a study, where a corporate mobility management plan was developed in connection with facility management. The study is linked to the research presented in the first appended paper, namely the impact potential of property services in achieving a green building certificate for an office building. Commuting is a part of several green building rating systems (e.g. LEED® and BREEAM) and as property services were shown to have a great impact in such ventures, it was deemed important to map the impact of property services in commuting and transportation issues as well.

Mobility management is a concept to manage the efforts to develop public transport and other alternative modes of transportation in order to reduce conventional private car use. In companies, a green commuter plan can be utilized to promote sustainable transport to employees. The study showed that corporate mobility management and implementing a green commuter plan

requires actions from several managerial areas. Facility management has a major role in assessing the premises and creating favourable circumstances for alternative commuting. A green commuter plan can even redefine facility management's role in a company's strategy.

In the study several methods for implementing the plan were found; promoting car-pooling and public transport, reconditioning the changing rooms and adjusting the parking policy and the company car policy. The majority of these actions are linked to facility management processes fully or at least partially. This shows that facility management is still evolving and expanding from the traditional concept of narrowly defined functional tasks relating to premises. To conclude, facility management could potentially have role in overall green management in organisations.

As the first two papers looked into the impact potential of green property services in the environmental performance of an office building, the third paper tries to understand more broadly how the tenants view and value the green property services concept.

### **3.3 Paper III: What is the Value of Green FM for Office Tenants? An Application of Kanos Model of Attractive Quality**

In this paper, the value of green property services to customers is studied. The paper presents case study conducted in a multi-tenant office building where a green property services concept was commenced. The data collection methods included a structured questionnaire based on the Kano model of attractive quality and semi structured interviews. Both data sets were collected in a single interview session with separate tenant representatives. Altogether 17 interviews were conducted and the interviewees represented relatively small companies, with 1 to 40 employees.

The Kano model evaluates customer satisfaction by discovering the influence of a certain characteristic of the product or service. The model has been used to assess customer value for example in example banking services (Bhattacharyya and Rahman, 2004; Rahman, 2004), e-services (Fundin and Nilsson, 2003; Nilsson-Witell and Fundin, 2005; Witell and Löfgren, 2007) and travel agent ticketing services (Shahin, 2004). The model recognizes five quality dimensions that represent the value of the specific characteristic, i.e. the green quality attributes in this study, for the customer. The five quality dimensions are *attractive*, *one-dimensional*, *must-be*, *indifferent* and *reverse* dimensions

Increase in Attractive attributes creates more customer satisfaction, but they do not cause dissatisfaction in nonfulfillment. Indifferent attributes do not affect customer satisfaction. Increase in Reverse attributes will cause dissatisfaction. One-dimensional attributes create more customer satisfaction when fulfilled, and they also cause dissatisfaction when not achieved. Increase in Must-be attributes does not increase customer satisfaction, but they result in dissatisfaction when not achieved.

The questionnaire was divided into two sections; property services and user services. The aim was to learn about tenants' views on the green aspects of the included services. The property services section included questions regarding a extensive scope of potential green property services e.g. energy conservation, energy management, recycling, green cleaning, catering services and information and communication of environmental matters. Similarly, the user services section included questions of for example parking arrangements, mailing and messenger services, security services, tele- and video conferencing facilities and consulting and support for environmental matters from manager.

The results showed that for the most part, there was no strong consensus regarding the green quality attributes. However, most attributes do have higher shares in attractive or the indifferent dimensions. Table 4 shows the high frequency attributes, namely those green property as well as user services that received more than 50% of all responses to one individual category.

