Department of Real Estate, Planning and Geoinformatics

The Untapped Potential of Urban Planning: Achieving Greater Success in Environmental Sustainability

Eeva-Sofia Säynäjoki

Aalto University

UNIVERSITY OF ICELAND

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Abstract

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Abstract

Both the source of and the potential solution to the global ecological decline can be traced to urban areas, where population and consumption concentrate to become the demand centres of the global economy. In an ever-increasing number of political visions, urban planning has the power to enable better futures through the transformation of urban areas into sustainable communities. The purpose of this dissertation is to examine how urban planning is applied to promote and facilitate environmental sustainability and to shed light on the extent to which current policies and practices are successful in reducing the environmental burden of urban communities. The context of the research is sparsely populated regions where, even in the major cities, population density is low on a global scale.

The predominantly qualitative, multi-method research approach includes two multiple case studies, a literature-based analysis, and a focus group study. Linking the findings of four separate publications, the dissertation argues that the full potential of urban planning to promote and facilitate environmental sustainability is not being reached. The densification of urban structures is found to be the dominant means through which urban planning attempts to achieve environmental improvements in sparsely populated urban areas. However, the anticipated environmental benefits of urban densification as a generic planning strategy do not necessarily materialise in sparsely populated regions, and the eventual environmental impacts and outcomes of urban regeneration may in end effect be contradictory to the objectives specified in the planning and decision-making processes.

Even more worrisome is that the environmental considerations made in urban planning appear to ignore a significant, varying share of the environmental burden that urban areas are responsible for. Professionals of urban planning do not see a connection between urban structure and sustainable lifestyles or consumption choices, aside from those related to housing and daily journeys. Conversely, this limited scope of urban planning's perceived influence carries the risk of actually increasing consumption. A broader perspective on urban environmental sustainability is suggested to provide greater success in reducing environmental burden through urban planning.

Keywords environmental sustainability, urban planning, sustainable communities, consumption, GHG emissions, sparsely populated regions, urban densification

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Tekijä
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Väitöskirjan nimi
Yhdyskuntasuunnittelun piilevä potentiaali ekologisesti kestävän kehityksen edistämisessä

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Tiivistelmä

Maailmanlaajuisen ympäristön tilan heikkenemisen voidaan ajatella johtuvan lähtökohtaisesti kulutuksesta, joka ohjaa tuotantoa ja toimitusketjuja. Kaupungistumisen myötä väestö ja kulutus keskittyvät, jolloin rakennetun ympäristön merkitys elämäntapojen ja kulutustottumusten laajempana puitteena korostuu. Kestävän kehityksen visioissa yhdyskuntasuunnittelu onkin ratkaisevassa asemassa paremman tulevaisuuden mahdollistajana. Rakennettua ympäristöä kehittämällä kaupunkialueet ja taajamat uskotaan voitavan muuttaa ekologisesti kestäviksi yhdyskunniksi. Tämän väitöskirjatutkimuksen tarkoituksena on selvittää, kuinka ekologista kestävyyttä edistetään yhdyskuntasuunnittelun keinoin ja kuinka hyvin yhdyskuntien ympäristölle aiheuttamaa kuormitusta onnistutaan vähentämään nykyisten toimintaperiaatteiden ja käytäntöjen varassa.

Väitöskirjan tutkimusote on kvalitatiivinen, ja työssä käytetään useita erilaisia tutkimusmenetelmiä. Väitöskirjatutkimuksen tulokset osoittavat, että yhdyskuntasuunnittelulla voitaisiin edistää ekologista kestävyyttä nykyistä paremmin. Yhdyskuntien ympäristövaikutuksia pyritään vähentämään erityisesti harvaan asutuilla seuduilla lähes yksinomaan yhdyskuntarakennetta tiivistämällä. Tavoiteltuja ympäristöhyötyjä ei kuitenkaan välttämättä saavuteta yhdyskuntarakenteen tiivistämisen kautta. Aluekehityshankkeiden vaikutukset voivat olla lopulta jopa täysin päinvastaisia kuin niille suunnittelu- ja päätöksentekoprosesseissa asetetut tavoitteet.

Erityisen huolestuttavaa on, että yhdyskuntasuunnittelussa jätetään kokonaan huomiotta merkittävä osuus yhdyskuntien aiheuttamasta ympäristökuormituksesta. Rakennettua ympäristöä kehittämällä pyritään vaikuttamaan vain autoiluun ja asumiseen. Muu kulutus rajataan tyypillisesti kestävyystarkastelujen ulkopuolelle, koska yhdyskuntasuunnittelun ammattilaiset eivät näe yhteyttä rakennetun ympäristön, elämäntapojen ja kulutusvalintojen välillä. Tähän kapeakatseisuuteen ja siitä seuraavaan lyhytnäköisyyteen liittyy riski hallitsemattomasti kasvavasta kokonaiskulutuksesta ja luonnon kantokyvyn ylittymisestä. Väitöskirjan löydösten perusteella kokonaisvaltaisempi näkökulma yhdyskuntien ekologiseen kestävyyteen avaisi yhdyskuntasuunnittelulle uusia vaikutusmahdollisuuksia, joiden kautta ympäristön kuormitusta onnistuttaisiin vähentämään tehokkaammin.

Avainsanat ekologinen kestävyys, yhdyskuntasuunnittelu, kestävät yhdyskunnat, kulutus, KHK-päästöt, harvaan asutut seudut, yhdyskuntarakenteen tiivistäminen

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Heiti doktorsritgerðar
Vannýttir möguleikar í borgarskipulagi: Að ná meiri árangri í umhverfissjálfbærni

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Útdráttur

Bæði ástæður og lausnir hnattrænnar hnignunar vistkerfisins má finna á borgarsvæðum þar sem þéttleiki íbúa og neysla hafa myndað miðpunkta eftirspurnar alþjóðahagkerfisins. Nú þegar stjórnmálin leggja fram sífellt fleiri hugmyndir að skipulagi framtíðar, getur borgarskipulagsfræði nýst sem tæki til að umbreyta borgarsvæðum í sjálfbær samfélög. Tilgangur þessarar ritgerðar er að kanna hvernig borgarskipulagi er beitt til að efla sjálfbærni í umhverfismálum og til að varpa ljósi á hve vel núverandi stefnur og starfshættir nýtast við að draga úr umhverfisálagi þéttbýlis. Rannsóknin tekur til svæða þar sem þéttleiki byggðar er hlutfallslega lítill á alþjóðavísu þó um borgir sé að ræða.

Rannsóknin felur í sér fjölþætta aðferðafræði sem eru aðallega eigindlegar. Tveir rannsóknarhlutar byggjast á skoðun tilfella og dæma, þá er framkvæmd heimildarýni og einnig er gerð rannsókn með rýnihópi. Ritgerðin tengir saman niðurstöður fjögurra rannsóknargreina og færir rök fyrir því að möguleikar skipulagsfræði til að örva og greiða fyrir sjálfbærni í umhverfismálum séu vannýttir. Niðurstöðurnar sýna að þétting byggðar er helsta verkfærið sem nú er notað til að reyna að ná fram úrbótum á sviði umhverfismála í dreifðri byggð. Hins vegar, þegar þétting byggðar er notuð sem einföld almenn skipulagsstefna næst væntur ávinningur ekki endilega. Umhverfisáhrif og afleiðingar af endurnýjun borgarsvæða með þéttingu geta reynst vinna gegn settum markmiðum skipulags- og ákvarðanatökuferlisins.

Enn varhugaverðara er að þau umhverfissjónarmið sem höfð eru til hliðsjónar við borgarskipulag virðist ekki taka tillit til tiltekinna marktækra en breytilegra umhverfisáhrifa byggðar. Fagfólki í skipulagsfræði hættir til að sjá ekki tengslin á milli byggðaforms og sjálfbærs lífsstíls eða neyslumynsturs nema að því er varðar húsakost og daglegar samgöngur. Þetta takmarkaða sjónarhorn á ætluð umhverfisáhrif borgarskipulags ber með sér hættu á því að aðgerðir auki neyslu þvert á áætlanir. Lagt er til að beitt sé víðtækara sjónarhorni á sjálfbærni í borgarumhverfi til að auka árangur af skipulagsaðgerðum sem ætlað er að draga úr umhverfisáhrifum.

Lykilorð umhverfissjálfbærni, borgarskipulag, sjálfbær samfélög, neysla, losun gróðurhúsalofttegunda, dreifð byggð, þétting byggðar í borgum

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Since Jukka invited me to join the Real Estate Business Research Group and to become one of his first doctoral students, I have generally been quite a pain for him: I have not researched what I was intended to, but have taken a totally different path of my own instead; each time after carefully listening to his good advice I have taken the course of action that I considered to be the best myself; and instead of following his footsteps of efficiency and generality, I have spent countless hours in the futile pursuit of perfection. Despite all of this, Jukka has never expressed disappointment, and has always fully supported my attempts to learn in my own way and to become the academic I want to be. Jukka has always been extremely willing, able and unhesitating to help me, whatever the problem or subject matter, and during four years of ups and downs I have never felt alone. When Jukka was appointed a professorship abroad and moved to Iceland, nothing changed. Thank you, Jukka, for dedicating so much of your time and expertise to me.

I see Seppo as the heart and the soul of the REB research group, which I am proud to belong to. He lets us try our wings and encourages us to fly but manages to catch anyone that falls before they hit the ground. Seppo's admirable expertise and strong character have always impressed me, and his help has been available whenever I have needed it (with or without admitting it myself on the first place). Seppo's sparring has been valuable for the quality of my thinking, and the few times I have felt unsure about the path I have chosen, Seppo has provided encouragement. Thank you, Seppo, for your trust, patience and wisdom.

When I joined the REB research group four years ago, I could not have felt more warmly welcomed. I had hardly sat down at my desk before Dr. Riikka Kyrö casually asked if I would like to co-author a paper with her. The REB researchers, past and present, have been the most fun colleagues one could wish for. Thank you, all, for sharing so much with me. An especially important research group colleague has been my big brother, Antti, who has provided amazing support, whatever I have been struggling with and whenever I have needed a helping hand. Thank you, Antti, for always being there for me.

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Regarding the compiling part of the dissertation, I am very grateful to my honoured pre-examiners, Associate Professor Evonne Miller and Assistant Professor Aumnad Phdungsilp, whose insightful comments have truly helped me to strengthen the argument. I also wish to thank Professor Jyri Seppälä for accepting the invitation to act as my opponent. It is a great honour to have my dissertation examined by someone I have always looked up to.

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List of appended papers

This doctoral dissertation consists of a compiling part and of the following four publications, which are referred to in the text by their numbering, as designated below.

Paper I
Säynäjoki, Eeva; Kyrö, Riikka; Heinonen, Jukka; Junnila, Seppo (2012) An assessment of the applicability of three international neighbourhood sustainability rating systems to diverse local conditions, with a focus on Nordic case areas. Taylor & Francis Group, *International Journal of Sustainable Building Technology and Urban Development*, volume 3, issue 2, pages 92–100. ISSN of journal: 2093-761X. DOI of article: 10.1080/2093761X.2012.696319.

Paper II
Säynäjoki, Eeva-Sofia; Inkeri, Ville; Heinonen, Jukka; Junnila, Seppo (2014) How central business district developments facilitate environmental sustainability – A multiple case study in Finland. Elsevier, *Cities*, volume 41, part A, pages 101–113. ISSN of journal: 0264-2751. DOI of article: 0.1016/j.cities.2014.05.010.

Paper III
Säynäjoki, Eeva-Sofia; Heinonen, Jukka; Junnila, Seppo (2014) Role of Urban Planning in Encouraging More Sustainable Lifestyles. American Society of Civil Engineers, *Journal of Urban Planning and Development*, 04014011. ISSN of journal: 0733-9488. DOI of article: 10.1061/(ASCE)UP.1943-5444.0000196.

Paper IV
Säynäjoki, Eeva-Sofia; Heinonen, Jukka; Junnila, Seppo (2014) The Power of Urban Planning on Environmental Sustainability: A Focus Group Study in Finland. MDPI AG, *Sustainability*, volume 6, issue 10, pages 6622–6643. ISSN of journal: 2071-1050. DOI of article: 10.3390/su6106622.

Author's contribution to the papers

Paper I
The author is responsible for writing the paper and for initiating and executing the research together with the second author. The third and the fourth authors provided advice, comments and suggestions.

Paper II
The author is responsible for writing the paper and for initiating and executing the research together with the second author. The third and the fourth authors provided advice, comments and suggestions.

Paper III
The author is responsible for initiating, executing and writing the paper. The second and the third authors provided advice, comments and suggestions.

Paper IV
The author is responsible for initiating, executing and writing the paper. The second and the third authors provided advice, comments and suggestions.

Table of contents

1. Introduction

> "*The world may well simply stay its present development course in the blind hope that things will all work out.*
>
> *If so, humans may well become the first species to document in exquisite detail the factors leading to its own demise without acting to prevent it.*"
>
> - Rees and Wackernagel 1996

1.1 Background

The explosive increase of gross global consumption threatens the vitality and existence of the Earth's immeasurably valuable ecosystems (Bithas and Christofakis 2006; Grimm et al. 2008; Simms et al. 2010; Bourdic and Salat 2012). Biodiversity loss, interference with biochemical flows and climate change seem to be the most urgent environmental problems of our time (Rockström et al. 2009; Steffen et al. 2015). The negative environmental impact of population growth is somewhat abating but that of consumption is still rising, sharply outpacing the development of environmental technologies (Dodman 2009; Satterthwaite 2011; Edenhofer et al. 2014). Therefore, it is suggested that a decrease in consumption through lifestyle shifts is required globally, especially among the most wealthy, to enable environmental sustainability through technological improvements (Huppes and Ishikawa 2009).

Both the source of and the potential solution to the global ecological decline can be traced to urban areas, where population and consumption concentrate to become the demand centres of the global economy (Rees and Wackernagel 1996; Bithas and Christofakis 2006; Grimm et al. 2008; Daffara 2011). Modern cities are among the greatest human achievements: they magnify humanity's strengths by allowing for social and economic mobility, attracting and developing talent, spurring innovation, and encouraging entrepreneurship, to name but a few examples (Glaeser 2011). However, urban areas are *parasites* in the sense that they heavily rely on rural ecosystems, their environmental impacts extending far beyond the urban domain (Eaton et al. 2007; Dodman 2009; Kissinger and Rees 2010). In terms of urban metabolism, natural resources including fuels, materials, water and nutrients are drawn into urban areas; whereas waste, greenhouse gases and other emissions are excreted to the air, water and soil of the surrounding nature (Bithas and Christofakis 2006; Dodman 2009; Kennedy et al. 2011). In the

globalised economy, urban consumption causes spatially separated resource extraction, pollution, and habitat destruction through trade and a highly complex web of supply chains (Ramaswami et al. 2008; Tukker et al. 2009; Wiedmann et al. 2011).

As environmental improvements in urban systems are an urgent priority in the global push for sustainability, and are gaining significant rhetorical ground in politics around the world, urban planning has become a key means of environmental governance (Bulkeley and Betsill 2005; Bithas and Christofakis 2006; Kenworthy 2006). In an increasing number of political visions, urban planning has the power to enable better futures through the transformation of urban areas into sustainable communities (Myers and Kitsuse 2000; Shane and Graedel 2000; Bulkeley and Betsill 2005; Holden and Norland 2005; Gunnarsson-Östling and Höjer 2011; Musakwa and Van Niekerk 2013). Urban planning is seen as means to create operational conditions for the achievement of environmental sustainability, to facilitate the success of technical solutions and to encourage certain human behaviours (Bithas and Christofakis 2006; Eaton et al. 2007; Bourdic and Salat 2012; Hoornweg et al. 2011). Therefore, understanding how the ongoing regeneration of urban structures affects lifestyles and consumption is critical for the success of environmental policies.

Of all of the intensifying environmental problems facing society today, climate change in particular has gained political momentum (Bulkeley 2010; Kunchornrat and Phdungsilp 2012). National and international commitments to the reduction of greenhouse gas (GHG) emissions have evoked a revolutionary municipal movement, whereby municipalities across the world develop localised climate action strategies, receive financial assistance from the national level, and mobilize a cluster of private actors to develop urban areas in a unified manner (Bulkeley 2010). A myriad of different sustainability schemes has emerged for the certification and benchmarking of urban developments.

The environmental benefits of a compact urban form and functional public transportation typically form the core of environmentally oriented urban development strategies (Kenworthy 2006; Eaton et al. 2007; Glaeser and Kahn 2010). High population density is an enabler for cost-effective, centralised infrastructure and services, and thus for combined heat and power, waste-to-energy generation, sewage disposal, waste sorting, and recycling of materials (Dodman 2009; Satterthwaite 2011). Short distances facilitate walking and cycling, and convenient public transportation services further reduce the need for private driving (Holden and Norland 200; Grazi et al. 2008; Kennedy et al. 2009). In addition, within a compact urban structure people inhabit less heated or cooled living space, and the urban areas occupy less land (Norman et al. 2006; Rickwood 2009; Satterthwaite 2011).

Given that the environmental impact of housing, waste management and daily journeys is thus likely to be smaller within large urban agglomerations than in areas of dispersed settlement, urbanisation may actually relieve the environmental burden of inhabitants' necessities (Grimm et al. 2008; Dodman 2009; Bulkeley 2010; Satterthwaite 2011). In order to fully employ this

environmental potential for urban land use, centralist principles are fundamentally incorporated into environmentally oriented planning agendas, and municipal authorities systematically reject plans for alternative forms of development (Valler 1996; Cullingworth and Nadin 2007; Henderson 2011).

Addressing, for example, climate change through urban planning is a local process, which should include such elements as measuring emissions and attributing them to the activities of the community, adopting reduction targets, preparing action plans, implementing policies, and monitoring and verifying results (Dodman 2009; Hoornweg et al. 2011). However, none of the international frameworks for sustainable urban development requires the precise measurement of emissions or provides detailed guidance for conducting urban emissions inventories (Dodman 2009). Therefore, an urban development project with a high sustainability rating does not necessarily generate lower GHG emissions than one with a low rating (Bourdic and Salat 2012).

Even if the GHG emissions were measured, a typical approach is to evaluate only the *direct* emissions from the use of energy and fuels *within* the urban area (Dodman 2009; Baynes et al. 2011). Since primary production is generally located outside of cities, and industry and the manufacturing of goods commonly too, this narrow focus tends to exclude the *indirect* emissions of urban consumption and thus fails to capture the link between urban environmental sustainability and total consumption (Van der Waals 2000; Holden and Norland 2005; Neuman 2005).

An alternative, consumption-based approach to the environmental evaluation of urban activities expands the perspective by also taking into account the impact of the original production and processing of all the products, materials, and food that may be imported to the urban area from elsewhere (Ramaswami et al. 2008; Weber and Matthews 2008; Kennedy et al. 2010). The consumption-based approach provides urban planners with a broader perspective and a conceptual base for planning urban structures that can, through reasonable assumptions, adjust the structure of consumption and the way different products and services are delivered, potentially leading to a reduction in total environmental load (Eaton et al. 2007; Hoornweg et al. 2011; Heinonen and Junnila 2011).

Consumption-based modelling shows how complicated the ecological footprint of an urban household actually is (Moll et al. 2005). A phenomenon called the *rebound effect* explains why improved material- or energy efficiency, or reductions in certain consumption segments do not necessarily have a positive environmental impact by reducing the consumption of energy and materials overall: what is saved from one place will most likely be re-invested elsewhere, resulting in a potentially even worse environmental impact than if no improvement was originally made (Jevons 1866; Schipper 2000; Hertwich 2005; Herring 2006; Turner and Baynes 2010; Galvin 2014).