Table 4 Highly scoring categories

	Property services	User services
<b>Attractive attributes<sup>1</sup></b>	<ul style="list-style-type: none"> <li>– Green image of the office building</li> <li>– Water saving techniques in cleaning services</li> <li>– Saving energy with energy saving investments</li> <li>– Minimizing energy consumption to decrease environmental impacts</li> <li>– Eco-labeled tissue papers and hand towel systems</li> <li>– Organic or local food in restaurant services</li> </ul>	<ul style="list-style-type: none"> <li>– Tele and video conferencing facilities</li> </ul>
<b>Indifferent attributes<sup>2</sup></b>	<ul style="list-style-type: none"> <li>– Hourly-based information of the buildings energy consumption</li> <li>– Comparing buildings energy efficiency to similar buildings</li> <li>– Regular information of premises electricity consumption</li> <li>– Regular communication of buildings environmental and energy matters from manager</li> </ul>	<ul style="list-style-type: none"> <li>– Green messenger services (e.g. bicycle messenger)</li> <li>– Personal consulting for premises' environmental and energy efficiency from reception services</li> <li>– Support for organisations environmental goals from manager</li> </ul>
<b>Reverse attributes<sup>3</sup></b>	<ul style="list-style-type: none"> <li>– Additional charges for green property and user services</li> </ul>	<ul style="list-style-type: none"> <li>–</li> </ul>
<b>One-dimensional attributes<sup>4</sup></b>	<ul style="list-style-type: none"> <li>–</li> </ul>	<ul style="list-style-type: none"> <li>–</li> </ul>
<b>Must-be attributes<sup>5</sup></b>	<ul style="list-style-type: none"> <li>–</li> </ul>	<ul style="list-style-type: none"> <li>–</li> </ul>

<sup>1</sup> Increase in Attractive attributes brings more customer satisfaction, but does not cause dissatisfaction in nonfulfillment.

<sup>2</sup> Increase in Indifferent attributes does not influence customer satisfaction

<sup>3</sup> Increase in Reverse attributes will cause dissatisfaction

<sup>4</sup> Increase in One-dimensional attributes brings more customer satisfaction, and causes dissatisfaction in nonfulfillment.

<sup>5</sup> Increase in Must-be attributes does not increase customer satisfaction, but causes dissatisfaction in nonfulfillment

A total of 17 green property service attributes were included in the questionnaire, and 11 of those (65%) received a high ranking score to a specific dimension as shown in Table 4 above. The ones that were found attractive i.e. green image of the building, water efficient cleaning, energy saving investments, minimizing energy consumption to decrease environmental impacts, eco-labeled tissue papers and organic or local food represent multiple property services, like cleaning and catering. Two of the attractive attributes focus on energy. Surprisingly, most of the indifferent attributes focus on energy as well (three out of four). The indifferent energy related attributes focus more on communicating and information about energy use, whereas the attractive attributes include energy saving actions. This could indicate that the tenants look for real improvement and prefer these services to be performed as a matter of routine by the building management, and without their contribution.

Seven green user service attributes were included in the questionnaire. Four of those (57%) received a high ranking score to a dimension. The only attractive attribute was tele and video conferencing facilities. Two of the indifferent attributes focus again on communication and one also on messenger services. Tele and video conferencing facilities may increase satisfaction as it can decrease the need for travelling thus decreasing costs also. However, consulting and support are not considered beneficial.

It can be deducted from the results, that green service characteristics can increase customer satisfaction by positively surprising the customer, as the attractive attributes indicate. The same amount of attributes was also found indifferent, indicating that some green characteristics are irrelevant for the respondents. One attribute, namely additional charges for green property and user services, was even found to cause dissatisfaction. None of the green attributes were dominantly regarded as one-dimensional or must-be, indicating that these types of services are not yet expected as standard service.

An additional perspective to the discussion of green property services is that small tenants do not necessarily have resources for active environmental management, and they could benefit from ready-made solutions and support from the manager. However, in this study it seemed that the tenants were most uninterested in the green attributes that would require some involvement from them, including the support, consulting and communication. It could be interpreted that for small tenants the value of environmental effectiveness is increasing as long as no extra effort or expense is required on their own part.

The first three papers have focused on two different green property services concepts; one from service provider and another from customer perspective. Similar to early literature both Papers I and III found that energy related services have a high impact both on the environmental performance and customer satisfaction and value, thus the next paper studies a specific energy management service in more detail.

### **3.4 Paper IV: Remote Energy Management Benefits in Retail Building Portfolios**

The fourth paper focuses on a single property service; energy management. One of the key areas identified in previous papers as well as literature was energy efficiency, thus energy efficiency in property service context was chosen to be studied more closely. The aim in this study is to find out how energy management can enhance the environmental performance of commercial buildings. The specific service chosen in the paper is a remote building control service, which performs energy management and conservation activities for commercial buildings utilizing building automation systems and also guiding the local maintenance staff on corrective measures.