1.2 Motivation

The current political momentum of environmental issues, in particular climate change, provides a strong environmental rationale to justify and influence decision-making in urban planning (Bulkeley and Betsill 2005; Bulkeley 2010; Book et al. 2010; Bourdic and Salat 2012). The active development of urban areas involves a large number of public and private actors who, through various means, processes and interactions, define the actions that are taken in response to environmental concerns (Bulkeley 2010). An outcome of this complex web of influence and interaction are urban planning decisions and policies, which not only determine the nature of the structures that are developed, but as a consequence also influence the way that society develops within the affected urban environment; impacting people's actions and needs, and redefining the general interpretation of welfare (Bithas and Christofakis 2006; Dodman 2009).

Motivation for this dissertation arises from the realisation that there is significant importance in validating the environmental rationale that is used to guide and justify current urban planning decisions. This importance is attributed at least for three main reasons. Firstly, urban planning decisions that are made today can have long-term and large scale consequences: they can systematically steer societal development towards a particular path, and choosing one path may preclude the possibility to take another (Holden and Norland 2005; Gunnarsson-Östling and Höjer 2011). Secondly, urban planning has a significant impact on people: how they live and how healthy, pleasant and rewarding their living environment is (Williams 1999; Vallance et al. 2005; McGuirk and Argent 2011; Buys and Miller 2012; Kyttä et al. 2013). Where negative social impacts of urban development are justified on environmental grounds, it should be ensured that the ends that justify the means are truly achieved. Thirdly, the processes of building new urban structures or modifying existing ones have huge environmental impacts in the short-run, and it is therefore critical that any long-run environmental benefits that are expected to arise are actually realised (Säynäjoki et al. 2012; Chester and Horvath 2012; Chester et al. 2013; Edenhofer et al. 2014).

The motives behind the research are further strengthened by the indication that, despite widespread political commitment to improving environmental sustainability, efforts in urban planning are failing to live up to the rhetoric (Bulkeley 2010; Jordan and Lenchow 2010). In this light, it seems possible that current urban planning policies and practices are unable to provide solutions to the environmental challenges we face today. For example, eco-efficiency is a popular concept in urban planning, providing a logical base for highly sought-after 'win-win' solutions in urban development: solutions that are expected to provide both economic and environmental benefits (Bulkeley 2010; Lorek and Fuchs 2013). However, many 'win-win' situations on the micro level can become 'win-lose' situations at the macro level, given firstly a limited scope of environmental considerations and secondly the environmental consequences of the resulting economic activities (Huppes and Ishikawa 2009; Bateman et al. 2013; Lorek and Fuchs 2013).

This example highlights what appears to be a critical gap in current knowledge of the true impact of urban planning policies and initiatives in the reduction of total environmental load, in that the outcomes of decisions intended to improve environmental sustainability could in reality have the opposite effect. Past literature has not adequately evaluated the impact of the policies and measures that are being put into place in a growing number of cities across the world (Bulkeley 2010; Jordan and Lenchow 2010; Edenhofer et al. 2014). The technical challenges of urban sustainability have been studied more than the political ones (Hall and Pfeiffer 2000; Whitehead 2003), and a focus on the local scale often ignores the multilevel political system through which the environmental governance of local economies is conducted (Marvin and Guy 1997; Gibbs and Jonas 2000).

However, within urban planning there still lies potential. Local authorities are willing, able and are ideally placed to influence environmental issues: they are key actors in leading the processes of urban development, mobilizing interest groups, co-ordinating action between different partners and facilitating community involvement (Gibbs and Jonas 2000; Bulkeley and Betsill 2005; Eaton et al. 2007). Under national guidance, municipalities form the urban arena within which environmental goals, agreed upon by national governments at an international level, can be reached (Bulkeley and Betsill 2005; Book et al. 2010). The research within this dissertation therefore aims to contribute to the understanding of the true potential of urban planning to prevent environmental degradation.

1.3 Research question and scope

The purpose of this dissertation is to examine how urban planning is applied to promote and facilitate environmental sustainability, and to shed light on the extent to which current policies and practices are successful in reducing the environmental burden of urban communities. The research seeks to understand how the procedures through which urban planning attempts to facilitate environmental sustainability are constituted and rationalised. In addition, the dissertation casts a critical eye on the effectiveness of the approach to urban sustainability and, more specifically, aims to identify how guidance from national and international standards on the promotion and facilitation of environmental sustainability is put into practice at the municipal level. Furthermore, it is critically discussed whether the full potential of urban planning to reduce the environmental burden of urban communities is currently being reached. The research question of the dissertation is accordingly:

'How successfully does urban planning facilitate environmental sustainability?'

The context of the research is sparsely populated regions where, even in the major cities, population density is low on a global scale. In such conditions, *higher* urban density is not necessarily *high* in the absolute means.

Furthermore, urbanisation and urban densification do not necessarily occur naturally but may require a political push. The interest of this dissertation thus lies in how the anticipated benefits of a generic planning strategy for urban development, should one exist, materialise in sparsely populated regions.

However, the interest of this dissertation does not lie in the success or failure of such a strategy's implementation in different conditions, but on the success of the strategy itself when properly implemented. According to Bulkeley and Betsill (2005), successful implementation of urban environmental sustainability requires firstly that local, national and global environmental politics are aligned, and secondly that municipal authorities and other urban actors have sufficient knowledge of the environmental issues upon which they act. Finland, as the main setting of the research, meets both requirements and thus serves the research well.

Research perspectives

The dissertation approaches the research question through three parallel perspectives: *standards for sustainable urban planning*; *the position of environmental sustainability in urban planning decision-making processes*; and *the consumption-based approach to the environmental burden of urban communities*. The contribution of each perspective is itemised below.

First, it is investigated where the potential of urban planning to environmental improvements is supposed to lie. In other words; how urban planning is guided and expected to approach the challenges of environmental sustainability. The first research perspective, namely *standards for sustainable urban planning*, takes international certification schemes and regional evaluation tools for urban environmental sustainability as a reference in the examination of how environmental sustainability is evaluated in the context of urban planning. The challenges that certification schemes for urban sustainability identify in sparsely populated urban areas are itemised, along with the types of planning strategy that they encourage to be conducted. Given that environmental issues are not the only interest in sustainable urban planning, it is assumed that the requirements set by the certification schemes for reducing environmental burden through planning practices are already coordinated and compromised with other dimensions of urban sustainability. It can therefore be revealed how the prevalent ideas and the best practices of sustainable urban development are presumed to promote environmental sustainability.

Second, the methods and means through which urban planning approaches environmental sustainability in practice are studied. The second research perspective, namely *the position of environmental sustainability in urban planning decision-making processes*, provides insight to the use of urban regeneration processes and procedures as a platform for environmental improvements, revealing how environmental considerations are integrated into the planning process and related decision-making. The varieties of planning strategies and spatial solutions through which municipal urban planning attempts to create the operational conditions for environmental

sustainability are itemised and assessed. The reasons for which urban planning has adopted its identified approach to environmental sustainability are then investigated, as is the extent to which the role of urban planning in environmental sustainability is understood. Additionally, the expectations and the achievements of environmental improvements are compared in the context of the urban development process.

Together, the first and the second research perspectives provide evidence of how local practices comply with national and international standards. While the first perspective addresses the current perception of best practices, the second provides insight into the everyday reality. The second perspective also sheds light on the political dimension of the research problem, revealing not only the stance that urban planning has taken on environmental sustainability within the research setting but also how it is a political issue, subject to the distribution of political power and conflicts of political interests.

Third and finally, the dissertation evaluates the extent to which the environmental impacts of consumption are taken into account in environmentally oriented urban planning. Through the third research perspective, namely *the consumption-based approach to the environmental burden of urban communities*, it is assessed how comprehensively urban planning takes total urban consumption and the related environmental degradation into account. The third perspective evolves from recent research that suggests that a consumption-based approach can provide a more holistic view of the true environmental impact of an urban area and the inhabitants within it. Within some parts of the research, GHG emissions are used as a simplified indicator of environmental burden.

Rather than widening the scope of the dissertation, the third research perspective applies more focus to the approach to the research question, with the first two research perspectives now being assessed in light of the third perspective – that of the consumption-based approach. The outcome provides evidence of the extent to which current policies and practices of modifying urban structure, with the aim of positively impacting environmental sustainability, are actually successful.

1.4 Structure of the dissertation

The dissertation is built upon four appended peer-reviewed research papers, all of which have been published in academic journals. The compiling part links the research together and discusses the contribution of the whole, demonstrating how the individual papers each contribute to the research question of the dissertation and lead to a mutual conclusion, which is the argument of the dissertation. Accordingly, the introduction for the dissertation associates the particular research purpose of each paper with the collective research problem and the research question of the dissertation. The methodology of the dissertation, in turn, details the research methods and data collection techniques that were applied in the individual papers.

Furthermore, a summary of the key aspects of each paper is included in the compiling part to highlight the contribution of each publication.

The compiling part of the dissertation is divided into five sections. Section 1 introduces the research topic, establishes the motivation for the dissertation and sets out the research question. Section 2 describes the methodology and the overall design of the research. Section 3 presents the argument of the dissertation. The argument is built on a selection of findings and conclusions, which are referred to in this section and justified in detail in the subsequent sections and in the appended papers. Section 4 summarises the individual papers for the purposes of describing the implications of each and explicating how the mutual conclusion is achieved. Finally, section 5 discusses the argument of the dissertation and presents the conclusions. The validity and the reliability of the research are evaluated and suggestions for future, related research are proposed.

2. Methodology

The roots of the methodological context of this dissertation are in the work of Denzin (1970), Yin (1994) and Eisenhardt (1989). Glaser and Strauss (1967), whose contribution still shapes methodological thinking, changed the status of qualitative research from being a preliminary base for surveys to an equal alternative to the quantitative approach (e.g. Locke 2001). Denzin suggested that triangulation, referring originally to a combination of merely qualitative research methods in the study of the same phenomenon, could be used to improve the accuracy of qualitative inquiries. Finally, Yin and Eisenhardt brought case study methodology to the core of modernist qualitative research, which was a major departure from the earlier methodological tradition of case study (Platt 1992; Denzin and Lincoln 1994).

2.1 Research approach

Even if different paradigms provide inspiring foundations for qualitative research, a choice has not been made between them to inform and guide the predominantly qualitative multi-method research approach of this dissertation. Instead, good quality of research is achieved through methodological fit, careful triangulation and, as Seale (1999) suggests, by open-mindedly combining different elements of different research techniques for the purpose of accomplishing practical goals in a real world context, and at the same time continuously studying methodological writings that focus on particular themes that appear to be useful in structuring the current research and improving its quality. The dissertation highly respects Seale's idea of qualitative research as a craft skill, which is relatively autonomous from the need to resolve philosophical disputes, but the quality of which enormously benefits from the researcher's eagerness to continuously develop skills through apprenticeship experiences, leading to the qualities of a good researcher, such as methodological awareness among others.

Given the intent of the dissertation to seek understanding of a phenomenon from a novel perspective, the qualitative approach is useful and appropriate for such aims of the dissertation as describing a complex phenomenon in rich detail and identifying contextual factors as they relate to the phenomenon (Johnson and Onwuegbuzie 2004; Edmondson and McManus 2007). Most importantly, a potential contribution of qualitative research is to refine current understanding and thus to facilitate successful policies and practices (Groleau et al. 2009; Polit and Beck 2010).

2.2 Methodological fit

For the purpose of answering a single, rather broad research question, the dissertation addresses multiple, more focused research questions in four separate studies and combines the prior work and the theoretical contributions of the four publications into mutual conclusions. To do so in a rigorous way, attention is paid first to the formulation of the right research questions and only then to the picking of suitable data and methods for answering those particular questions, as Bouchard (1976) suggests.

Even if the key elements of each individual study – namely the research question, prior work, research design and theoretical contribution, according to Edmondson and McManus (2007) – were congruent and mutually reinforcing, this does not necessarily guarantee a perfect fit with the research question of the dissertation. The overall methodological fit is created through carefully combining four study designs, including research questions to be asked and answered, prior work to be done, data to be collected and analysed, and research methods to be used. A high degree of internal consistency among the key elements is achieved through an iterative process of designing and conducting one study after another, where the four key elements of each study are reconsidered and revised until they match, both within each study and in regard to the research question of the dissertation.

2.3 Triangulation

Given the importance of the methodological fit, triangulation of qualitative methods is the backbone of the research design. A single phenomenon is examined through multiple research methods for the purpose oh both collecting divergent data and analysing the data qualitatively. This *between methods* type of triangulation ensures that the findings are not attributable to a method artefact and thus enhances confidence in the conclusion (Bouchard 1976; Denzin 1970). Triangulation adds rigour, breadth, complexity, richness and depth to qualitative inquiries (Flick 2007; Denzin 2012).

The multi-method approach is useful regardless of whether the studies corroborate or not (Jick 1979; Johnson and Onwuegbuzie 2004). On the one hand, it provides stronger evidence for a conclusion if divergent analyses on the same issue lead to the same conclusions. On the other hand, divergent results from multiple methods can add insights and understanding that might be missed should only a single research method have been used, thus leading to an enriched explanation of the research problem. Therefore, triangulation may allow for more confident interpretations as well as for new or deeper dimensions of a phenomenon to emerge (Jick 1979).

A fundamental principle of triangulation and thus an important guideline for the research design of this dissertation is that the combination of research methods should result in complementary strengths and not in overlapping weaknesses or potential for bias (Rohner 1977; Jick 1979; Johnson and Turner 2003). The disadvantages of each method are identified and compensated by including additional methods that have counterbalancing strengths.

2.4 Research design

The profile of the research design and the main elements of triangulation across the four papers of the dissertation are itemised in Table 1. Research perspectives 1, 2 and 3 refer to the three perspectives that are introduced above in sub-section 1.3 on pages 22-23. Researcher 1 refers to the author of the dissertation, Researcher 2 to the second author of Paper I, and Researcher 3 to the second author of Paper II.

Table 1. The research design of the dissertation in a nutshell.

	Paper I	**Paper II**	**Paper III**	**Paper IV**
Methods triangulation	Method 1: multiple case study	Method 1: multiple case study	Method 2: literature-based analysis	Method 3: focus groups
Data source triangulation	Data source 1: urban planning documentation (qualitative data)	Data source 1: urban planning documentation (qualitative data)	Data source 2: past studies (qualitative and quantitative data)	Data source 3: focus groups (qualitative data)
Perspective triangulation	Research perspective 1	Research perspective 2	Research perspectives 1 & 3	Research perspectives 2 & 3
Investigator triangulation	Researchers 1 & 2	Researchers 1 & 3	Researcher 1	Researcher 1

The two multiple case studies provide a solid basis for the research design of the dissertation by addressing the first and the second research perspectives separately through similar study designs. However, even if the two sets of cases display some diversity in the type and the phase of urban developments that they exhibit, the mutual conclusion relies on only five cases and three sustainability frameworks. In addition, given that the fundamental interest of case studies does not explicitly lie on the phenomenon of interest itself, but also on a wider level whereby the phenomenon and its context are not necessarily distinguishable (e.g. Yin 1994), the outcome is somewhat unfocused.

The literature-based analysis and the focus group study each contribute both to methods triangulation and to data source triangulation. Furthermore, they add a third research perspective to focus the approach to the research question, as explained in more detail in sub-section 1.3. In addition, the literature-based analysis, which investigates results and data from past studies, increases the numbers of case areas and environmental frameworks considered, even if they do not provide as deep insight into the case areas and frameworks as a dedicated case study. It can therefore be considered that the multiple case studies and the literature-based analysis together provide a firm depiction of the phenomenon in its real life context, but not of its rationale. The use of the focus group method can fill this gap through its ability to uncover the attitudes, perceptions and beliefs of study participants, with group interaction typically forcing participants to explain the reasoning behind their thinking (Kitzinger 1994; Skop 2006). Furthermore, the inclusion of a study

with a totally different design has the potential to either strengthen the mutual conclusion or reveal new insights, and thus to confirm or to alter the findings.

Finally, the second authors of both Paper I and Paper II contribute to the investigator triangulation. The second author of paper I is responsible for one of the three parallel analyses that appear to produce consistent results and lead to a mutual conclusion. The second author of Paper II is responsible for collecting the data and conducting one of the two consecutive analyses. Therefore, the phenomenon of interest is examined not only by the author of the dissertation, but partly also by two other researchers, both of whom contribute to the evaluation of the chain of evidence presented in the dissertation.

Case study method

As can be seen in Table 1, case studies have an important role in the research design. The qualitative approach selected is appropriate for studying a limited number of cases in depth (Johnson and Onwuegbuzie 2004). Adhering to the fundamental ideas by Yin (1994), the case studies were conducted as comprehensive empirical investigations, with the phenomenon of interest being observed as it occurs in its real-life context. The strengths of case study research culminate in the gaining of empirical evidence and fresh insights (Eisenhardt 1989). Accordingly, any empirical regularities identified during the studies are likely to be empirically valid, and thus the findings, if achieved through good scientific practice, closely mirror reality.

To achieve such empirically and contextually valid findings, the case selection strives for contextual appropriateness. The casework is *collective*, referring to the type of research questions that require cases to be chosen from a number of possible alternatives (Stake 1994). The research question specific requirements for site features and data availability limited the number of suitable cases. The sites chosen for the case studies are therefore representative examples of a few alternatives as opposed to a random sample of from a vast multitude of options. Given the qualitative approach, the samples are small and are studied intensively, with each case study generating rich information on the phenomenon. Furthermore, the selection of qualitative cases examined within this dissertation is conceptually driven by the theoretical framework and the research question, which was designed to allow analytic but not statistical generalisations (Miles and Huberman 1994; Curtis et al. 2000).

Case study research creates auspicious circumstances for gaining new theoretical vision through the candid examination of evidence across cases and data sets, between cases and literature, and through the creative reframing of the phenomenon (Eisenhardt 1989). The research design allows the dissertation to reach such a theoretical vision. However, even if case studies are considered to have the potential to build new theory in the study of the built environment, the dissertation does not specifically target the creation of new theory but rather targets the uncovering of empirical regularities that may or may not lead to a unique theoretical contribution (Amaratunga et al. 2002).

Focus group method

The last study of the dissertation aims to paint a fuller picture of the issue by collecting data that reveals the rationale behind the identified phenomenon. As such, the focus group method – a method that is devoted to data collection (Morgan 1996) – was selected. The groups *focus* in order to, for example, debate a particular set of questions, and the group interaction is explicitly used as research data (Kitzinger 1994), with the researcher typically performing an active role in creating the conversations amongst participants (Morgan 1996). The setting encourages spontaneous responses and provides different insights to those gleaned from interviews or survey questionnaires (Skop 2006). Such data has the potential to reveal how people denote their opinions, perceptions and beliefs in relation to other viewpoints (Kitzinger 1994).

The recruited participants of focus groups are required to facilitate the collection and analysis of rich data through their discussion and conversations, hence participant samples are suggested to be purposive as opposed to random (MacDougall and Fudge 2001). In order to best utilise the informal networks and personal contacts of the target group, the participants of the focus groups were first and foremost recruited through an open invitation, which was freely distributed within and between organisations. In order to ensure, however, that the sample extensively represented the target group, the focus groups were arranged as part of an event that appealed nationwide, offering relevant additional value to the target group.

While the focus group method has a strong status as a data collection technique, it does not provide established guidance for data analysis and interpretation (Massey 2011). The analysis of focus group data is typically based more on a rich investigation of content than on the use of word counts and statistics (Massey 2011). Single responses are seen as being expressed in a larger social context (Morgan 1997; Hollander 2004). The work of Miles and Huberman (1994) in particular has provided an extremely helpful framework for designing the structure of all the qualitative analyses included in this dissertation, which are itemised in Table 1 and introduced in more detail in the appended papers.

3. Argument of the dissertation

Linking the findings of the four papers, the dissertation argues that the power of urban planning could be used more successfully to reduce the environmental burden of urban communities. The densification of urban structures is found to be the dominant means through which urban planning attempts to achieve environmental improvements in sparsely populated urban areas. International certification schemes for sustainable urban development (see Paper I) as well as a variety of other regional evaluation tools for eco-efficiency or sustainability (see Paper III) indicate higher urban density to be the key means through which urban planning can be used to improve environmental sustainability in regions where population is sparse. Furthermore, densification is included in most political agendas for urban regeneration and is often considered as an environmental improvement in itself.

Higher urban density is assumed in particular to reduce the environmental impact of private driving and the use of energy for heating buildings. Shorter distances between homes, workplaces and facilities within an urban area enable walking, cycling and convenient public transportation to be used as alternatives to private vehicles and, even if private vehicles were to be used for these journeys, the distance travelled would be less. Furthermore, when people live in small apartments, close to one another, less heating energy is consumed. This also makes it more efficient for district heating to be delivered through combined heat and power production. Waste management and recycling services are also more cost-effective to run within denser urban structures. In addition to these benefits, the use of existing infrastructure by more people saves natural resources (as opposed to building additional infrastructure to serve newly developed areas), and brownfield development in general means saved greenfield elsewhere.

Given that environmental sustainability is not the only concern of urban planning decision-making processes, densification seemingly provides an ideal, win-win solution, providing both environmental benefits and monetary savings for the municipality. The environmental improvements that it is assumed can be achieved through higher urban density can even be used to justify urban densification policies, which local inhabitants are not always delighted about (see e.g. Vallance et al. 2005; Kyttä et al. 2011; Buys and Miller 2012). It is found that short-term economic considerations dominate municipal decision-making and urban planners struggle with the complexity of environmental issues (see Paper IV). Therefore, it is indeed tempting to

believe that environmental sustainability can be promoted side by side with such values as *new construction*, *improved consumption facilities*, *shopping mall-like spatial design*, and *self-sufficient development* (see Paper II).

Nevertheless, urban densification does not necessarily lead to any reduction of the environmental burden at all, and the eventual environmental impacts and outcomes of urban regeneration may in end effect be contradictory to the objectives specified at the beginning of the planning and decision-making process (see Paper II). Even more worrisome is that the environmental considerations made in urban planning appear to ignore a significant, varying share of the environmental burden that urban areas are responsible for (see Paper III). The professionals of urban planning do not see a connection between urban structure and sustainable lifestyles or consumption choices, aside from those related to housing and daily journeys (see Paper IV). They would like to support sustainable lifestyles (see Paper IV) but it is evidently difficult in the increasingly convenient and concentrated centres of consumption that they create through urban planning (see Paper II).

The chosen strategy that sustainable communities are attempted to be built based on urban densification, and the scope of the environmental considerations being limited to ground transportation and housing, appears to be an inefficient means of reducing environmental burden. In addition to the inconsistency between the objectives and the outcomes of urban regeneration, within the limited scope adopted, such a strategy carries a risk of leading to a net increase in consumption. If all the direct and indirect environmental impacts of all consumption were taken into account, alternatives to densification could potentially be found to be more successful in reducing the environmental burden of urban communities. However, for as long as both international standards and national practices exclusively promote densification policies, the alternatives are unlikely considered. Accordingly, the argument of the dissertation is:

'The full potential of urban planning to promote and facilitate environmental sustainability is not being reached due to the limited scope of the anticipated influence and the dominance of densification policies.'

In the argument *the full potential* does not refer to what could be achieved if environmental sustainability was the only goal of urban planning. Instead, it refers to the potential of alternative compromises between economic, social and environmental interests and challenges. This dissertation argues that the reasoning for the prevalence of densification strategies in urban planning is based strongly on an environmental interest to reduce the burden of ground transportation and housing operation, but appears to take into account such a limited share of the complex issue of environmental sustainability that, paradoxically, the net impact of densification on the total environmental burden of urban communities may actually be a negative one. However, this dissertation does not claim that densification of urban structures could not be a successful strategy to promote certain social, economic and even

environmental goals and thus improve urban sustainability to some extent. What is argued is that the weight that environmental issues carry cannot be used to universally justify urban densification policies. The contribution of each paper to the argument of the dissertation is itemised briefly in Table 2 and described in more detail in the following section.

Table 2. The summary contribution of each paper.

RESEARCH QUESTION: How successfully does urban planning facilitate environmental sustainability?				
	Paper I	**Paper II**	**Paper III**	**Paper IV**
Title	An assessment of the applicability of three international neighbourhood sustainability rating systems to diverse local conditions, with a focus on Nordic case areas	How central business district developments facilitate environmental sustainability – A multiple case study in Finland	Role of Urban Planning in Encouraging More Sustainable Lifestyles	The Power of Urban Planning on Environmental Sustainability: A Focus Group Study in Finland
Perspectives	Standards for sustainable urban planning	The position of environmental sustainability in urban planning decision-making processes	The consumption-based approach to the environmental burden of urban communities; Standards for sustainable urban planning	The position of environmental sustainability in urban planning decision-making processes; The consumption-based approach to the environmental burden of urban communities
Study design	Two case studies: predominantly residential urban developments	Three case studies: central business district developments	Literature based analysis: GHG emissions and environmental evaluation tools	Three focus groups: professionals of urban planning and environmental sustainability
Main contribution	According to the international standards insufficient density of urban structure is the key constraint for the land use in sparsely populated urban areas to be environmentally sustainable, urban densification being the obvious cure.	In urban planning environmental sustainability is targeted mainly through higher urban density. The process is rather linear, without feedback loops, and environmental evaluations are not integrated into the decision-making phases. In fact, the outcomes may be contradictory to the anticipated benefits: densification may actually increase the exact environmental burden it is expected to decrease.	The extent to which the environmental impacts of consumption are factored into the evaluation practices of urban planning ignores a remarkable, varying share of the environmental burden that urban communities are responsible for. Density is used as an indicator for environmental sustainability even if denser areas host more consumption.	The power of urban planning to facilitate sustainable lifestyles is underestimated by disclaiming the ability to influence consumption. The supremacy of urban density blocks alternative patterns of urban land use that could potentially be more sustainable. The complexity of environmental issues and the dominance of short-term economic interests explain the weak practice.
ARGUMENT: The full potential of urban planning to promote and facilitate environmental sustainability is not being reached due to the limited scope of the anticipated influence and the dominance of densification policies.				

4. Summaries of the papers

Each of the four publications approaches the research problem from a specific perspective. The papers reinforce one another, providing an encompassing response to the research question. Jointly, the findings of the four papers provide a firm basis for assessing how successful current urban planning policies are in reducing the environmental burden of urban communities.

4.1 Paper I: An assessment of the applicability of three international neighbourhood sustainability rating systems to diverse local conditions, with a focus on Nordic case areas

The first paper investigates international standards for sustainable urban planning. A case study approach is adopted to examine the certification criteria of three recently launched sustainability schemes, namely American LEED for Neighborhood Development (LEED ND), British BREEAM for Communities and Japanese CASBEE for Urban Development (CASBEE-UD). The research considers two predominantly residential case areas in Southern Finland, for which master plans already exist but developments have not yet commenced. A comparative analysis determines the extent to which the two case areas could meet the minimum mandatory requirements of the three certifications and further identifies and analyses problematic criteria.

The contribution to the dissertation arises from the research setting, which provides insight not only to the applicability of the rating systems but also to the features of sustainable urban planning. The certification criteria are used as a framework to examine how the current planning practices differ from the international ideal of environmentally sustainable urban planning. The analysis reveals what practices are seen to be ideal and how urban land use in the relatively sparsely populated Nordic countries should change to be more sustainable if the international rating tools were taken as a reference.

The results of the two cases concur. Most of the minimum mandatory criteria of the certifications can feasibly be met. However, some of the evaluation criteria are identified to be unfeasible or irrelevant given the local natural conditions. Remarkably, in both the LEED ND and the CASBEE-UD rating systems, the criteria that are associated with requirements for urban density are found to be among the most problematic for the case areas. Insufficient urban density can thus be seen as a key constraint for the development of urban areas in sparsely populated countries to be sustainable, according to the international standards, with densification being the obvious cure.

4.2 Paper II: How central business district developments facilitate environmental sustainability – A multiple case study in Finland

The second paper considers the planning process. It is investigated how urban regenerations are shaped to carry out sustainable development and how sustainability is integrated into the planning process. The documentation of the planning process reveals not only the original environmental, social and economic aims and objectives, which may sometimes be idealistic or even unrealistic, but also the actual expected outcomes of the approved plans, which are often achieved through compromises and optimisation.

The paper examines how central business district (CBD) developments are designed to facilitate environmental sustainability in cities that are major centres in sparsely populated countries but relatively small on a global scale. A multiple case study is conducted first to model the CBD development process in Finland and second to examine how the considerations of environmental sustainability are integrated into the process. Furthermore, it is briefly considered whether the environmental, social and economic aspects are considered competently and with impartiality. The three case cities have populations ranging from 45,000 to 200,000 inhabitants.

A common process model is identified for the case developments: the CBD development process is divided into two main phases and six sub-phases as illustrated in Figure 1. Sub-phases 1 through 4 can typically overlap with one another, as can sub-phases 5 and 6, but only within their respective main phase. The ratification of the CBD plan clearly separates the two main phases from each other. In each case, the duration of the *construction* phase is fairly constant, at 5 to 6 years, but the length of the *planning and decision-making* phase varies greatly, and ranges from 3 to 9 years.

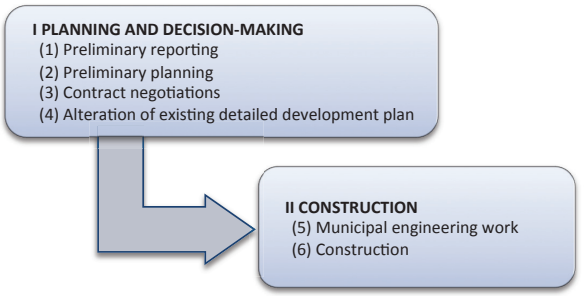

Figure 1. The CBD development process.

Even though *sustainability* is found to be mentioned only a few times in the official plan reports, the environmental, social and economic aspects considered are described in detail. In each case, the same four development themes form the core of the CBD development and are expected to facilitate a number of the desired social, economic and environmental outcomes, as presented in Table 3.

Table 3. The central CBD development themes and desired outcomes.

Development theme	Desired social outcomes	Desired economic outcomes	Desired environmental outcomes
Enhancement of commercial services	Improved consumption facilities New jobs Pleasant public indoor-space that facilitates spontaneous interaction	Increased business activity and new entrepreneurship New jobs Improved competitiveness of commercial services Customer flows and purchase power directed to the CBD Higher commercial status of the CBD	Reduced travel from the CBD to other destinations
Higher urban density, increased permitted building volume and new construction	Improved housing availability Increased social interaction and social control	More space for business activities Denser and more attractive commercial structures Self-sufficient development (positive business plan) The costs of required renovations covered New jobs	Brownfield-based use of existing infrastructure Brownfield development saves greenfield elsewhere Aims to reduce private driving by encouraging walking, cycling and the use of public transport
High quality of the built environment	Lively urban atmosphere Improved safety of the living environment Shopping mall-like spatial design	Increased value of the real estate within the CBD	Aims to protect green space and urban ecosystem services
New parking arrangements and improved accessibility by all means of transport	Equal accessibility Improved conditions for walking and cycling Improved parking arrangements	More space for parking Customer flows and purchase power directed to the CBD	Aims to reduce private driving by encouraging walking, cycling and the use of public transport Costs of parking are allocated to the users

The CBD developments are found to strongly promote higher urban density and the enhancement of commercial activity. It is found that environmental sustainability is attempted to be facilitated through higher urban density, and urban densification is highlighted in each case as being an environmental improvement in itself, although the anticipated benefits are not explicitly stated. The case plans aim to reduce private driving and to protect green spaces, urban ecosystem services and ground water quality.

Quite to the contrary, the outcomes that are actually expected to occur following the completion of construction are increased private driving and related emissions, major losses of green space and increased risk of ground water contamination. The finding that the expected actual outcomes of each case development are contradictory to the original environmental objectives specified in the plans indicates that environmental evaluations are made only in the beginning and at the end of the linear planning process and are thus not integrated into the decision-making phases.

Rather interestingly, all of the expected negative social and environmental outcomes could be viewed as being consequences of higher urban density. It is also noted that not a single negative economic outcome is mentioned in the plan reports. The economic perspective thus appears to dominate decision-making. The paper concludes that the main driver behind CBD developments is to create more convenient and concentrated centres of consumption.

4.3 Paper III: Role of Urban Planning in Encouraging More Sustainable Lifestyles

The third paper examines the environmental burden of urban communities from a consumption-based, lifecycle-wide perspective. Given that environmental awareness within urban planning is traditionally limited to the consumption categories of traffic and housing, the interest of the study lies in what is left outside of these considerations and if the demarcation is optimal for the success of urban planning in reducing the environmental burden of urban communities. Greenhouse gas (GHG) emissions are investigated as a simplification of environmental burden.

The distribution of the consumption-based GHG emissions is examined across three consumption categories that are (1) housing, (2) ground transportation, and (3) personal consumption. “Housing” refers not only to emissions relating to the construction of buildings but also to heating, electricity, furniture, appliances, and all maintenance services. Similarly, “ground transportation” refers to all means of transport, including the construction of infrastructure, the manufacture of vehicles, all the maintenance operations, and the use of fuels. The term “personal consumption" is taken to exclude any personal expenditure related to housing or to ground transportation and includes all other expenditure on goods and services.

The study declares first what proportion of regional GHG emissions is attributed to personal consumption and thus potentially ignored in urban planning. Second, it is investigated whether the regional environmental evaluation tools, which should help urban planners in municipalities to create more sustainable urban environments, take into account the indirect environmental burden related to personal consumption.

Past data from the application of a hybrid life cycle assessment model is used to estimate how regional GHG emissions are distributed in their attribution to housing, ground transportation and personal consumption. The analysis is carried out for a variety of Finnish regions, encompassing a city quarter, five cities, the capital region, two groups of towns, three groups of municipalities (groups comprising of regions all of a certain type) and the whole country.

Between a quarter and a half of each regional carbon footprint is found to be attributed to personal consumption, which rather surprisingly, appears to account for a significantly larger share of GHG emissions than ground transportation, regardless of the type of the region. Furthermore, the higher the level of urbanisation, the larger the share of emissions attributed to personal consumption. Within the densest urban area in Finland, the downtown core of Helsinki, the share of GHG emissions attributed personal consumption is at its largest, surpassing even that of housing. Table 4 summarises the breakdown of the annual consumption-based per capita GHG emissions in different case regions and presents the proportion of the total carbon footprint accounted for by each of the three consumption categories, expressed as a percentage. The table is organised into the order of highest to lowest proportion of personal consumption.

Table 4. The distribution of annual consumption-based GHG emissions.

Region	Population density (per km^2)	GHG emissions (t CO_2e)	Distribution of consumption-based GHG emissions		
			Housing	Ground transportation	Personal consumption
Helsinki downtown core	10,000	14.7	43 %	11 %	46 %
Helsinki	3,000	12.4	54 %	12 %	34 %
Helsinki metropolitan area	1,327	12.5	53 %	13 %	34 %
Espoo	740	14.4	51 %	15 %	34 %
Tampere	340	10.9	50 %	18 %	32 %
Porvoo	70	10.3	48 %	21 %	31 %
Vantaa	780	11.1	55 %	15 %	30 %
Cities in Finland	87	10.9	54 %	16 %	30 %
Finland	20	10.2	53 %	18 %	29 %
Urban towns around Tampere	80	10.1	50 %	23 %	27 %
Semi-urban areas in Finland	16	9.9	53 %	21 %	26 %
Rural areas in Finland	5	9.0	52 %	23 %	25 %
Rural towns around Tampere	20	11.1	59 %	17 %	24 %
			43… 59 %	11… 23 %	24… 46 %

In addition, 33 regional evaluation tools for environmental sustainability are examined to investigate (1) whether the tools are able to measure the environmental impacts relating to personal consumption; (2) whether the tools intend to promote urban planning that encourages more sustainable lifestyles amongst inhabitants, thus diminishing the negative environmental impacts of not only traffic and housing but also personal consumption; and (3) whether the evaluation tools consider urban density to be a valid indicator of environmental sustainability in urban areas.

The vast majority of the evaluation tools are found not to consider a consumption-based, lifecycle-wide scope. It appears that none of the eight assessment schemes for eco-efficiency or the thirteen for ecological and social sustainability utilises any available methods for calculating consumption-based environmental burden. It is concluded therefore, that none of them has the intention of directing urban planning to diminish the environmental impacts of personal consumption and that none of them can be used to promote urban planning that encourages more sustainable consumption. Remarkably, the idea of high urban density is identified as an environmental rationale for the assessment criteria of most of the tools, and six of them are found to use urban density as a direct environmental indicator.

The results of the study show that personal consumption can account for a remarkable share of the environmental burden of urban communities but is not factored into the management practices of regional environmental sustainability. Efforts to make improvements to the environment through urban planning seem to concentrate on reducing the environmental impact of traffic and housing. However, Paper III demonstrates that “the forgotten share”, personal consumption, might offer significant potential for environmental improvements. Moreover, it is concluded that the tools available for regional environmental assessment do not sufficiently take into account this potential. The evaluation tools mainly seem to overlook the issue, and therefore so, most probably, do the regional environmental management strategies of the areas that utilise them.

4.4 Paper IV: The Power of Urban Planning on Environmental Sustainability: A Focus Group Study in Finland

The fourth paper adds the voice of the actors in the field – the professionals of urban planning and environmental sustainability at both the municipal and state levels. Three focus groups were organised for the purpose of revealing how the participating professionals experience the steering effect of increased environmental awareness on urban planning and related decision-making. Their stances are observed in the context of itemising and explaining urban planning policies and analysing the dynamics of the related decision processes. The discussion and interaction amongst the professionals provides insights into how the role of urban planning in environmental sustainability is understood and into the planners' mandate to attempt to reduce the environmental burden of urban societies. The results provide a rationale for the phenomenon identified in the previous papers by explaining the stance that urban planning has taken with regard to the environmental sustainability of urban communities.

The main finding of the study is that those involved in urban planning underestimate the power of their profession to facilitate and support sustainable lifestyles in the wider meaning, referring to consideration of the environmental impacts of all consumption. Instead, in the context of current urban planning, improved environmental sustainability mainly refers to the reduction of GHG emissions from daily journeys and from the use of heating energy in buildings. The connection between urban structure and sustainable lifestyles or consumption choices appears to be unaccounted for, apart from in relation to housing and private driving. Even if urban planners have an essentially unlimited mandate to devise sustainable solutions, it was dominantly stated in all the groups that only limited things can be affected through urban planning.