The service was analysed by collecting and analysing the influence of the energy management service in two retail building portfolios (A and B) comprising 44 properties located all around Finland. The buildings had been connected to the remote energy management control center, an energy guidance pro-

tol was implemented and the energy consumption was followed on a regular basis. The analysis utilized consumption data from a 24 month control period. The consumption was then compared to the reference consumption levels retrieved from a 12 month period before the buildings were connected to the service.

Energy consumption is divided into electricity consumption (grid purchase) and heating energy consumption (combined power and heat). In Finnish context heating is of major importance; thus in local context it is always separated. There is good additional rationale to separate them, price (ca. 50% difference), carbon profile, the owner of the bill, etc. In this case setting, the consumption of electricity during the 24 months control period was decreased in first test portfolio (A) by 7% and heating energy by 26%. In the second portfolio (B) electricity consumption decreased also by 7% and heating energy by 4%. These totaled 332,930 € economic benefits and 1,212 tons of saved GHG emissions for portfolio A and savings of 418,544 € with 1,436 tons GHG emissions for portfolio B. These results were achieved via the implementation of a continuous and regular energy monitoring and control of building systems and equipment. Further analysis showed that the energy consumption kept on decreasing after the initial improvements of the first year. However, it should be noted that the results depend heavily on the characteristics of the property in question, and the willingness of the owner to invest in improvements. The interviews did not relieve the reason for unwillingness to invest in energy efficiency, but the literature has recognized several possible reasons, for example too long pay-back times or split incentives, which may well be the actual reasons in this case also.

Based on the results, it can be assessed that energy management and control of building systems can be a cost effective way to ensure that the building systems operate properly and energy use is minimized. The results depend on the characteristics of the particular properties, but at a portfolio level efficiency and energy savings can be obtained. The centralized service can serve geographically dispersed buildings thus producing the same service level independent of the professional expertise at separate local units in multiple locations.

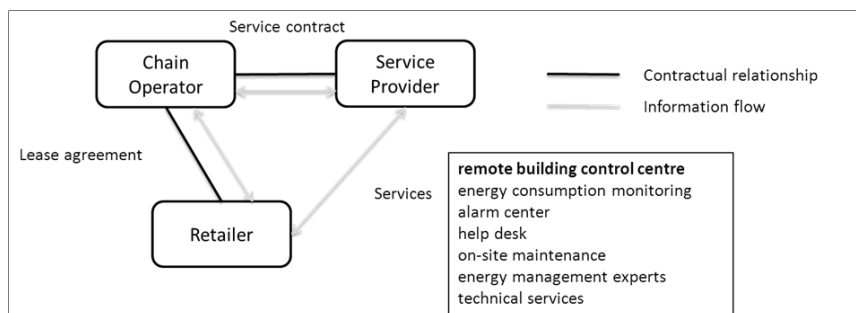
As this paper studied the benefits of implementing the energy management service, the next paper seeks to understand more deeply the overall value the energy management service to its customers.

### **3.5 Paper V: Value Delivery Barriers in Energy Services**

The fifth paper continues to study the energy management service. The purpose was to understand how the customers of the energy management service perceived the value of active energy management. The study included only one of the previously studied building portfolios. The analysis includes the strengths and weaknesses of the service delivery that may affect the value experienced by the customer.