The roots of this narrow perspective lie in the complexity of environmental issues. Short-term economic considerations are found to dominate municipal decision-making, and in order to make environmental issues worth the effort of being considered in decision processes they are required by the decision-makers to be simplified and quantified. It was found that the professionals from different cities share the ambition to design environmentally sustainable urban environments, but they would need co-operation and assistance to figure out which urban forms, structures and practices actually are sustainable. At the moment they themselves feel responsibility for creating an atmosphere in which the issue of environmental sustainability carries weight in decision-making processes.

Furthermore, it is found that, in order to be accepted, the environmental manifesto should support or be included in other political agendas, and not conflict with them. The idea of achieving environmental benefits through urban density perfectly fits these requirements: it enormously simplifies the connection between urban planning and environmental sustainability and at the same time provides potential win-win solutions in that both environmental benefits and monetary savings for the municipality are assumed to be realised.

The connection between urban structure and environmental sustainability could not be simpler or any easier to quantify than *the denser the better*. Moreover, the expected environmental benefits can be used to justify urban densification policies that inhabitants may not always be happy with, with the real driving force being the benefit to the municipal economy.

It therefore comes as no surprise that density is considered by the study's participants as an imperative character of urban structure in the consideration of environmental sustainability. The dominant belief is that densification has a strong positive impact on environmental sustainability. Notably, the benefits of increased environmental knowledge were seen, amongst other things, to be an improved ability to examine the environmental benefits of high urban density and to justify higher urban density.

However, the belief that higher urban density brings about improved environmental sustainability actually undermines the power of urban planning to decrease the environmental burden of urban communities. Given that cities are increasingly regarded as the demand and consumption centres of the global economy and that recent research suggests a consumption-based approach for the environmental analysis of urban areas, such ultimate simplifications as that of the environmental role of urban density may lead to false assumptions. Due to higher overall consumption volumes, lifestyles in dense urban areas may in fact cause more environmental damage than those in more dispersed, suburban areas. Nevertheless, it is found that personal consumption and leisure related choices in particular are seen by industry professionals as impossible to affect through urban planning.

The key role that density is found to have in urban planning practices and decision-making therefore rules out the use of alternative patterns of urban structure that could potentially support sustainable lifestyles and reduce the overall environmental burden of all consumption. Urban planners would like to support sustainable lifestyles but this is evidently difficult in the consumption centres that they create. The phenomenon is grounded in national density policies, which local authorities interpret at the municipal and neighbourhood scales. In Finland, high urban density is included in most political agendas of urban regeneration nationwide and is the core of national land use guidelines for environmentally sustainable communities.

Reducing environmental burden at a municipal level is important not only because cities are sites of concentrated high consumption and waste production but also because local authorities are willing to take on board the complex agenda of sustainable development. Indeed, the main concern arising from the results of Paper IV is that, if urban planners do not see a connection between urban structure and lifestyles related consumption patterns, how are they able to limit the urban trend of high consumption and production of waste? The study suggests that co-operation, jointly-held environmental objectives, criticism of the prioritisation of short-term economic considerations over long-term environmental concerns and a consumption-based approach to the evaluation of environmental burden are all necessary in order to create better futures through sustainable urban communities.

5. Discussion and conclusions

This dissertation investigates how urban planning is applied to promote and facilitate environmental sustainability, how the procedures are rationalised, and how successful current policies and practices are in reducing environmental burden. Based on the findings of four studies, applying three research perspectives, the dissertation argues that the full potential of urban planning to promote and facilitate environmental sustainability is not being reached due to the limited scope of anticipated influence and the dominance of densification policies. It is suggested that a broader perspective on urban environmental sustainability will provide greater success in reducing environmental burden through urban planning. The findings of the dissertation show that the anticipated environmental benefits of urban densification as a generic planning strategy do not necessarily materialise in sparsely populated regions.

Standards for sustainable urban planning

International certification schemes and regional evaluation tools for urban environmental sustainability are taken as a reference to investigate where the potential of urban planning to create environmental improvements is assumed to lie. The prevalent scope of environmentally sustainable urban planning is found to be limited to the consumption categories of ground transportation and housing and to the benefits of centralised infrastructure. Furthermore, it is found that, according to international standards, insufficient density of urban structure is considered to be the key constraining factor for land use in sparsely populated urban areas to be environmentally sustainable, with urban densification being the obvious cure.

Urban planning seems to approach the challenge of environmental sustainability by tackling only a portion of the issue. However, even within a scope limited to the environmental burden of ground transportation and housing, the sustainability gains achieved through urban densification may be undercut through a phenomenon termed *parallel consumption* (Heinonen et al. 2013). People living in small apartments may extend their living space into public and commercial service premises and may also possess summer cottages or second homes, equipped completely with modern technology and heated all year round. As a result, a person spending an evening for example in a restaurant may consume heating energy, furniture, appliances and maintenance operations in three places at the same time. In addition to this, moving between these extensions of living space may increase traffic (Perrels

and Kangas 2007; Strandell and Hall 2015). Furthermore, even if urban densification led to decreased net private driving, the environmental benefits may be undercut by increased air travel (see Ottelin et al. 2014).

Another potential bias within the identified, limited scope of sustainable urban planning stems from inconsistency in lifecycle thinking and ignorance of embodied energy. Mandating, for example, the energy- and emission-intensive construction of new, eco-efficient urban structures and transportation infrastructure, or the replacement of old vehicle stock with modern, cleaner vehicles, in pursuit of use phase eco-efficiency, may lead to a massive environmental impact in the production phase (Bin and Dowlatabadi 2005; Rickwood et al. 2008; Säynäjoki et al. 2012). Greenhouse gas emissions in particular are at their most harmful when occurring in the production phase, at the very beginning of the lifecycle, due to their long atmospheric lifetime (Ricke and Caldeira 2014). If the indirect environmental impacts of ground transportation and housing – for example those related to their inherent materials, manufacturing, construction and maintenance – are either ignored in the environmental considerations of urban sustainability or made proportional to very long use phases, the outcome of the devised policies may be negative within the time frame of the local and national environmental goals. Furthermore, the anticipated savings and benefits in the use phase are supposed to accrue slowly over time, which contains significant uncertainties concerning for example energy production technologies and consumption patterns in the future (e.g. Phdungsilp 2010).

The position of environmental sustainability in urban planning decision-making processes

This dissertation identifies processes by which urban regeneration is used as a driver for improvements in environmental sustainability and investigates how urban planning approaches environmental sustainability in practice. The analysis reveals the types of planning strategy and spatial solutions through which municipal urban planning attempts to create the operational conditions for environmental sustainability, how environmental considerations are integrated into planning process and the related decision-making, and finally to what extent the environmental aims of urban regeneration are achieved. Furthermore, the reasons behind the adoption of urban planning's particular approach to environmental sustainability are examined, as is the extent to which urban planning's role in achieving environmental sustainability is understood.

Local practices are found to comply well with national and international standards. Urban densification is found to be the dominant means of targeting environmental improvements through urban planning, and the environmental aims of urban regeneration are found to orient around reducing the environmental burden of ground transportation, housing and infrastructure. However, the findings indicate that the process of considering the environmental issues of urban development is rather linear and without feedback loops. Furthermore, environmental evaluations do not appear to be

fully integrated into the decision-making phases of the urban planning process.

Quite notably, it is found that urban densification does not necessarily lead to a reduction of environmental burden at all. In fact, the environmental outcomes of current urban regeneration projects may be contradictory to the anticipated benefits: densification may actually increase the precise environmental burden that it is expected to decrease. Furthermore, the limitation of the scope of environmental considerations to ground transportation and housing appears to be a rather inefficient means of reducing environmental burden, in that it risks promoting a net increase in consumption. It is found that professionals of urban planning would like to support sustainable lifestyles and consumption choices but that, in their view, their sphere of influence in this regard is restricted to housing and daily journeys.

The complexity of environmental issues and the dominance of short-term economic interests in decision-making are found to explain the weak practice. In urban regeneration, improvements in environmental sustainability are typically made in such a way that they primarily serve other interests (Bulkeley and Betsill 2005; Krueger and Buckingham 2012). Urban densification seemingly provides ideally simple, win-win solutions to the challenges of urban planning, the result being both environmental and economic benefits for the municipality. However, the overwhelming prevalence of urban density in policies and guidelines may preclude the consideration and development of alternative patterns of urban land use that could potentially be more sustainable. If the full impact of all consumption – both direct and indirect – were taken into account, it is likely that an alternative to density could be identified as a better indicator for the environmental sustainability of urban areas. However, as long as the superiority of densification policies stays unquestioned in both international and national standards, alternatives will not be seriously considered in local planning and decision-making.

The consumption-based approach to the environmental burden of urban communities

Recent research suggests the use of a consumption-based approach to urban environmental sustainability. This dissertation investigates how urban planning approaches urban consumption and assesses the extent to which the environmental impacts of consumption are taken into consideration. The power of urban planning to facilitate sustainable lifestyles seems to be underestimated in that the ability to influence consumption is disclaimed by urban planning professionals. Furthermore, an assessment of the extent to which the environmental impacts of consumption are factored into the evaluation practices of urban planning finds that a remarkable, varying share of the environmental burden that urban communities are responsible for is ignored. The complexity of environmental sustainability seems to hinder its position in decision-making, and urban density is found to be used as an

indicator for environmental sustainability even if in sparsely populated regions denser areas may host more consumption.

The dissertation suggests that even if the causalities may be extremely complex, efforts to investigate how the living environment affects the patterns of how people spend their time and money are worthwhile. For example, a study by Holden and Norland (2005) has shown that when relevant socio-economic and attitudinal factors are controlled, residents who have access to a private garden spend, on average, 1000 kWh less energy annually for leisure-time air and private car travel than residents who do not have access to such amenities. Baiocchi et al. (2010) point out that physical urban infrastructure on a neighbourhood level can be one of the key determinants for lifestyle-related consumption and related environmental impacts, and thus a potential barrier against environmentally undesirable lifestyle shifts.

Finally, expanding the perspective to the environmental burden of total consumption brings the discussion to the rebound effect, also known as Jevons' paradox (Jevons 1866; Schipper 2000; Hertwich 2005; Herring 2006; Turner and Baynes 2010). Because savings of money or time tend to be re-invested in other activities, environmental improvements in the consumption categories of ground transportation and housing may be partly or fully offset, or even outpaced, by increased consumption in other categories, such as goods, services and air travel (Holden and Norland 2005; Ornetzeder et al. 2008; Dodman 2009; Gray et al. 2010; Shammin et al. 2010). The rebound effect is a complex phenomenon, the direction of which can differ over time, and is dependent at least on the structure of the economy and on which production sectors are directly affected by the eco-efficiency improvement (Turner and Hanley 2011). A rebound effect of over 100% refers to a rather worrisome, paradoxical situation whereby an improvement in energy efficiency leads to an increase, rather than a decrease, in energy consumption. As an extreme example, in Hungary an annual energy efficiency improvement of 0.7% is met by a rebound effect of 550%, while in Finland the respective numbers are also quite severe, with an efficiency improvement of 0.6% leading to a rebound effect of 210% (Galvin 2014).

5.1 Contribution of the dissertation

The physical form of urban communities is a widely discussed factor of environmental sustainability (e.g. Williams et al. 2000; Gray et al. 2010; Grazi and van den Bergh 2008). Previous research has concluded that urban planning can facilitate environmental sustainability through the development of the urban structure (Bithas and Christofakis 2006; Eaton et al. 2007; Bourdic and Salat 2012; Hoornweg et al. 2011). However, the impact of policies and measures that are being put into place in a growing number of cities across the world to reduce environmental burden through urban planning has not been adequately evaluated (Bulkeley 2010; Edenhofer et al. 2014).

The final conclusion and the main contribution of this dissertation is the assertion that planning policies that aim to improve urban environmental sustainability should strive to acknowledge and influence the bigger picture, and should not target individual, disconnected elements. Furthermore, the weight carried by environmental issues should not be used to justify a universal approach to urban planning when the environmental outcomes of the approach are not fully understood or even fully considered. This dissertation provides sufficient evidence to argue that current policies and practices are based on a short-sighted rationale and do not necessarily serve their objectives.

The dissertation provides refined understanding of the potential of urban planning to promote and facilitate environmental sustainability. By questioning the effectiveness of current practices, more successful, targeted policies and practices, and thus more successful environmental outcomes, can be achieved. It is concluded that common simplifications of environmentally-oriented planning practices, such as a belief that modifications to urban form can improve the eco-efficiency of housing and daily journeys without having significant side effects on other aspects of urban environmental sustainability, are unlikely to achieve the intended aims. The dissertation identifies a generically applied planning strategy for sustainable urban development and empirically demonstrates how its anticipated environmental benefits do not necessarily materialise when applied to sparsely populated urban areas. The results of the dissertation add evidence to the claim that the density of urban structure is neither a necessary nor a sufficient condition for achieving environmentally sustainable urban living, and that such a concept seems to be a belief in a simplicity that does not exist (de Roo 2000; van der Waals 2000; Neuman 2005).

On the one hand, the findings of the dissertation support the suggestion by Jones and Kammen (2014) to locally adopt a highly tailored, community-scale approach to environmental sustainability. Such an approach does not necessarily entail increasing urban density but, rather, an awareness of the broader issues of urban planning (Dodman 2009). Many different urban forms may be more environmentally beneficial, or do less harm, depending on the local context and existing structure (Guy and Marvin 2000). Private driving in the countryside may, for example, contribute less environmental burden than the construction of new housing and infrastructure, should the same people move to the city and use public transport instead. Particle emissions are also known to be more harmful to people's health within an area of relatively higher urban density, even to the extent that a decreased amount of emissions within densified urban structure may be more harmful than the original amount within the original urban structure (Schweitzer and Zhou 2010; Apte et al. 2012).

The dissertation also suggests that urban planning policies, referring to the multilevel political system through which the governance is conducted, should collectively apply a more holistic, consumption-based approach to environmental improvements and sustainability. The dissertation provides

integrated understanding for the evaluation of a complex phenomenon in a complex context. In the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (Seto et al. 2014), the benefits of urban densification as a generic planning strategy and the risks of short-sighted planning are presented side by side. Even if densification dominates guidance for urban planning, indirect emissions are also addressed, and the long life cycles of the built environment are stated to place urban planning into a position where it may lock in development pathways, lifestyles and consumption patterns that are difficult to change. The dissertation contrasts these two considerations and suggests that alternatives to densification policies be considered in sparsely populated regions. As Myers and Kitsuse (2000) conclude, it is the duty of academics to help planning practitioners develop a more intellectually sophisticated and defensible approach to shaping the future.

Finally, the dominance of short-term economic interests in municipal decision-making is argued to be a threat to urban environmental sustainability. If any improvements in environmental sustainability are to be achieved, it is not possible to grow first and to deal with environmental issues later (Gibbs and Jonas 2000; Turner and Baynes 2010; Lorek and Fuchs 2013; Steinberger et al. 2013). This dissertation contributes to a topical discourse on this matter, which seems to be gaining ground given that the current growth-bound economic system and the necessity of economic growth for the development of human wellbeing is being increasingly challenged (Berg and Hukkinen 2011; Steinberger et al. 2102).

5.2 Evaluation of the research

The applied triangulation of various qualitative research methods, data sources, research perspectives and investigators appears to produce largely consistent and convergent results. However, the consistency and the convergence of the results do not ensure the rigour of the research. Given that rigour in the form of plausibility and credibility is central to all research, the broad and abstract concepts of validity and reliability work universally to achieve this (Eisenhardt 1989; Hammersley 1992; Yin 1994; Kuzel and Engel 2001).

Validity is defined by the extent to which research manages to address and answer a given research question or problem, in other words whether the conclusions describe the reality of the phenomenon that is supposed to be examined (Amaratunga et al. 2002). The concept of validity is often divided into *internal* and *external* validity. Reliability refers to repeatability, defined by the extent to which the same research procedures would produce the same results under constant conditions on all occasions (Yin 1994).

While reliability focuses mainly on results and how rigorously they are produced through data collection and analysis, internal validity addresses the consistency of the identified causalities, focusing more on how the conclusions are drawn from the results (Amaratunga et al. 2002). External validity refers to the generalisation of results and conclusions.

Verification strategies

Reliability and validity of the results of this dissertation are actively attained through *investigator responsiveness*, *methodological fit*, *sampling adequacy* and *analytic stance*. These verification strategies are built into the research process, as Morse et al. (2002) suggest, for the purpose of identifying and correcting errors before they are built in to the developing research and before they subvert the analyses. Nevertheless, the chosen research approach entails several uncertainties and limitations, which are discussed in this section.

Investigator responsiveness, referring to the qualities and actions of remaining open, using sensitivity, creativity and insight, and being willing to relinquish poorly supported ideas regardless of their potential to lead to interesting findings, is crucial to reliability and validity in qualitative research (Morse et al. 2002). The research process of the dissertation is documented in sufficient detail to demonstrate the management of openness, sensitivity and creativity in conducting this piece of scientific work. The level of insight achieved in this regard is best revealed in this compiling part: The cumulative knowledge and understanding gathered during the dissertation work has improved the level of responsiveness from its level at the very beginning of the research process.

However, data availability and quality often limited what could be researched and the kind of analysis that could be conducted. Because the focus of the analyses was mainly what is not understood, or what may be understood but is perhaps neglected or ignored, many questions could not be directly asked and answered and instead relied on the interpretation of the available data. This aspect of the analyses therefore, to some extent, depended on imperfect documentation, some ambiguous information and unpredictable interaction in the focus groups.

Methodological fit refers to the congruence between the research question, the methods, the data and the analytic procedures (Morse et al. 2002; Edmondson and McManus 2007). As explained in more detail in section 2, the core of this dissertation consists of key elements from four individual studies, which, through an iterative process, are reconsidered and revised until consistency is achieved both within each study and in regard to the research question of the dissertation. Given a particular research question, a myriad of different combinations of suitable data, research methods and analytic procedures can be picked. Therefore, it would be unrealistic to claim that the methodological fit of the dissertation is the optimum. Rigour is achieved instead through considering the issue of methodological coherence throughout the process of designing, questioning and modifying the elements of the research.

The data and the selected analysis methods do however support the particular approach to the research problem, which prioritises insightful investigation of the big picture over precise numerical inspection. For this very reason though, it should also be considered that what is gained in the breadth, complexity, richness and depth of the analyses is somewhat lost in the exactness and absoluteness of the results.

Sampling adequacy refers to the quantity and the qualities of the data being sufficient and appropriate to account for all aspects of the phenomenon of interest, and is ideally evidenced by saturation and replication (Morse et al. 2002). In the work of this dissertation, attention is paid especially to the contextual appropriateness of the sampling, both with regard to the site selection for the case studies and to the recruitment of the participants of the focus group study. The samples are carefully composed in order to both serve the specific research purposes of each individual study and to compile sufficient and appropriate data to draw and evidence the mutual conclusion of the dissertation. Consequently, the cases studied together form a good representation of the phenomenon of interest in its real-life context and the focus groups extensively represent the targeted group of participants.

The samples are, however, small. Because of the qualitative approach and the related intention to conduct in-depth analyses in rich detail, evidence of data saturation is limited, as is verification of completeness through replication. The sampling used therefore allows analytic but not statistical generalisations (Miles and Huberman 1994; Curtis et al. 2000) to be made, which the reported results and conclusions, as well as the argument of the dissertation, support.

Analytic stance refers to a scientifically sophisticated approach to the actions of collecting and analysing data concurrently, thinking theoretically, and drawing well developed and informed conclusions, which is essential for attaining reliability and validity (Morse et al. 2002). The structure of the dissertation, comprising multiple individual research papers, supports an iterative interaction between data collection and analysis, with constant assessment of what is already known and what is still missing. Furthermore, the fundamental approach taken to the data is to carefully listen to it, moving beyond the mechanical approach of encoding words and phrases in order to abstract and synthesise identified themes and patterns. A solid foundation for comprehensive, logical, and consistent conclusions is built through deliberate theoretical thinking. Conclusions are drawn as an outcome of the research process through the development of macro level conceptual understanding, firmly based on the micro level content of the data. This is simultaneously a great strength and an unsettling uncertainty of the qualitative research approach. The analyses, although systematically conducted, still depend on the capability and, to an extent, the idiosyncratic perception of the investigator. Furthermore, the outcome of such analyses is rarely definitively correct, but rather highlights a logically and methodically drawn conclusion.

This dissertation addresses validity and reliability by implementing verification strategies that are integral and self-correcting in nature. Verification strategies that are applied proactively throughout the research process, built into each phase of each individual study to manage identified threats to reliability and validity, act as a self-correcting mechanism to ensure the quality of the research (Morse et al. 2002). The chosen approach is based on Kvale's (1989) idea that the very nature of validation is to investigate, check, question and theorize as integral components of research, however it should be noted that alternative concepts for the evaluation and verification of

qualitative analyses exist (see e.g. Lincoln and Guba 1985; Sandelowski 1986; Howe and Eisenhardt 1990; Lincoln 1995; Thorne 1997; Popay et al. 1998; Frankel 1999; Whittemore et al. 2001).

Analytic generalisation

Because of the rich, detailed and insightful nature of their findings, in-depth qualitative studies are particularly able to reveal concepts that can be generalised (Glaser 2002; Misco 2007; Polit and Beck 2010). The argument of this dissertation is generalised from the findings and conclusions of the four papers, which cannot be fully justified as research results are always embedded within a context. However, making an inference about the unobserved based on the observed is the only way to use academic work in evidence-based practice (Polit and Beck 2010). Firestone (1993) has conceptualised three models of generalisability that are: statistical generalisation, analytic generalisation, and transferability. The generalisation of results and conclusions within this dissertation follows Firestone's concept of analytic generalisation, which allows researchers to deal with the paradox of qualitative research, in that it addresses the particular in pursuit of the general (Schwandt 1997).

Due to the limited scope of the research, however, its context-specific results can only be generalised to sparsely populated regions where, even in the major cities, population density is low on a global scale. Considering the share of consumption-based GHG emissions that categories other than ground transportation and housing are shown to be responsible for, the data from Finland provides results that are rather moderate: a recent comparison between a Finnish study and previous international studies indicates that housing represents a more significant share of consumption-based GHG emissions in Finland than in Europe on average (Seppälä et al. 2011). The share of other consumption categories is therefore not likely to be substantially smaller in other European countries.

5.3 Future research needs and final remarks

Drastic change is required to seriously address environmentally unsustainable consumption patterns and the related global environmental decline. To cast a critical eye on the role and the assumed potential of urban planning in the reduction of the environmental burden of urban communities, this dissertation applies a novel variation of triangulated qualitative research methods. Even if this approach is shown to be appropriate to the research problem, it is by no means superior to alternative research designs, including innumerable variations of triangulation that may involve both qualitative and quantitative methods. Within the context of critically evaluating the prevailing ideas of urban sustainability, this dissertation has opened rather than closed the case of combining various elements of different research techniques for the accomplishment of practical goals in a real world context. Alternative

methodological approaches to the same research problem would undoubtedly add to the understanding of the phenomenon.

Through the three research perspectives and several case analyses, the dissertation sheds light on the extent to which current policies and practices are successful in reducing the environmental burden of urban communities. However, the results cover only a limited portion of relevant aspects and do not allow wide generalisation. Therefore, new research perspectives and comparable case studies in other countries could enable both more universal interpretations and new dimensions of the phenomenon to emerge. However, theoretical implications of the dissertation indicate that further studies, rather than building a universal conclusion about the success of the current urban development strategies, have the potential to verify the extent of the success of the same planning policies in different regions and to identify imperative conditions.

The findings of this dissertation give the indication that urban planning may have hidden potential and underestimated power to affect lifestyles through the reshaping of living environments, and thus to enable and encourage consumption patterns that cause lower collective environmental degradation. It is suggested that the estimated potential be studied further in order to enable the use of urban planning to better enhance urban environmental sustainability. Important areas of future research are to investigate which elements of different living environments and urban infrastructure have potential to support environmentally sustainable consumption and lifestyles, and, if used to its full potential, to what extent urban planning can address the challenges of environmental sustainability (Bulkeley and Betsill 2005; Baiocchi et al. 2010).

Consumption-based studies have found that denser urban structures tend to host more consumption-intensive lifestyles, which in turn are responsible for more environmental degradation (Lenzen et al. 2004; Gray et al. 2010; Heinonen et al. 2011; Wiedenhofer et al. 2013). Although socio-economic drivers, such as income, education and household size, appear to be the predominant factors that define and influence lifestyles and consumption patterns (Lenzen et al. 2004; Minx et al. 2013; Jones and Kammen 2014), some studies have shown variation between individual households at similar expenditure levels, which indicates that there is potential to make environmental improvements by changing the ways in which people consume, if not the overall volume (Ornetzeder et al. 2008; Weber and Matthews 2008).

The systematic changing of urban structure does not only modify the physical surroundings but also affects the deeper constitution of society and its functions. According to Myers and Kitsuse (2000), planning practices address the future in ways that are "superficial, short-sighted or hollow". Huge potential for urban planning to improve environmental sustainability lies in its ability to modify the preconditions for lifestyles, use of time, expenditure and total consumption. This can at the same time, however, be a threat, as while certain urban forms may, for example, decrease the direct environmental impacts of ground transportation and housing, they may simultaneously

promote and facilitate more consumption-centred lifestyles, such as through the higher availability of a multitude of goods and services (Lenzen et al. 2008; Wiedenhofer et al. 2013). In addition, the unavailability of high quality ecosystem services, such as fresh air, clean water, natural green areas and biodiversity; and of amenities for environmentally harmless activities, such as hiking, fishing or reading a book under a tree, to name but a few; may further shift urban lifestyles to a more unsustainable path. Recent results indicate, for example, that in a less urbanised environment people tend to spend more time at home (Heinonen et al. 2013) and therefore perhaps less time consuming goods and services.

Phdungsilp (2011) defines sustainable development as *a constraint on present consumption to ensure that future generations will inherit opportunities that are no less than the inheritance of previous generations*. This definition is one huge leap in the direction that this dissertation suggests future research should lead urban planning and its related decision-making. Better scientific knowledge is a prerequisite for successful long-term strategic planning and associated knowledge-based policies, which address environmental sustainability in an integrated manner (Phdungsilp 2009). As this dissertation argues, a generic planning strategy, such as that of urban densification, does not necessarily provide the best avenue for environmentally sustainable urban development in widely varying local conditions. Case studies are therefore needed in order to better understand the patchwork of urban forms and to explore alternative paths for urban development.

Perhaps one of the most important factors of environmental sustainability is the involvement of people, which does not necessarily result from a feeling of concern. In Australia, for example, a study has shown that less than half of those who reported to be concerned about environmental issues were actually involved in doing something to reduce environmental burden (Miller and Bentley 2012). Literature that explores different factors of sustainable behaviour (e.g. Schultz and Zelezny 1998; Stern 2000; Kollmuss and Agyeman 2002; Miller et al. 2009) can provide a solid foundation for investigating firstly how urban planning can successfully facilitate sustainable behaviour and secondly what else is needed to encourage people to commit to sustainability and to adopt more sustainable lifestyles. Miller and Bentley (2012) have already started by studying the motivations, viewpoints and experiences of Australian *sustainability leaders*, living in eco-villages and traditional suburban communities. Their results indicate that a locally suitable combination of supportive technological infrastructure and social networks may enhance the transition to more sustainable consumption through lifestyle shifts.

However, consumption-based thinking should not draw attention away from the need for environmental improvements in production (Seppälä et al. 2005; Whiteman et al. 2011; Ramaswami and Chavez 2013). Future research can contribute to the drive for sustainability by delivering understanding about environmental issues at both the production *and* consumption ends of the

supply chain. Finally, even if climate change has gained strong political momentum and has inspired an increasingly fast-growing body of research, too little is known about other important environmental issues, such as the question of how to preserve biodiversity and the nitrogen and phosphorus cycles. Rachel Carson's (1962) *Silent Spring* is a marvellous example of how scientific research can spur positive environmental change on a global scale. Something similar is needed again for the sake of the Earth's immeasurably valuable ecosystems.

> "*As our ecological footprint expands, so should our perception of issues of the greater scales beyond us, and of the broader impacts of our individual and collective life-styles, choices, and actions*."
>
> - Grimm et al. 2008

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An assessment of the applicability of three international neighbourhood sustainability rating systems to diverse local conditions, with a focus on Nordic case areas

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The increasing awareness of the urban environment's contribution to climate change and other environmental problems has brought about a myriad of commercially available schemes that aim to mitigate detrimental impacts on the environment. These schemes, or rating tools, provide a convenient way to benchmark the eco-efficiency of buildings and, more recently, neighbourhood developments. Furthermore, acting beyond regulatory requirements has become a business strategy for many stakeholders within the construction industry. In general, these tools assess the eco-efficiency of neighbourhoods based on different criteria including urban density, connectivity, site ecology, energy efficiency and water management. The rating tools are often marketed globally. However, different regions of the world vary greatly in terms of climate, legislative, cultural, or ecological conditions, to name but a few examples. For the sake of consistency, factoring in regional variations when implementing the rating tools would be essential. In Finland, some of the criteria included in the tools are already accounted for at the regulatory level, and do not therefore lead to additional eco-efficiency. Meanwhile, other criteria may be impossible to meet due to local conditions. The purpose of this research is to pinpoint prospective issues in implementing international environmental sustainability rating systems in Finland in the context of new residential developments. The results of the study show that some of the mandatory requirements of the referenced international certifications may be unfeasible in Finland. In addition, it may not always be possible to meet some evaluation criteria due to local conditions and irrelevance to local environmental goals.

Keywords: sustainable planning and development; neighbourhood eco-efficiency; rating tools; LEED for Neighborhood Development; BREEAM for Communities; CASBEE for Urban Development; local conditions

1. Introduction

International rating tools provide a convenient way to benchmark the eco-efficiency of buildings and neighbourhoods. The primary function of the rating tools is to facilitate the measuring of environmental impacts of complex systems [1]. Due to the fact that acting beyond regulatory requirements has become a business strategy for many stakeholders, international rating tools also provide a marketing niche [2,3]. The emergence and evolution of environmental rating tools, within the context of urban environments, responds to a tension between the need for scientifically rigorous and objective environmental assessment and the desire for simple and practical evaluation criteria that the building industries could respond to with manageable step changes in practice [4].

Environmental rating systems for the urban environment span from the evaluation of energy consumption to life cycle analysis and total environmental quality assessment [5]. Neighbourhood sustainability rating tools generally assess the eco-efficiency of specific urban developments consisting of not only buildings but also urban infrastructure, such as roads and public transportation, and green spaces. Common components of neighbourhood-wide sustainability assessment are building energy- and water efficiency, energy production and supply, water- and waste management systems, transportation solutions and footpaths, connectivity, urban density, site ecology, mixed use, and involvement of the public [6]. Particularly when assessing the climate impact, focus has traditionally been on the energy consumption of buildings and on transportation [5,6]. In urban areas, compact development is usually seen as qualification for reducing vehicle miles travelled (VMT) and, consequently, air emissions [7].

Certain aspects of the rating systems have also hindered their adoption, such as requirements for heavy documentation, and rigid systems that do not allow for different approaches to sustainability concerns [1]. Moreover, many rating systems do not sufficiently explain how and why the criteria were chosen and the methodology used to determine the requirements is not clear [1]. Most notably, however, green building indicators in general tend not to take local conditions sufficiently into account [8]. This issue applies to areal sustainability rating tools as well. In fact, the problem might become amplified, as most of the criteria are location based and different regions of the world vary greatly with regard to climate, legislative, cultural, or ecological conditions. For the sake of consistency, factoring in the regional differences when

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implementing the rating tools would be essential. In Finland for instance, some of the criteria included in the international rating tools are accounted for at the regulatory level and they do not therefore contribute towards additional eco-efficiency. Meanwhile, it may be impossible or unfeasible to meet other criteria due to local natural or cultural conditions.

Systematic reviews of international environmental sustainability rating systems as well as comparisons between the schemes have been conducted for building-level tools [5,9–11]. The purpose of this research is to pinpoint prospective issues in implementing international rating tools in Finland in the context of new residential developments. In order to obtain a better understanding of the possibilities to use international neighbourhood rating systems in Nordic conditions, an empirical case study is added to the literature review. The analysis considers three international neighbourhood sustainability rating tools and two case areas for which master plans already exist, but the development has not yet commenced. It is hypothesised that some of the criteria included in the tools are unfeasible or irrelevant under Finnish conditions. In addition to this, it is examined whether having a master plan already in place hinders the obtaining of a neighbourhood development certificate. In other words, should the target of obtaining a certificate be taken into account at an earlier stage?

According to the study, it is possible to meet most mandatory certification requirements of the referenced neighbourhood rating tools for both case areas. However, meeting some of the criteria might not always be feasible due to local conditions and national or regional environmental priorities. One viable option to benefit from the international schemes could be to use the existing rating systems, but adopt only the criteria that are suitable for the particular sustainability goals of the local project, even though this would result in the development not achieving an international certification. It is also possible that the assessed environmental rating systems will make an effort to improve the suitability of their tools for differing regional and cultural environments.

The remainder of the paper is structured as follows: Chapter 2 explains how the study is constructed and introduces the rating tools and the case areas subject to analysis. The results of the analysis are then presented in Chapter 3. Finally, Chapter 4 discusses the findings further. The paper is concluded with recommendations for further action.

2. Study design

The study was conducted using a combination of a literature review and a case study approach. An introduction to the assessment criteria of three international tools for assessing the environmental sustainability of neighbourhood developments, namely Leadership in Energy and Environmental Design (LEED) *for Neighborhood Development*, *Building Research Establishment's Environmental Assessment Method (BREEAM) for Communities* and *Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) for Urban Development*, was based on a literature review, as was an analysis of selected certification criteria from these rating systems. It was investigated whether these three tools, none of which had yet been adopted in Finland, could be used to assess the environmental sustainability of two Finnish residential developments. The results of this case study were expected to pinpoint prospective issues in implementing international environmental sustainability rating systems in Finland in the context of new residential developments.

Data on the rating tools was collected from previous studies, email enquiries, and publically available websites. This data was examined in order to determine the extent to which the two case areas meet the mandatory requirements of the neighbourhood sustainability certifications. In addition to analysing the case areas in light of the requirements of each rating tool, it was investigated whether already having a master plan for a development project in place hinders the ability to obtain an international neighbourhood sustainability certificate. In other words, should the target of obtaining a certificate be taken into account at an earlier stage of planning? The three referenced rating tools, as well as the two case areas, are briefly introduced in the following subchapters.

2.1 Rating tools

Three international rating tools were chosen as a reference in the study, each of which specifically address the environmentally sustainable design and development of neighbourhoods. The rating tools include *LEED for Neighborhood Development* (LEED ND) from the United States, the UK based *BREEAM for Communities* and *CASBEE for Urban Development* (CASBEE-UD) from Japan.

2.1.1 LEED for Neighborhood Development (LEED ND)

The first sustainability indicator chosen for this study was the Leadership in Energy and Environmental Design for Neighborhood Development (LEED ND) rating system, a joint undertaking of the United States Green Building Council (USGBC), the Congress for the New Urbanism, and the Natural Resources Defence Council. LEED ND is the most recent of the LEED rating systems: certification has been available since 2010 [12]. The rating system is applicable to both new developments and neighbourhood retrofits and aims to promote diverse use, walkability and sustainable living. At the time of study, 87 LEED ND

registered developments and 71 LEED ND certified developments existed, mostly in North America (US and Canada). One registered project was located in China and one in South Korea [13]. For international projects, the USGBC requires feedback from the applicants in order to improve the applicability of the system to different regional and cultural conditions. The feedback entails filling out a questionnaire regarding the site conditions, as well as participating in interactive sessions during the certification process [12]. No registered or certified LEED ND projects were located in Finland at the time of this study [13].

The LEED ND rating system comprises five categories with which to measure the sustainability of neighbourhoods. Of these five categories, four are applicable internationally, while one category is based upon regional priority credits for different states within the US. The four internationally applicable categories include *Smart Location and Linkage*, which discourages urban sprawl, draws attention to preservation of undeveloped land and seeks alternative transportation solutions; *Neighborhood Pattern and Design*, which addresses habitability and accessibility of communities; and *Green Infrastructure and Buildings*, which focuses on the sustainability of the construction of buildings and infrastructure. Finally, *Innovation in Operations* provides bonus points for new and innovative technologies and strategies beyond other LEED credit requirements or for considerations not addressed in LEED. [12]

The LEED ND rating system has 12 prerequisites that must always be met in order to achieve certification for a neighbourhood development. Five of the prerequisites fall under the *Smart Location and Linkage* category, three fall under *Neighborhood Pattern and Design* and four fall under *Green Infrastructure and Buildings*. Once the prerequisites have been met, the credits to be pursued can be chosen freely from all of the four assessment categories that comprise altogether 45 credits, from which a maximum of 106 points can be obtained in international projects. The basic level certification requires the minimum of 40 points, silver level requires 50 points, gold level 60 points and the highest level, platinum, requires 80 points. The requirements for meeting the prerequisites and attaining LEED ND points are typically described in significant detail and for many of the credits different ways to fulfil the criteria are introduced for different development types. Nevertheless, the LEED ND rating system does not have a policy of taking local conditions into account when implemented abroad, and does not intend to create specific schemes for different sites, regions or countries. [12]

2.1.2 BREEAM for Communities

The second international sustainability rating tool discussed in this study is *Building Research Establishment's Environmental Assessment Method for Communities* (BREEAM for Communities), which was launched in the United Kingdom in 2009. The BREEAM for Communities certification can be carried out both for new developments and for site-wide regeneration projects. At the time of this study, no information on the number of BREEAM for Communities registered projects (stage 1) or developments with an Interim (stage 2) or Final certificate (stage 3) was publicly available [14]. BREEAM for Communities is tailored to the specified planning policy requirements of nine individual regions in England [15]. The BREEAM for Communities certification for development projects registered outside of the UK will require the creation of a bespoke BREEAM for Communities Standard for a single project or the creation of a BREEAM for Communities scheme for a particular country or region with Building Research Establishment (BRE) Global's assistance [15]. Nonetheless, until now neither a single BREEAM for Communities development nor a national BREEAM for Communities scheme has been registered in Finland.