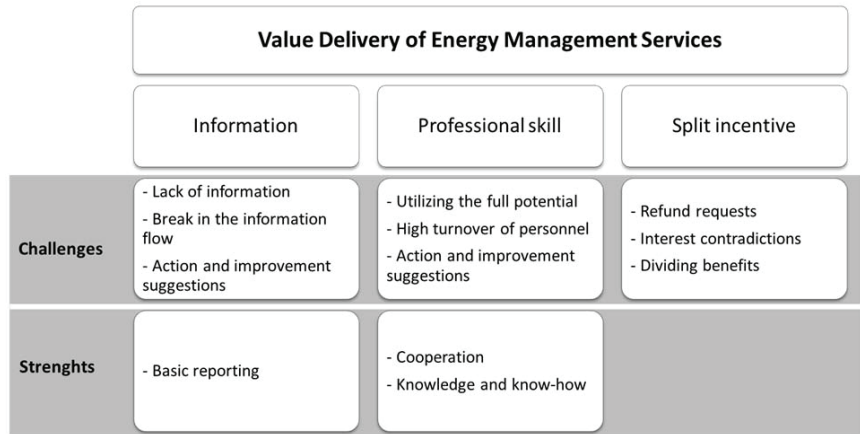
The customer of the energy management service is a retail store chain operator in Finland, one of the above studied two commercial building portfolios in Paper IV. The research setting is presented in Figure 3 below. The retailers have signed a lease agreement with the chain operator. The chain operator is generally responsible for the heating of premises and property-electricity (e.g. ventilation). The retailer pays for the metered consumption of end-user electricity (e.g. lighting and refrigeration). The basic maintenance services are included in the lease. The retailer is responsible for the maintenance of their own equipment, e.g. refrigeration equipment. In Figure 3 the dark line represents contractual relations and grey line represents information flow.



**Figure 3 Research setting**

The study was conducted with 8 semi-structured interviews with the customer party. Half of the interviews were conducted with the chain operator representatives and the other half with retailers. The interview transcriptions were analysed and coded to form categories of the repetitive themes. The themes were then searched for strengths and weaknesses which were listed and rearranged to identify the final central categories for energy management service delivery.

The importance of energy management services was recognized by all interviewees both from the retail chain operator and retailer perspective. The main driver behind energy management seemed to be the economic value it can provide. Half of the interviewees (two retailers and two chain operators) predicted that even more attention to energy management is needed as energy costs continue to grow and the importance increases with the growth. In addition, three categories of energy management characteristics that can affect customer value could be identified based on the interviews. They are here named information, split incentive problem and professional skills. The weaknesses of energy management service delivery showed as challenges in information category; information flow and lack of information, for professional skill category; key-personnel turnover and full utilization of energy management expertise and for split incentive problem category including the allocation of the benefits. The strengths of energy management delivery in the information category is reporting and for professional skill category cooperation and know how. The results of the study are illustrated in Figure 4.



**Figure 4** Categories affecting the value delivery of energy management service

The categories present issues that can affect customer satisfaction, as presented in Figure 4. The information category is related to the quality of the service. Reports and suggestions should be fully completed and condensed in order for the customer to fully utilize the service. The high turnover of key personnel can create breaks in the service performance and level of quality. Split incentive problems are related to the service contracting and energy cost allocation between the parties. The benefits of the energy management service can be difficult to divide fairly between the retailer and the chain operator. However, good cooperation and know-how of the energy management service generate value for the customer.

## 4 Conclusions and Discussion

### 4.1 Summary of the results

The aim of this research was to evaluate green property services' ability to enhance building environmental performance, while at the same time creating customer value. The results can be analysed from a two-level point of view. On the other hand, green property services were studied on a broad scale, focusing on the green property services as an extensive service concept. On the other hand, one specific service was chosen to be analysed more thoroughly. The energy management service was chosen as it has the most direct link between buildings environmental efficiency, namely, energy use affecting the energy efficiency of the building.

The first research question endeavored to find out how green property services can enhance the environmental performance of commercial buildings. It was found that the green property services concept could contribute to achieving a green building certification for an existing office building, and also in achieving practical savings in energy and water consumption. The energy management service contributed to both energy and monetary savings for operational retail buildings of different ages and characteristics and use patterns. Thus energy management service was found to have a large role in the environmental performance of commercial buildings. Also, including mobility management and commuting in to the scope of property services could create further GHG emission reduction, increasing the potential positive impacts.

These results indicate that professional property services have a direct connection to the very core of building environmental performance, namely energy use and the consequent GHG emissions. However, if the concept of property services is expanded even further from the traditional definition, even more environmental advantages could be obtained from developing the service scopes. Including the mobility management aspect in the mindset of green property services could transform the future direction of the field towards overall green management.