BREEAM for Communities certifies developments with a rating of Pass (25–39% of maximum credits), Good (40–54%), Very Good (55–69%), Excellent (70–84%) and Outstanding (85–100%). The rating system is broken into 51 criteria within 8 categories: *Climate and Energy* (CE), *Resources* (RES), *Place Shaping* (PS), *Transport* (TRA), *Community* (COM), *Business* (BUS), *Ecology and Biodiversity* (ECO) and *Buildings* (BLD). The only rating category that does not contain any prerequisites for the certification is *Business* (BUS). A project can only achieve BREEAM for Communities certification if one compulsory credit in each of the 15 minimum mandatory requirements is met. Once the prerequisites have been met, a maximum of three points is available for each rating criterion. In addition to this, extra credits can be scored for innovative ideas. [15]

The BREEAM for Communities rating system does not emphasise the location of the development and the density of urban structure as much as the LEED ND scheme. Issues relating to direct environmental impacts such as energy efficiency and greenhouse gas emissions, material efficiency, and the considerations of ecology and biodiversity are disclosed as separate assessment categories, in contrast to the LEED ND scheme. However, neither BREEAM for Communities nor LEED ND uses the most sophisticated scientific life cycle analysis methods for calculating the prospective emissions and environmental impacts of new neighbourhoods [16].

2.1.3 CASBEE for Urban Development (CASBEE-UD)

The third areal sustainability indicator chosen as a reference in this study is the *Comprehensive Assessment System for Building Environmental Efficiency for Urban*

Development (CASBEE-UD), which was released in Japan in 2006. The Japan Sustainable Building Consortium (JSBC), which is administered by the Institute for Building Environment and Energy Conservation (IBEC) has also developed CASBEE-City, another areal sustainability-rating tool based on the same methodology, but given the type and size of the case areas assessed in this study, which lie outside of the city centre, it was deemed that CASBEE-UD is better aligned with the purpose of the case studies. Similar to LEED ND and BREEAM for Communities, CASBEE-UD is applicable to both new neighbourhood design projects and urban redevelopment projects. Because CASBEE does not have a registration system, data on the number of developments currently under evaluation is not available, but so far only one project has been certified under CASBEE-UD [17].

Each development evaluated by CASBEE-UD is categorised either as *city-centre type* or as *general type*. Both types use the same rating system but there are some differences in the criteria applied and in their weighting to reflect the location characteristics [18]. The rating system comprises two categories and six sub-categories, listed below:

Environmental Quality in Urban Development (Q_{UD}):
- $Q_{UD}1$ Natural Environment (microclimates and ecosystems)
- $Q_{UD}2$ Service Functions for the Designated Area
- $Q_{UD}3$ Contribution to the Local Community (history, culture, scenery and revitalisation)

Load Reduction in Urban Development (LR_{UD}):
- $LR_{UD}1$ Environmental Impacts on Microclimates, Facade and Landscape
- $LR_{UD}2$ Social Infrastructure
- $LR_{UD}3$ Management of the Local Environment

The CASBEE-UD assessments are ranked in five grades: Poor, Fairly Poor, Good, Very Good and Excellent, according to the final Building Environment Efficiency of Urban Development (BEE_{UD}) value, which is calculated from Q_{UD} and LR_{UD} assessment results. The only prerequisite for the certification is that related laws and ordinances are satisfied [18]. Given that the CASBEE-UD evaluation requires knowledge in many expert fields and a certain level of planning precision, a brief version of CASBEE-UD has been set with greatly simplified assessment methods and judgment criteria for the sake of saving labour and the ease of application at the initial planning stage [18]. Outright, the requirements for achieving CASBEE-UD certification points are less specific in terms of detail than those of LEED ND or BREEAM for Communities. Some criteria of the CASBEE-UD assessment compare the development to the local level of environmental progressiveness rather than to a fixed international framework.

2.2 Case areas

For the first two rating tools, LEED ND and BREEAM for Communities, the mandatory requirements of the certification were viewed in light of the case areas to establish whether it could even be possible to implement the international environmental sustainability rating systems in Finland in the context of new residential developments. The criteria for assessing each of the case areas were classified into four separate categories, as "met", "plausible", "unfeasible", or "cannot be determined at this point". For the third rating tool, CASBEE-UD, there are no existing mandatory requirements for the certification, and therefore a few selected example criteria were examined to pinpoint prospective issues in applying the rating system to conditions in Finland.

The research considered two case areas, both located in the Helsinki Metropolitan Area in Southern Finland. Both of the case areas currently have master plans, according to which they will be developed as predominantly residential areas. For the purpose of the assessment, master plans, area maps, and aerial photographs were consulted in order to gain the information required to assess each of the areas. For reasons of confidentiality, this paper will not identify the areas or describe them to the level of detail available to the researchers.

2.2.1 Case Area 1

The first case area is located approximately 20 km outside the Helsinki city centre. The planned development is not an infill site, but some previous developments are located in the surrounding area. Additionally, a major highway passes adjacent to the site. Based on the current plan, the area will host a little over 1,000 new residents, mainly in detached housing, although some multi-family buildings are allowed. The planned site area covers approximately 55 hectares, and the total permitted building volume is approximately 70,000 square metres.

2.2.2 Case Area 2

The second case area is planned to be developed approximately 15 km from the Helsinki city centre. The site area and immediate surroundings are previously undeveloped. Similar to Case Area 1, the site comprises approximately 55 hectares, however the total permitted building volume for the area is less than 40,000 square metres. The area is planned to include predominantly detached, but also semi-detached and terraced, housing. When finished, the development will be home to some 500 residents.

Table I. LEED ND prerequisites that are met (marked with "□"), plausible (marked with "*"), unfeasible (marked with "–"), or cannot be determined (marked with"?") for the case areas.

	Case Area 1	Case Area 2
Smart Location and Linkage		
SLLP1: Smart Location	□	□
SLLP1: Imperiled Species and Ecological Communities	*	*
SLLP3: Wetland and Water Body Conservation	*	*
SLLP4: Agricultural Land Conservation	*	*
SLLP5: Floodplain Avoidance	*	*
Neighborhood Pattern and Design		
NPDP1: Walkable Streets	-	-
NPDP2: Compact Development	□	□
NPDP3: Connected and Open Community	-	-
Green Infrastructure and Buildings		
GIBP1: Certified Green Building	?	?
GIBP2: Minimum Building Energy Efficiency	?	?
GIBP3: Minimum Building Water Efficiency	?	?
GIBP4: Construction Activity Pollution Prevention	?	?

3. Findings

The results of the two case studies were very similar. Based on the comparative analysis, most of the minimum mandatory criteria of the international certifications examined in the study either were met or could feasibly be met for both of the case areas if the developers decided to aim for certification at this stage, that is, prior to specific construction plans. However, some of the environmental evaluation criteria of the rating systems were identified as both irrelevant and unfeasible given local conditions in Finland. The results of the three separate analyses are presented in the subchapters that follow.

3.1 LEED for Neighborhood Development (LEED ND)

The LEED ND rating system comprises 12 prerequisites that must always be met in order to achieve certification. The most problematic criteria for the two case areas fell under the *Neighborhood Pattern and Design* (NPD) category. Two of the three NPD prerequisites were unfeasible for both case areas. The prerequisite of *Walkable Streets* (NPDP1) was unfeasible because it would not be possible to build a principal functional entry on the front facade for 90% of new building frontage, and because less than the required 15% of street frontage within and bordering the project areas could be built with a minimum building-height-to-street-width ratio of 1:3. Similarly, it was unfeasible to achieve the prerequisite of *Connected and Open Community* (NPDP3) in each of the case areas because the projects were not planned to be located in such a way that the connectivity of the existing streets within a quarter of a mile of the project boundary could have as many as 90 intersections per square mile. These issues all relate to urban density and thus the case areas with their predominantly detached housing were not able to meet the prerequisites described.

All the five prerequisites of the *Smart Location and Linkage* (SLL) category were found to offer various ways to achieve the criteria, including the drafting of policies to protect sensitive receptors, such as water bodies, and were thus could plausibly be met for both of the case areas.

Meeting the prerequisites found in the *Green Infrastructure and Buildings* (GIB) category mostly depends on decisions made during the building design and construction phase, and it could not therefore be determined at this stage whether they are met or not, however it is feasible to be able to meet most of the GIB criteria for both case areas. However, according to Garde [2] the GIB category is rarely used for anything other than mandatory criteria because often the cost is seen to be too high for the benefit and because certification can also be achieved using only the points gained from the two other location-related categories in the tool.

The expected allocation of the LEED ND prerequisites is presented in Table I.

Once the prerequisites have been met, the credits to be pursued can be chosen freely. In order to pinpoint prospective issues in implementing LEED ND in Finland in the context of new residential developments, the case areas were analysed with respect to several additional LEED ND criteria. These were chosen based on Garde's 2009 study [2] on the popularity of the LEED ND credits. Out of the LEED ND credits in the *Smart Location and Linkage* category, *Preferred Location* (SLLC1) was the most used, while in the *Neighborhood Pattern and Design* category, credits associated with *Walkable Streets* (NPDC1) dominated. The credits from the *Green Buildings and Infrastructure* category were in general less popular than those from the other two categories.

Table II. BREEAM for Communities prerequisites that are met (marked with "□"), plausible (marked with "*"), unfeasible (marked with "–"), or cannot be determined (marked with"?") for the case areas.

	Case Area 1	Case Area 2
Climate and Energy		
CE1 Flood Risk Assessment	*	*
CE2 Surface Water Run Off	*	*
CE5 Energy Efficiency	□	□
CE6 Onsite Renewable	□	□
Resources		
RES1 Low Impact	*	*
Place Shaping		
PS5 Design and Access	*	□
PS7 Local Demographics	*	□
PS8 Affordable Housing	*	-
Transport		
TRA9 Local Parking	?	?
TRA11 Impact Assessment	□	□
Community		
COM1 Inclusive Design	*	*
COM2 Consultation	*	*
Ecology and Biodiversity		
ECO1 Ecological Survey	□	□
Buildings		
BLD1 Domestic	?	?
BLD2 Non-Domestic	?	?

Nonetheless, *Stormwater Management* (GIBC8) was the most addressed within the category, and was consequently chosen for this additional assessment.

Meeting the three selected criteria, namely *Preferred Locations* (SLLC1), *Walkable Streets* (NPDC1) and *Stormwater Management* (GIBC8), was found to be unfeasible in both case areas. The *Preferred Locations* (SLLC1) criterion aims to encourage development within existing dense urban structure. In both case areas it had already been determined in the early planning phase that the development would be located beyond the limits of existing development. It would be impossible to gain any additional credits from the *Walkable Streets* (NPDC1) category as even the prerequisite of the *Walkable Streets* category was deemed to be unfeasible in both case areas. The *Stormwater Management* (GIBC8) criterion was deemed to be unfeasible to meet due to the common practice in Finland of discharging storm waters directly into nearby lakes, rivers and other bodies.

3.2 BREEAM for Communities

The BREEAM for Communities system comprises a total of fifteen criteria in seven different categories, of which at least one point per criterion must be achieved to obtain certification. This requirement is comparable to the prerequisite components in the LEED ND rating tool.

In three of the seven assessment categories; *Climate and Energy*, *Resources* and *Community*; all minimum mandatory requirements were either met by both case areas, or it could plausible to meet them. In the *Transport* category and the *Buildings* category it could not be determined at this early stage of planning whether the prerequisites could be fulfilled, however the achievement of the minimum mandatory requirements was not found to be problematic either. Only the prerequisite of *Affordable Housing* (PS8) in the *Place Shaping* category was deemed to be unfeasible, and only for Case Area 2, because the types of housing unit planned to be developed would not meet the required volumes of affordable housing required under the BREEAM tool.

A detailed statement of the fulfilment of each BREEAM for Communities minimum mandatory requirement by Case Areas 1 and 2 can be seen in Table II below.

One of the policies of BREEAM is to create a specific BREEAM for Communities scheme for each particular site, region or country. Therefore it was not unpredictable that the local conditions of the two Finnish case areas do not forestall evaluation.

Although predominantly a residential development with detached housing, Case Area 1 also includes plans for commercial and public services and for housing types for different demographics, thus making it particularly compatible with BREEAM for Communities requirements. In Case Area 2, however, a shortage of affordable housing results in a failure to meet the prerequisites for BREEAM for Communities certification. Apart from this, all other BREEAM for Communities minimum mandatory requirements were found to be attainable, for both case areas.

Despite the fact that all BREEAM for Communities evaluation criteria are adaptable to various local conditions, each criterion in itself cannot be optimal or even appropriate for assessing the diverse nature of development sites worldwide. A critical natural or cultural divergence may well impair the reliability of some BREEAM for Communities assessment results.

3.2.1 CASBEE for Urban Development (CASBEE-UD)

The CASBEE-UD is different to the LEED ND and BREEAM for Communities ratings systems in that it entails no prerequisites. In fact, the only mandatory requirement is that related laws and ordinances are complied with. Instead, the CASBEE-UD rating system comprises 80 separate scoring criteria where five levels of performance can be achieved. Given the nature of the rating system, a CASBEE-UD certification with the grade "Poor" or "Fairly Poor" would rather be comparable to a

failed LEED ND or BREEAM for Communities certification.

Both case areas assessed within this study would be categorised as "general type" CASBEE-UD developments. Due to the alternative brief version of CASBEE-UD, the assessment implementation is flexible and thus applicable to developments that are at various stages of their lifecycle. Therefore the fact that both Case Area 1 and Case Area 2 are in early stages of planning does not constrain the evaluation process. Although it was not possible to conduct a detailed assessment of the potential compliance with minimum mandatory requirements for CASBEE-UD in the way that it was conducted for the LEED ND and BREEAM for Communities tools, examples of the different criteria used for assessment of developments under the CASEBEE-UD system have been identified. These example criteria were chosen for the purpose of pinpointing prospective issues in implementing the rating system in Finnish local conditions, in the context of new residential developments.

Some of the CASBEE-UD criteria are already stipulated by law in Finland, such as, Q_{UD} 2.6 *Consideration for universal design* and LR_{UD} 3.2.6 *Selection of materials with consideration for impact on health*. The law and the national socio-political atmosphere in Finland are relatively advanced with regard to the rights of disabled people and to health and safety issues. It is general practice in Finland to take the disabled and infirm into special consideration when designing and planning the urban environment and public places. Similarly, it would be considered abnormal in Finland to use materials or chemical substances that have potentially adverse effects on health in the external cladding of buildings, in the structures that make up facade and landscape or in fertilisers.

The criteria of Q_{UD} 1.1 *Consideration and conservation of microclimates in pedestrian space in summer (to reduce the rise in surface temperature)* would be possible to meet in Finnish neighbourhoods but are not necessarily relevant given the local climate and other natural conditions. Because of the cool Nordic climate, the requirements of 1.1.1 *Mitigation of heat island effect with the passage of air*, 1.1.2 *Mitigation of heat island effect with shading*, 1.1.3 *Mitigation of heat island effect with green space and open water etc*., and 1.1.4 *Consideration for the positioning of heat exhaust* are not supportive of environmental sustainability improvements in Finland. Criteria related to Q_{UD} 2.4.1 *Understanding the risk from natural hazards* would be difficult to meet since areal hazard maps have not been developed in Finland. The risk of earthquake, which is irrelevant in Finland, dominates the scoring criteria Q_{UD} 2.1.1 *Reliability of supply and treatment systems*, Q_{UD} 2.2.1 *Reliability of information systems* and Q_{UD} 2.4.2 *Securing open space as wide area shelter*, but this emphasis does not forestall CASBEE-UD evaluation.

Some assessment criteria of the CASBEE-UD evaluation system would be difficult to comply with for cultural reasons or the traditional use of land, such as Q_{UD} 2.5.1 *Distance to daily-use stores and facilities*, Q_{UD} 2.5.2 *Distance to medical and welfare facilities*, and 2.5.3 *Distance to educational and cultural facilities,* which include demands for high urban density and next door facilities. In scarcely populated Finland, access to centralised medical, educational and cultural facilities is purposefully guaranteed by transportation services.

4. Discussion

Even if there is no doubt that international rating tools contribute significantly towards achieving the goal of sustainable development within the urban environments, they still have certain limitations that reduce their effectiveness and usefulness [9]. Inflexibility is one of the major obstacles to the acceptance of environmental building assessment methodologies [9]. The purpose of this research was to pinpoint prospective issues in implementing international environmental sustainability rating systems in Finland in the context of new residential developments. It was hypothesised that some of the assessment criteria would be unfeasible to meet or would be irrelevant in the Nordic environment. In addition, it was examined whether being able to obtain a neighbourhood development sustainability certificate is hindered by already having a master plan for a development project in place.

In the LEED ND rating system, the prerequisites that were associated with requirements for high urban density were found to be most problematic for the Finnish case areas. Finland is a scarcely populated country and high density and land-use efficiency have not traditionally been seen as desirable. Recent research also suggests that higher urban density does not necessarily indicate reduced greenhouse gas emissions in Finland [19,20]. Thus, a Finnish neighbourhood development may fail to achieve LEED ND certification because of not meeting criteria that are not aligned with local environmental goals and that might not even support environmental improvement given the local conditions. To achieve LEED ND certification would also require the location and density requirements to be taken into account at a very early phase of planning.

Since there is a strong tradition for detached housing in Finland, it may be problematic to achieve the BREEAM for Communities prerequisite of affordable housing in Finnish neighbourhood developments, as was found to be the case in one of the case areas. The application of the BREEAM for Communities scheme to Finnish urban planning could however support affordable housing in

Finland quite effectively. In any case, if the volume of affordable housing at a neighbourhood level is not determined to be a key sustainability issue in Finland, this could be taken into account in the Finnish-specific BREEAM for Communities scheme that would have to be developed if this British rating system were to be implemented (a prerequisite of the international application of the scheme).

In general, it can be seen that the more specific and detailed the sustainability requirements of the certification are, the more effectively the assessment directs urban planning towards the environmental goals of the assessment criteria. However, both the nature of environmental goals and the best ways to achieve them are often dependent on local conditions. For example, the assessment of flood or earthquake risk should not be prioritised highly in Finland given the local natural conditions. Similarly, improvements to the energy efficiency of buildings may be achieved very differently in countries where houses need to be heated during long and cold winters to in countries where houses need to be cooled year-round. Some of the CASBEE-UD criteria are irrelevant to Finland and thus the tool partly fails to encourage environmental improvements by awarding points for irrelevant achievements. In addition to this, the fact that a few sustainability points are awarded for achieving criteria that are already required under law might undermine the reliability of the assessment.

On the other hand, if the assessment criteria of the rating tools are too flexible, the rating system may lose some of its ability to direct urban planning towards the environmental goals of the scheme. As Garde noted in the case of LEED ND Pilot Projects, most projects did not make any changes to be able to obtain the certification, and instead only addressed the criteria that would be met anyway [1]. In these cases the certification becomes merely a marketing tool with no relevance to sustainability goals.

International rating tools have in some cases been accused of being too rigid and not taking into account differences in local climate, and socio-political conditions [8]. Given that none of the rating systems have yet been adopted in Finland, it has not been possible at this point to evaluate how flexible the criteria will be, which creates some uncertainty in the results of this study. Moreover, given that both of the case areas that were analysed were only at the planning stage of development, the level of detail in the data was not sufficient for a full analysis, and is also subject to change. It is therefore worth noting that the purpose of this study was to pinpoint prospective issues in general, and that the results of the research cannot be treated as a preliminary analysis of the case areas' compliance with the rating systems.

The case study approach and the selection of the cases lead to some uncertainties in the results of the research. While the location of both areas within the same metropolitan region added to the robustness of the results, the external validity of the results obviously suffered from this geographical restriction. Put in other words, the results cannot necessarily be generalised to other Nordic cities. Nonetheless, Armatunga and Baldry distinguish generalisation to populations or universes (i.e., statistical generalisation) from generalisation to theoretical propositions (i.e., analytical generalisation) [21]. The latter may well be achieved through case studies [21].

5. Conclusions

Augmenting the ability of environmental assessment methodologies to enhance dialogue among a range of construction stakeholders broader than a design team has provided a considerable theoretical and practical contribution to furthering environmentally responsible building practices [22]. Few would deny that the same potential lies in the neighbourhood-wide versions of sustainability rating tools. Nevertheless, in this study we have shown that applying international environmental rating systems to neighbourhood developments in Finland would likely uncover suitability, appropriateness, and reliability issues. To avoid reinventing the wheel, however, one viable option might be to use the existing international tools, but to only adopt the criteria deemed suitable for the local sustainability goals and for the particular urban development project, even though the project would not achieve an international certification. In the context of neighbourhood development, where the presence of international investors is more limited than for individual commercial buildings, for example, the benefit of the marketing niche created by an international certification might not be as relevant. The benefits of actual environmental improvements and of increased attractiveness of the area to potential new residents are more of a priority in this context, and could be achieved through the fulfilment of a few targeted, relevant sustainability criteria.

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How central business district developments facilitate environmental sustainability – A multiple case study in Finland

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ABSTRACT

Sustainability is widely accepted as an important conceptual framework within which to position urban policy and development. Furthermore, urban planning is recognised as an important instrument for promoting sustainable development. The purpose of this study is to examine how Finnish central business district developments are designed to facilitate environmental sustainability. Three recent urban regeneration projects are explored as a multiple case study, firstly to model the central business district development process in Finland, and secondly to analyse how the expected outcomes of such regeneration projects support environmental sustainability. Official plan reports and supplementary case data are analysed qualitatively. A common development process model is identified and environmental sustainability is found to be promoted through higher urban density. However, environmental considerations are made only in the beginning and at the end of the linear planning process. In each of the cases studied, the contribution to environmental sustainability appears to be scarce.

Introduction

Both the source of and the solution to the main sustainability challenges of our increasingly urbanized world lie within cities (Grimm et al., 2008; Rees & Wackernagel, 1996; Tan, Wang, & Sia, 2013). In the late 1990s and early 2000s urban development policy and practice has undergone radical restructuring: resources have been redirected towards the development of the inner city and, at the same time, urban sustainability discourses have emerged (Bramley & Power, 2009; Dickinson, 2005; Krueger & Buckingham, 2012). Agendas of urban sustainability have been widely adopted in European and North American cities, and sustainability schemes have emerged, such as BREEAM for Communities, LEED for Neighborhood Development and CASBEE for Urban Development. New planning discourses and practices typically lie at the nexus of higher urban density, improved infrastructure, new city centre retail complexes, mixed use and creative design of public space (Bramley & Power, 2009; Dixon, 2005; Henderson, 2011; Krueger & Buckingham, 2012). Given the competition between cities (Book, Eskilsson, & Khan, 2010; Vigar, Graham, & Healey, 2005; Warnaby, Bennison, & Davies, 2005), central business district (CBD) development projects seek to create favourable images, and a general expectation is that additional investments, employment and even environmental improvements will simply follow on from the flagship development projects (Henderson, 2011; Rousseau, 2009).

Urban development strategies based on higher urban density are often claimed to support *environmental* sustainability: dense urban structures and improved infrastructure can cost-effectively facilitate sophisticated sewer systems, waste collection, material recycling, and reduced per capita demand for occupied land; waste process heat from industry and power plants can be used for space-heating in dense urban developments; and use of motor vehicles can be reduced by facilitating walking, cycling, and public transportation in denser urban areas (Holden & Norland, 2005; Kenworthy, 2006; Van der Waals, 2000). However, the potential of the compact city policy to contribute to environmental sustainability is actually very limited when the environmental impact of consumption is considered (Holden & Norland, 2005; Neuman, 2005; Van der Waals, 2000). Cities are concentrated centres of consumption, dependent on the productive capacities of ecosystems well beyond their city boundaries, and responsible for a host of local and global environmental problems. These problems occur not just in cities themselves, but also in the rural and industrial areas that supply them with the energy and materials demanded by urban lifestyles and that absorb their waste (Bithas & Christofakis, 2006; Grimm et al., 2008; Paloheimo & Salmi, 2012). This notion is not new: almost 20 years ago, Rees and Wackernagel (1996) concluded

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that urban policies should strive to massively reduce the energy and material consumption associated with cities. Similarly, Grimm et al. (2008) have stated that as our ecological footprint expands, so should our perception of environmental issues of a greater scale, and of the broader impacts of our individual and collective life-styles, choices and actions.

A common European approach to *social* sustainability, within the context of urban planning, is that sustainable communities are places that meet the diverse needs of existing and future residents, or more specifically, that they are places where people *want* to live and work and that contribute to a high quality of life: they are safe and inclusive, well planned, built and run, and they offer equality of opportunity and good services for all (Dempsey, Bramley, Power, & Brown, 2011). Urban developments that focus on higher density have the potential to positively impact social sustainability: to improve access to services and facilities, to decrease car-dependency (a social excluder for those without a personal vehicle), to increase the potential for spontaneous interaction and to create the sense of community in neighbourhoods (Burton, 2000; Nasar & Julian, 1995; Talen, 1999). Compact urban structures may also demonstrate a mixed usage pattern and host a less segregated urban population, even if it is not axiomatic that social mix or use mix correlates with urban density (Burton, 2000; Dempsey et al., 2011; Sharifi & Murayama, 2013). It has however also been reported that compact urban forms can worsen neighbourhood problems and related experiences of insecurity and can cause stress and dissatisfaction (Bramley & Power, 2009; Burton, 2000; Kyttä, Broberg, & Kahila, 2011). According to some (case) studies in the United Kingdom, the United States and New Zealand, people may actually prefer low-density suburban living, with medium density areas seeming to be optimal for social interaction and participation in neighbourhood activities (Bramley, Dempsey, Power, Brown, & Watkins, 2009; Gordon & Richardson, 1997; Vallance, Perkins, & Moore, 2005).

From the *economic* point of view, the development of city centres is expected to bring much-needed investment to the urban core (e.g. Krueger & Buckingham, 2012). Given that cities aspire to become and to remain attractive places to live, work, visit and to do business, a goal has been set for urban policies to present cities as attractive products (Rousseau, 2009; Van den Berg & Braun, 1999; Warnaby et al., 2005). The target market of these developments is typically the middle classes given the anticipation that their consumer power and consumption habits will overcome any wider economic decline (Rousseau, 2009). The tastes and consumption preferences of this audience thus tend to largely impact the design of current CBD developments. The marketing of urban places as a process whereby urban activities are related to the demands of targeted customers has been widely studied already in the 1990s (Ashworth & Voogd, 1990; Griffiths, 1998; Ward, 1998). In the 2000s several authors have studied the potential contribution of the retail industry to the regeneration of deprived urban areas (Mitchell & Kirkup, 2003; Warnaby et al., 2005; West, 2002). However, Dixon (2005) still sees it as vital to accurately assess the real economic contribution that retail development makes in municipalities if, as seems to be the case, retail is a core element of CBD regeneration programmes (e.g. Balsas, 2001).

Sustainability is widely accepted as an important conceptual framework within which to position urban policy and development, and urban planning is recognised as an important instrument for promoting sustainable development (Grimm et al., 2008; Holden & Norland, 2005; Musakwa & Van Niekerk, 2013). Even if the evidence of a positive link between developed urban structures and improved sustainability is relatively scarce and incoherent (Burton, 2000; Heinonen, Kyrö, & Junnila, 2011; Liu, Song, & Arp, 2012), urban infill developments are typically seen as being favourable. Given that centralist principles have been incorporated into sustainability oriented urban planning frameworks in Europe and North America, the ability of municipal authorities to argue against decentralised and out-of-town forms of development has strengthened (Cullingworth & Nadin, 2007; Henderson, 2011; Valler, 1996). In this sense one might even consider sustainability principles to have been enrolled to bolster the case for large-scale city centre flagship projects, and thus to intensify urban entrepreneurialism (Henderson, 2011).

The purpose of this study is to examine how CBD developments are designed to facilitate environmental sustainability in Finland. The primary aim of the study is to build a general model for the Finnish CBD development process through the study of three case developments. Secondly, a cross-case analysis of the economic, social and environmental considerations of each of the case developments aims to discover how sustainability is integrated into the process and how, in considering environmental sustainability, the planning process and the approved development are impacted in each of the case areas. Furthermore, it is briefly considered whether the economic, social and environmental aspects are considered competently and with impartiality in each of the case areas. Given that the case cities are relatively small (45,000–200,000 inhabitants) on a global scale, the results are likely to be applicable only for cities and towns of a comparable size. However, each city is unique, and a case study only reveals what may occur in a similar context elsewhere.

The paper is structured as follows: the next section introduces the research methods and the material used. 'Results' models the Finnish CBD development process and presents the findings of the sustainability analysis. The results are discussed in the following section. Finally, conclusions are presented in the last section.

Study design

The study utilises a mixed method strategy with a two-phase linear qualitative analysis structure. Two separate qualitative content analyses were conducted using data collected from three separate case projects. The primary data consisted of the textual and pictorial documentation of the land use planning process, which were supported by interviews to confirm the interpretation of the documents. All the data were commensurate between the three developments studied, ensuring that the same information was available for each of the cases.

Data

The official plan reports were the main source of data for both analyses. A data set for qualitative content analysis usually consists of purposively selected texts that can inform the research questions being investigated (Zhang & Wildemuth, 2009). A plan report typically contains detailed information on all major elements of the land use plan and provides a comprehensive summary of the results of all impact assessments conducted during the planning process. The subject areas for the impact assessments include (1) spatial structure and the potential for utilising the old infrastructure; (2) housing supply and technical service networks; (3) traffic volumes, public transport system, networks for bicycle and pedestrian traffic and the general flow of traffic; (4) municipal economy, jobs and the operational preconditions for businesses; (5) landscape, cityscape, cultural environments and building heritage; (6) nature, natural resources, soil, bedrock, ground water and other environmental issues; and (7) living conditions, environmental health and safety, and the recreational opportunities for different population groups.

Some supporting documents for each of the cases were also evaluated, including maps, graphs and photographs; detailed assessment results of implementing the land use plans; and some additional financial accounts. The contribution of the supporting documents to the findings of the study was more corroborative than imperative. The maps, graphs and photographs enabled the visualisation of the content of the official plan reports as opposed to providing supplementary information. The financial accounts provided additional details and insights but did not reveal anything fundamentally new.

In order to fill any gaps in the textual and pictorial body of documentation, additional informal interviews were conducted with project managers and other specialists: from the city of Vantaa, the project manager and the street network specialist; from the city of Mikkeli, the manager of the city centre development organisation, the town geodesist and two civil engineers; and from the city of Hyvinkää the technical director and the town geodesist. These interviews, although unstructured and generally conversational in nature, helped to understand the project background and any impacting policies and also provided details on schedules, costs, economic considerations, the roles of different stakeholders in the process, contract details, contracting parties and the contractual obligations such as construction commencement order and contingencies. Nevertheless, the data that was collected through the interviews was utilised for the first analysis only. Given that the interviews were not recorded, any content of the analysis that leaned on the interview data (notes) was subsequently formally confirmed with the interviewees.

The key properties of the data are summarised in Table 1.

Analysis method

There are various definitions for the method of qualitative content analysis. To name just a few, the term is suggested to refer to "an approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytic rules and step by step models, without rash quantification" (Mayring, 2000, p. 2); "any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings" (Patton, 2002, p. 453); and "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005, p. 1278). The main consistency of the definitions is that qualitative content analysis examines the chosen concept or hypothesis, in a subjective but scientific manner, through unique themes and meanings rather than the statistical significance of the occurrence of certain words or ideas (Zhang & Wildemuth, 2009). The themes and meanings may be manifest or latent (Zhang & Wildemuth, 2009).

More specifically, the analysis method applied in this study is *summative* content analysis. It fundamentally differs from the other two approaches, *conventional* and *directed*, in that the textual data is analysed in relation to particular content rather than as a whole (Hsieh & Shannon, 2005). Such analysis leads to an interpretation of the contextual meaning of the chosen content. In summative content analysis, the manifest content is first identified and sorted, the aim being to understand the contextual use of the content (Hsieh & Shannon, 2005; Zhang & Wildemuth, 2009). Following this, the summative analysis extends to include latent meanings and themes, which separates it from pure manifest content analysis (Hsieh & Shannon, 2005; Zhang & Wildemuth, 2009). As part of the summative approach, latent content analysis refers to the process of interpreting the content to discover underlying meanings (Hsieh & Shannon, 2005). The main strength of the summative approach is that the textual evidence is consistent with the interpretation, which was seen to serve this study well because the topic was seen as sensitive to bias. Nevertheless, the findings from summative content analysis are "*limited by their inattention to the broader meanings present in the data*" (Hsieh & Shannon, 2005).

Kracauer (1952) has stated that qualitative analysis should explore the whole content of the data "in quest of important categories, free of any biasing prepossession with manifest content". He suggests qualitative data to have so many latent meanings that to isolate their manifest content would be almost impossible and above all would not yield relevant results. However, Kracauer has also stated that qualitative analysis is resolutely impressionistic and inevitably subjective. It was attempted to consider both the strengths and the weaknesses of different analysis methods in this study design. Hence the main emphasis was given to the manifest content of the data, but the latent content was also considered.

Research process

Data collection was considered to be the first step of the process of these qualitative content analyses. Early involvement directs the data collection toward sources that are most useful for addressing the research questions (Miles & Huberman, 1994). As the second step, the data was prepared for each analysis through simple sorting procedures. As the third step, individual themes were defined as the unit for analysis rather than for example words, sentences, or paragraphs. Therefore, as the fourth step, codes were assigned to text chunks of any size, as long as each chunk represented a single issue of relevance to the research questions. Multiple data displays were produced for both analyses, as described in more detail below. The conclusions were drawn as the last step of the analyses, which in general is the most critical part of the analysis process, relying largely on personal reasoning abilities (Zhang & Wildemuth, 2009). The reconstructions of meanings were derived from the last data display of each analysis and the inferences were made based on both the manifest and the latent content of the data.

The objective of the first analysis was to identify similarities in the processes that were followed in the planning and approval of each of the case developments. From this, a general model of the

Table 1
Summary of the data.

Type of data	Substance	Scope	Contribution to the 1st analysis	Contribution to the 2nd analysis
Official plan reports	Introduction to the land use plan (basic facts) and a comprehensive summary of all impact assessment results	544 Pages	Primary data	Primary data
Maps, graphs and photographs	Images and definition of the case areas before and after the development	47 Pages	Supportive data	Supportive data
Supporting accounts	Background, detailed assessment results of implementing the land use plan, analyses of the commercial structure, plans for public participation and documentation of a planning contest in Vantaa	Exploited selectively	Supportive data	Supportive data
Interviews	Background, details of the development process, financial information and detailed calculations	Brief notes	Primary data	Not used

planning and approvals process in Finland was produced. The multi-phase analysis commenced with an examination of the structure of each CBD development process as an individual case. A cross-case analysis then followed, combining the results of the individual examinations to investigate whether a common development process model could be identified. The results of these two analyses were used to produce a common process model for CBD development in Finland, which is introduced step by step in Chapter 3. Two data displays were produced during the first analysis. The first display is a detailed description of each of the planning processes, as derived from the case data, with the steps listed chronologically. A simple matrix was then produced in order to summarise the process phases and compare and contrast their content and duration.

The objective of the second analysis was to ascertain sustainability objectives of urban regeneration in Finland and to identify which elements of the CBD development process relate to sustainability. Two matrices were built to assist with this analysis. The first was a simple table, highlighting which elements of the study data related to sustainability issues. Data reduction for the first matrix was a simple process whereby relevant parts of the case study data were flagged and included. The plan reports (a total of 544 pages) were found to provide an encompassing and coherent insight to the aims and outcomes of the case developments. In the second matrix the reduced data was analysed further to itemise the expected social, economic and environmental outcomes of each of the case developments. Both of the matrices that were created could be used for both individual case and cross-case analysis. Even though the results of the analysis are seemingly based on cross-case considerations, careful within-case observations played a major role in interpreting the data.

Cases

Three recent major CBD development projects were selected for the study, in the cities of (1) Vantaa, (2) Mikkeli and (3) Hyvinkää. These three projects were selected as they met the following criteria: Firstly, a major objective of each of the developments was to change the traffic conditions and the commercial structures of the CBD. Secondly, each project was started and was estimated to be fully completed within the same time period: 2002–2016. Thirdly, the three case cities represent a variety of geographical locations and socio-demographic characteristics. The cases are presented briefly in Table 2 and in the following paragraphs.

In Finland, only the four biggest cities have a population greater than 200,000 and only five further cities have more than 100,000 inhabitants. Vantaa is the fourth most populous city in Finland and is officially considered to be part of the capital region, hosting Finland's only international airport. The administrative centre of Vantaa, where the CBD development takes place, is located in the eastern half of the capital region, some 20 km north from the downtown core of Helsinki. In contrast, the second case city, Mikkeli, represents the towns outside of the influence sphere of the Helsinki Economic Area. Mikkeli is a relatively important administrative centre in the Finnish Lake District in Eastern Finland, hosting such institutions as the new Army headquarters and the Mikkeli University Consortium. Given that both Vantaa and Mikkeli provide jobs for the people from neighbouring municipalities, the third case city, Hyvinkää, is unique in being commuter-based and strongly influenced by the Capital region. Mikkeli and Hyvinkää are approximately of the same size, being the 20th and the 24th most populous cities in Finland.

The main goals of the case developments are clearly stated in the official plan reports. The CBD development in Vantaa aims to be a "*complementary construction that creates an attractive, characteristic and architectonically high quality city core*". In addition, the railway station and the bus terminals are re-designed to serve increasing numbers of transit passengers. In Mikkeli the redevelopment aims to "*improve the vitality and the competitiveness of the CBD area, to ensure high quality services, to facilitate more housing and to make running errands easy and comfortable within the area*". Rather similarly, the main goal of the CBD development in Hyvinkää is "*to revise the detailed plans of the eastern quarter to allow new construction for both commercial services and housing*", while the spatial design of the area aims for "*a shopping mall -like environment, with a focus on on integrated parking arrangements*".

Table 2
CBD development cases.

Case city	Vantaa	Mikkeli	Hyvinkää
Population (2011)	203,000	48,900	45,500
Annual population growth	1.5%	0.3%	0.1%
Working population	99,600	20,500	20,800
Workplace self-sufficiency	102%	103%	88%
CBD development project started	2002	2002	2006
Construction started	2010	2005	2008
CBD development project finished (estimated)	(2016)	2011	(2014)

Results

CBD development process

Case 1 Vantaa

The construction phase of the CBD development in Vantaa started in 2010 and was still in its early stages when the study was conducted, however the process of confirming the new land use plans had been completed. The old railway station was to be replaced with a very large service and infrastructure centre that would include a travel centre, with a railway station and bus terminals, and an office and retail centre with, among other amenities, a citizen services office. In addition, the town square was to be re-located next to the City Hall, closer to the new travel centre, and six apartment buildings for 500 people, a church and two parking garages for 600 vehicles were to be built in the immediate area. The geographic borders of the CBD development site in Vantaa can be seen in Appendix A.

Four alternative preliminary plans were prepared between 2004 and 2005, from which one was selected for development in 2005. The construction contract negotiations were based on a tendering process. The price of the building land was already fixed. Seven construction companies submitted proposals and the planning process continued with two new partners. Later on, one of the two construction companies involved in the planning process renounced the project and was replaced by another. Despite more than a year of negotiation and delays to the planning process, the city could not achieve land use agreements with all the real estate owners. The plan was eventually amended to omit the problematic area.