The second research question strived to find out how customers value green property services. The green property services concept was found to have an impact on the customer value, for example by increasing customer satisfaction in a multi-tenant office building. However, the tenants were not willing to pay extra for the specialized green services. They saw the value, but did not see the cost-benefit relation, or would have needed more education and information

about it, in order to consider expenditure on implementation of green strategies. Regarding the energy management service, the research showed that when the customers are already environmentally conscious, added value for the customer can be achieved along with energy and monetary savings and energy management is regarded highly and it is expected that its importance will increase in the future.

To summarize, it can be stated that **green property services do have a positive effect in environmental performance of buildings, and they can create added value for customer** both on an extensive scale (green property services concept) and on a narrow (specific service). Energy management in particular may have a considerable influence over a buildings' energy consumption, even when no major investments are implemented or building occupants are not invested in improving their energy related behavior.

This thesis proposes that **green property services concept could be a simple way for building owners and tenants to take environmental responsibility into account, even if they do not have the necessary resources or expertise to do it themselves**. However, it would seem that some incentive is still needed to get all tenants interested and willing to invest their time and/or money into environmental efficiency. In particular, the split-incentive problem needs more feasible solutions to overcome it. This is a challenge also for property and facility managers. An important question is how they could, or should, support both their contract customers as well as the occupants of the buildings in finding the right solution in these situations.

## 4.2 Evaluation of the research

Each appended paper contains its own discussion of the quality of research, applicable for the particular study. In this section, the quality of the compilation thesis is discussed. The quality of research is usually evaluated discussing the validity and reliability of the research (Eisenhardt, 1989). Validity refers to whether the research studies what it was supposed to study (Metsämuuronen, 2006). Reliability refers to the repetitiveness of the research; would the same results be achieved by another researcher following the exact same process (Eisenhardt, 1989; Metsämuuronen, 2006).

Four tests have commonly been used to test the quality of empirical research, such as case studies (Yin, 1994). These tests are *construct validity*, *internal validity*, *external validity* and *reliability*. Next, the four tests are discussed in more detail.

### Validity

Construct validity refers to whether correct operational measures for the concepts have been established (Eisenhardt, 1989). Often, this test has been found problematic in case study research. Yin (1989) however presents tactics to increase construct validity, one of which is using multiple sources of evi-

dence. This research included multiple case studies, and data collection exploited multiple methods and data sources; such as interviews, observation, a questionnaire and numeric consumption data. This research utilized various data collection methods and evidence, which improves the construct validity of the study and is in accordance with Yin's approach.

Internal validity is a concern for causal or explanatory research (Eisenhardt, 1989), where the researcher tries to determine whether one event led to another or was there a third component affecting it. This study claims no causality in traditional sense; therefore the internal validity is not an issue as such. For these reasons, internal validity is mostly left out of the assessment. However, in the case of energy management service, paper IV, the internal validity is supported by the time-series structure of the study, as presented by Yin (1994).

External validity refers to whether the study's findings can be generalized beyond the case study and, if it can, to which groups (Eisenhardt, 1989). Typically, single cases are deemed non-generalizable. However, case studies do not aim at statistical generalization, but rather analytical generalization, with the focus to generalize results to some broader theory. Yin (1994) suggests replication to increase external validity in case study research. Even when the case studies were not replicated as such, the research included two separate green property services concepts which were studied independently. Similarly, this gives some foundation for external validity, as well.

### **Reliability**

The objective of reliability is that if another researcher would follow the exact same processes and procedures and conducted the same case study again, they would reach the same results and conclusions (Yin, 1994). Reliability is sometimes also called repeatability. The goal is to minimize errors and bias of the study. Yin (1994) suggests two tests to increase the reliability of case study research. Those tests refer to using case study protocol and developing case study data base. Silverman (2000) also recommends researchers to document their procedures to increase reliability.

The case studies' progress and results were followed regularly by the research or management teams. Research plans were developed in advance and findings and results were reflected to those plans. Documentation and archiving data and evidence were taken care of and the data is securely stored. These efforts improve the reliability of the thesis. Similarly the results have been reviewed by several external reviewers in the academic peer-review and publishing process as well as reported publicly.

Case study database means that other investigators could review the evidence directly and not be limited to written reports (Yin, 1994). In this thesis, case study database has been developed, and all data, comprising transcribed interviews, consumption data and questionnaires have been stored. However, some of the data includes identifiable information of people and buildings which are not authorized to general public, but are nevertheless read by several internal stakeholders.

### 4.3 Contribution

This thesis focuses on the operations and management of existing commercial buildings. The discussion around the built environment and its climate impacts is continuing, both in academia and practice making the thesis topical. The importance of building operation in environmental efficiency has been brought up by many scholars already (Junnila and Horvath, 2003; Junnila et al., 2006; Reed and Wilkinson, 2005; Wood, 2006). Facility management or services have been linked to sustainability also by several authors, such as Hodges (2005) and Aune (2009). Also greening facility management has been suggested as a new strategy for added value of facility management (Jensen et al., 2012).

This research builds on the previous studies, but is one of the first to combine the environmental benefits of green property services with customer value, providing new perspectives to real estate research. The value in terms of cost savings is evident for property owners, however, also value for occupants can be generated in terms of customer satisfaction. The occupant perspective expands the potential contribution of property services even further, as usually building owner is considered customer from the management's point-of-view.

This dissertation contributes to the understanding of property services field, as the studies show that coinciding benefits can be achieved with green property services, whether by management of a larger integrated set of services or a singular service, or meeting the needs of the building owner or occupants. The benefits can include both energy consumption and GHG emission reduction, and improving customer satisfaction.

This thesis contributes to the property service practice by improving the business case for green services. The study shows that green property services and energy management create not only environmental benefits, but also improved customer satisfaction and relationship, i.e. customer value. This study also demonstrated the need to improve the information flow, in particular the cost-benefit analysis, towards customers. The information should be made available to the customer, who may not have the resources or expertise to evaluate the benefits of environmental or energy related improvements for their operation. In other words, green property services should be able to provide relevant information to a customer who may not even know to ask.

### 4.4 Future research

This research included only a limited number of case studies; hence the research could be continued by studying more green property services concepts and services. In this research, it was possible to study two green property services concepts and one energy management service. To continue the research by other green service concepts would create a more solid foundation for both the academic and practical field of facility and property management. The case studies in this thesis are also limited to Finnish context; international studies would generate a more comprehensive view of the topic.

There is a clear need for further and more detailed research within the domain of energy and environmental efficiency of the built environment. The sustainable operation of buildings is not hindered by a lack of technologies. More information is however needed on the different roles of the different actors in the area. Kyrö (2013) brought attention to the different actors in housing management with regards to climate change mitigation, similar research could prove beneficial for the commercial building sector as well. The role of facility and property management in the environmental performance of existing commercial building stock needs further evidence to form a basis for sustainable building management.

Value must be created to the customer – be it the building owner or the occupant. Understanding what creates value for the customer is vital. Balancing between the owner and tenant and their needs and incentives in environmental or energy efficiency improvements would be worth investigating. Continuing the research around added value of facility management and in particular the influence on organisations' core business and creating added value through green facility management would be useful, as suggested by Jensen et al (2012). This research just scrapes the surface of customer value through green property services, and thus more studies are required on the topic. Customer needs also change over time. It would be interesting to see whether the attitudes for green property services and energy management change over a period of time.

The relationship, behavior, and complex contractual links between manager, service provider, owner and tenants would also be worthwhile to study further. Situations such as split incentive and free rider problems are issues which need solving in order to encourage and reach sustainable development.

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## Appended Papers I-V

Existing buildings hold the most potential for improving environmental performance, as the building stock renews itself at a slow pace. While new development projects benefit from tightening building codes and regulations, existing commercial buildings are mostly at the discretion of the building owner or real estate management. This dissertation introduces green property services as a way to improve commercial buildings' environmental performance, while at the same time creating customer value. A green property services concept could be a simple way for building owners and tenants to take environmental responsibility into account, even if they do not have the necessary resources or expertise to do it themselves. However, it would seem that some incentive is still needed to get all tenants interested and willing to invest their time and/or money into environmental efficiency.



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