Prior to the approval of the CBD development, the total permitted building volume within the development site was 30,000 m^2 of floor area, of which three quarters was reserved for office buildings. The new plan added up to 55,000 m^2 of floor area to the permitted building volume. The city of Vantaa owned most of the real estate within the area and sold the land to the construction companies for a total of €12.4 million. In addition, the land use agreements obliged private real estate owners to contribute to the costs of the municipal engineering work, which amounted to a total of €2.3 million. The annual real estate tax income to the city was estimated to increase by €0.7 million.

Case 2 Mikkeli

The construction phase of the CBD development in Mikkeli had started in 2005 and was fully completed in 2011. The old bus station was relocated next to the train station to form a new travel centre. Two new shopping centres were built on the old bus station site and in the neighbouring block. In addition, most above-ground parking spaces were removed from the CBD and a new parking hall for 600 vehicles was constructed underground. The geographic borders of the development site in Mikkeli can be seen in Appendix B.

Three alternative preliminary plans were prepared, of which two were developed further according to the statements given. A final decision was made based on a comparison of the two alternatives, with the following factors being taken into consideration: business needs, traffic and parking arrangements, fairness to the landowners, political preference, living environment and cultural environment. Following approval, an amendment was made to the plan due to permission to demolish a number of wooden houses that were built in the 19th century being withheld by the administrative court. The buildings in dispute were bordered outside of the development site.

The Mikkeli development was financed by €153 million of private investment and €14 million from the city. The approved development authorised an extra 25,000 m^2 of floor area to be added to the permitted building volume within the site. Given that most of the real estate was privately owned, an increase in the monetary value of the development site (€7 million in total) benefitted mainly the private owners and the land use agreements entitled the city to charge them €2 million as compensation. In addition, the city of Mikkeli sold some real estate (with included buildings/planning rights) between two construction sites for €1.9 million. The annual real estate tax income to the city was estimated to increase by €0.2 million.

Case 3 Hyvinkää

The construction phase of the CBD development in Hyvinkää started in 2008 and was estimated to be completed by 2014. The city hall, some other administration functions, the fire station and most over-ground parking places were relocated from the development site to release land for new commercial activities. A new business and retail centre was planned, consisting of three new buildings and serving as business premises for two supermarkets and for 75 shops and offices, creating jobs for 300 employees. In addition, 80 apartments were designed for the immediate area and 1600 new parking places were to be located underground. The geographic borders of the CBD development site in Hyvinkää can be seen in Appendix C.

In Hyvinkää, the plan for the new city centre development was put together in conjunction with the private real estate owners and construction companies. The two major real estate owners of the proposed development site were the two biggest retail conglomerates in Finland. In a similar manner to the planning process in Mikkeli, three alternative preliminary plans were prepared, of which two were developed further. Of the two shortlisted plans, the main difference was that one would conserve an old office building whereas the other, which was eventually selected, would replace the old building with an extended shopping centre and new apartment buildings.

The city owned most of the real estate within the CBD and bought two additional pieces of property, which were demolished in order to accommodate a new shopping centre. The new development increased the permitted building volume by 44,000 m^2 of floor area within the development site. Prior to the development, over-ground parking areas dominated the CBD and the permitted building volume was mainly reserved for non-commercial buildings. With the new plan, a protected library building was retained but all the other land was allocated for commercial and apartment buildings. The city of Hyvinkää commissioned all of the municipal engineering work itself, at a cost of €1.8 million, and was thus the sole beneficiary of the increase in the monetary value of the real estate. Following completion, the city sold the property, with the exception of the old library, at market prices and gained €14.5 million in revenue. The loss in value from the demolition of the city hall and the fire station was estimated to be €6.5 million.

The process model

In all three cases, the CBD development process can be divided into two main phases that are (I) *planning and decision-making*, and (II) *construction*. The *planning and decision making* phase consists of four sub-phases that are (1) *preliminary reporting*, (2) *preliminary planning*, (3) *contract negotiations*, and (4) *alteration of existing detailed development plan*. Similarly, the *construction* phase can be divided into two sub-phases that are (5) *municipal engineering work*, and (6) *construction*. Sub-phases 1 through 4 can typically overlap with one another, as can sub-phases 5 and 6, but only within their respective main phase. The ratification of the CBD plan clearly separates the two main phases from each other.

In each case, the duration of the *construction* phase was fairly constant, at 5–6 years, but the length of the *planning and decision-making* phase varied greatly, and ranged from 3 to 9 years. The average duration of the whole CBD development process was 10 years, but within the three cases it varied from 8 to 14 years, due to the variation in the duration of the *planning and decision-making* phase. Each of the six sub-phases is described in more detail in the following paragraphs.

Planning and decision-making phase

Preliminary reporting

A wide body of accounts and reports is prepared during the *preliminary reporting* phase to examine the diverse influences and impacts of the forthcoming CDB development. Typical interests of preliminary reporting are (1) traffic: connections to other areas and destinations, improvements to walking and cycling facilities, and traffic calming schemes within the CBD; (2) services: availability, purchasing power and potential service providers; and (3) the quality of the environment: cultural values, ecosystem services and health factors. Impacts to wider area within the municipality are considered in the local master plan. Arrangements for project partnerships can begin already in the *preliminary reporting* phase. Typical CDB project partners are real estate owners and investors and construction companies. The vision and the specific aims of a CDB development project are typically determined in the *preliminary reporting* phase. The duration of the first sub-phase varies, and part of it can be seen as precursory to the actual CDB development process as opposed to being part of the development process itself.

Preliminary planning

Even though a city may have a clear vision of the desired CDB development, multiple alternative preliminary plans are typically prepared to demonstrate possible variations. Some accounts and preliminary reports can still be prepared during the *preliminary planning* phase. According to the interviews, transparency and sincerity, early-arrangement of project partnerships, close co-operation with stakeholders and active community engagement during the *preliminary planning* phase are beneficial to the process and reduce opposition later on in the process. In each of the cases studied, the duration of the second sub-phase was from one to two

years, from submission of the preliminary plan to a single plan proposal being published.

Contract negotiations

Two types of contracts were needed in each case: (1) land-use contracts with land owners, where the costs of the municipal engineering work were apportioned, and (2) construction and other related operations contracts with assigned partners, where the construction plan and the related schedule were fixed. Approval of the proposed alteration to the existing detailed development plan cannot be made before the required land-use agreements are signed, but construction contract negotiations can continue, overlapping with the *alteration of existing detailed development plan* phase. From the interviews that were conducted, it was established that effective contract negotiations facilitate a smooth transition from the *planning and decision-making* phase to the *construction* phase. The duration of the *contract negotiation* phase varied from half a year to one year in each of the projects studied.

Alteration of existing detailed development plan

This phase encompasses the entire chain of decision-making that takes place to the point that the alteration (i.e. the approval of the new development) comes into force. The proposal that was selected in the *preliminary planning* phase is finished and is formally validated and approved. Co-operation with the building inspection authorities is often required in order to avoid the misinterpretation of the amended detailed development plan. The display of the amended plan for public inspection and the right of the general public to file a complaint about the amended plan are fundamental to this phase. According to the Land Use and Building Act (188§), a legally valid local master plan restricts the right to file a complaint to the Supreme Administrative Court of Finland about an alteration of detailed development plan. However, in practice any attempt to file a complaint usually delays the development process. In each of the cases studied, it took between half a year and one year for the amendment to the detailed development plan to be approved.

Construction phase

Municipal engineering work

Each municipality is responsible for building basic infrastructure within a detailed development plan. Municipal engineering work typically includes construction of streets and pipelines and transfer of power lines. Ideally, the timing of these activities does not interrupt or delay other construction work. Within the case projects, it took between one to one and half years for municipal engineering works to be completed.

Construction

The municipality is responsible for overseeing construction and ensuring that work is conducted in accordance with the detailed development plan and related requirements of the CBD development project. The construction contracts prepared in the *contract negotiations* phase may contain some more detailed clauses. In Hyvinkää, construction took three years and in Mikkeli five years. In Vantaa, construction is not yet complete.

Environmental sustainability in CBD developments

Sustainability is mentioned a total of 8 times in the 8 plan reports that cover the three development cases (a total of 544 pages). Here, the environmental aspect dominates the considerations of sustainability. The occurrences are listed below, case by case.

Case 1 Vantaa

(1) "The supplementary construction is sustainable because of the use of the existing infrastructure."
(2) "The technical care would have been sustainable without the alteration of plan as well."
(3) "The alteration of plan targets ecological sustainability."
(4) "The costs of an over-ground bus terminal are more economically sustainable."
(5) "The development takes place on brownfield, supplements existing urban structures and promotes higher urban density. It improves the functionality of public transport and leans on excellent railway connections. The parking needs of both the cars and the bicycles of the railway passengers have been taken into account. In addition, new pedestrian streets and higher urban density encourage cycling. The development diversifies commercial services, which reduces private driving. Given that also urban runoff control has been taken into account, the plan can be considered to meet the objectives of sustainable urban development."

Case 2 Mikkeli

(6) "Considerations of sustainable development are particularly important in both land use planning and construction preparations when urban planning causes environmental changes in a county centre."
(7) "The solution must respond to partly contradictory requirements (good living environment supports ecologically, economically, socially and culturally sustainable development, nurtures cultural values, facilitates the best functionality of a society and creates supportive conditions for business)."

Case 3 Hyvinkää

(8) "As sustainable development, the CBD development reduces dependence on private driving and supports walking, cycling and public transport."

Even though sustainability is mentioned only a few times in the plan reports, the social, economic and environmental aspects that were considered are described in detail. The expected outcomes of the CBD developments, both positive and negative (as cited in each of the plan reports) are presented in Tables 3, 4 and 5.

Finally, four development themes form the core of the CBD development in each case: (1) enhancement of commercial services, (2) higher urban density, increased permitted building volume and new construction, (3) high quality of the built environment, and (4) new parking arrangements and improved accessibility by all means of transport. All the four development themes facilitate a number of desired social, economical and environmental outcomes. The central CBD development themes and the related desired outcomes are presented in Table 6.

Discussion

The CBD developments strongly promote higher urban density and the enhancement of commercial activity. Urban densification is highlighted in the case development plans as being an environmental improvement in itself but the related detailed contribution to environmental issues is not always clarified. Furthermore, the detailed list of the occurrences of the term sustainability indicates that the term is used rather randomly, as vastly simplified and disconnected from the broad idea of sustainable development. It could be argued that the term is not thoroughly understood or is

Table 3
The social outcomes expected to emerge from the case developments.

Expected social outcomes (P = positive, N = negative)			Case 1 Vantaa	Case 2 Mikkeli	Case 3 Hyvinkää
1	P	Improved consumption facilities	x	x	x
2	P	New jobs	x	x	x
3	P	Equal accessibility	x	x	x
4	P	Improved conditions for walking and cycling	x	x	x
5	P	Improved parking arrangements	x	x	x
6	P	Lively urban atmosphere	x	x	x
7	P	Safe, high quality living environment	x	x	x
8	P	Increased social interaction and social control	x	x	x
9	P	Pleasant public indoor-space that facilitates spontaneous interaction	x	x	x
10	P	Improved housing availability	x	x	x
11	P	Special housing for senior citizens	x		x
12	P	Tailored, high-quality housing	x	x	
13	P	Higher social status of the CBD	x	x	
14	P	Shopping mall-like spatial design		x	x
15	N	Increased traffic and related emissions and noise within the CBD and residential areas	x		x
16	N	Reduced and limited green space	x	x	
17	N	Houses very close to one another and courtyard spaces smaller		x	
18	P	Underground parking releases city space for other uses		x	
19	P	Balanced population structure	x		

Table 4
The economic outcomes expected to emerge from the case developments.

Expected economic outcomes (P = positive, N = negative)			Case 1 Vantaa	Case 2 Mikkeli	Case 3 Hyvinkää
1	P	Higher commercial status of the CBD	x	x	x
2	P	More space for business activities	x	x	x
3	P	Denser and more attractive commercial structures	x	x	x
4	P	Improved competitiveness of commercial services	x	x	x
5	P	Customer flows and purchase power directed to the CBD	x	x	x
6	P	Increased business activity and new entrepreneurship	x	x	x
7	P	New jobs	x	x	x
8	P	More space for parking	x	x	x
9	P	Increased value of the real estate within the CBD	x		x
10	P	Self-sufficient development (positive business plan)	x	x	
11	P	The costs of required renovations covered		x	
12	P	New investment		x	
13	P	Attracts new workforce to the area	x		
14	P	Supermarkets (their attractiveness) staying within the CBD			x

Table 5
The environmental outcomes expected to emerge from the case developments.

Expected environmental outcomes (P = positive, N = negative)			Case 1 Vantaa	Case 2 Mikkeli	Case 3 Hyvinkää
1	P	Brownfield-based use of existing infrastructure	x	x	x
2	P	Reduced travel from the CBD to other destinations	x	x	x
3	P	Aims to reduce private driving by encouraging walking, cycling and the use of public transport	x	x	x
4	N	Increased private driving and related emissions	x		x
5	P	Aims to protect the green space and urban ecosystem services	x	x	
6	N	Major losses of trees and green space	x	x	
7	P	Brownfield development saves greenfield elsewhere	x	x	
8	P	Aims to protect ground water quality		x	x
9	N	Increased risk of ground water contamination			x
10	P	Encourages biodiversity in the new city park and courtyards	x		
11	P	Provides connections to wider green spaces	x		
12	P	Urban runoff control is taken into account	x		
13	P	Contaminated land remediation	x		
14	N	Requires re-arrangements and re-building of the existing infrastructure (water, electricity, district heat)	x		
15	P	LEED gold certification for one or more buildings	x		
16	P	Environmentally friendly building materials are recommended		x	
17	P	Costs of parking are allocated to the users		x	
18	–	None of the alternative plans causes fewer emissions than the others		x	

misconstrued. Be that as it may, the concept of sustainability is not used to systematically outline and itemise the social, the economic and the environmental aspects of the planning process.

As environmental goals, the case plans aimed to reduce private driving, to protect green space and urban ecosystem services, and to protect ground water quality. However, none of these benefits

Table 6
The central CBD development themes and desired outcomes.

Development theme	Desired social outcomes	Desired economic outcomes	Desired environmental outcomes
Enhancement of commercial services	Improved consumption facilities New jobs Pleasant public indoor-space that facilitates spontaneous interaction	Increased business activity and new entrepreneurship New jobs Improved competitiveness of commercial services Customer flows and purchase power directed to the CBD Higher commercial status of the CBD	Reduced travel from the CBD to other destinations
Higher urban density, increased permitted building volume and new construction	Improved housing availability Increased social interaction and social control	More space for business activities Denser and more attractive commercial structures Self-sufficient development (positive business plan) The costs of required renovations covered New jobs	Brownfield-based use of existing infrastructure Brownfield development saves greenfield elsewhere Aims to reduce private driving by encouraging walking, cycling and the use of public transport
High quality of the built environment	Lively urban atmosphere Improved safety of the living environment Shopping mall-like spatial design	Increased value of the real estate within the CBD	Aims to protect the green space and urban ecosystem services
New parking arrangements and improved accessibility by all means of transport	Equal accessibility Improved conditions for walking and cycling Improved parking arrangements	More space for parking Customer flows and purchase power directed to the CBD	Aims to reduce private driving by encouraging walking, cycling and the use of public transport Costs of parking are allocated to the users

was anticipated to materialise in the end, and, quite to the contrary, *increased private driving and related emissions*, *major losses of trees and green space* and *increased risk of ground water contamination* are outcomes that were actually expected to occur. The fact that the expected environmental outcomes of all of the cases were contradictory to the environmental objectives specified at the outset indicates that environmental evaluations were made only at the beginning and at the end of the linear planning process and were not considered in the decision-making phases. Furthermore, as shown in Table 7, two of the expected negative *social* outcomes actually appear to occur as a result of the negative environmental impact. Table 7 also demonstrates how the environmental aims and the expected environmental and social outcomes appear to be rather inconsistent in the projects studied.

In the case developments, provision of commercial services and creating high urban density are especially seen as being urgent issues. According to the plan reports in each case there was "need for" more commercial services or "lack of" certain kind of commercial services within the CBD. Similarly, the urban structure of the CBD was for example "scattered" and "required higher density". In contrast, many other issues were barely taken into account. Rather interestingly, all the expected negative social and environmental outcomes could be viewed as being consequences of higher urban density. Noticeably, there is not a single negative economic outcome mentioned in the plan reports. The economic perspective therefore appears to dominate decision-making, but the evidence for this is not solid.

For example in Mikkeli, the chosen proposal was criticised by the Southern Savonia Centre for the Environment and by the Finnish National Board of Antiquities because of the high increase in permitted building volume and the proposed demolition of wooden houses. In addition, most of the trees and green spaces were to be removed and residents were expected to look for green areas outside of the CBD. As justification for the decision to select this plan, a comparison with the other plan was shown. The selected plan earned more points than the alternative plan in the areas of "business needs", "traffic and parking arrangement", "fairness to the landowners" and "political preference" but fewer points in the areas of "living environment" and "cultural environment".

Even if compensation of green areas is a part of the formal planning procedure in some areas, for example in Germany (Rundcrantz & Skärbäck, 2003), the issue was not brought up in the cases of this study. The value of undeveloped urban land is commonly seen to lie in socioeconomic benefits, outdoor recreation and sustained biodiversity (Gustavsson, Hermy, Konijnendijk, & Steidle-Schwahn, 2005; Skärbäck, 2007). Therefore compensation of green areas refers to the substitution of ecological functions or qualities that are impaired by spatial development (Cuperus, Canters, & Piepers, 1996; Cuperus, Canters, Udo de Haes, & Friedman, 1999). In each of the case developments the socioeconomic benefits of urban green areas as well as possibilities for outdoor recreation within the CBD were considered but not prioritised highly. In Vantaa and Mikkeli especially, brownfield development was considered to save natural green areas and thus biodiversity elsewhere. In Vantaa, the new city park and courtyards were also stated to encourage biodiversity. However, no explicit comparison of the green areas to be lost and the new green areas to be built was made in any of the cases. As a scarcely populated country, Finland has relatively large natural areas far away from urban settlements and also many natural green areas within city boundaries or in their immediate surroundings. This may explain why the compensation of green areas was not seen to be an issue of interest in the planning and decision-making processes for these CBD developments.

Most of the recognised development themes are seen to be win–win-solutions as they contribute both to social satisfaction

Table 7
Links between negative social outcomes and (inconsistent) environmental aims and outcomes.

Environmental objective	Environmental outcome (anticipated)	Social outcome (anticipated)
All the three cases: Aims to reduce private driving by encouraging walking, cycling and the use of public transport	Cases 1 and 3: Increased private driving and related emissions	Cases 1 and 3: Increased traffic and related emissions and noise within the CBD and residential areas
Cases 1 and 2: Aims to protect the green space and urban ecosystem services	Cases 1 and 2: Major losses of trees and green space	Cases 1 and 2: Reduced and limited green space

and to the municipal economy. However, in each of the cases studied, the real contribution to environmental sustainability appears to be scarce. Furthermore, the current needs have a strong dominance over the needs of the future generations. Improved consumption facilities are actually likely to encourage higher consumption volumes, and therefore encourage urban lifestyles that are, environmentally, less sustainable (e.g. Heinonen, Jalas, Juntunen, Ala-Mantila, & Junnila, 2013). Developing cities to be more functional and convenient as concentrated centres of consumption is problematic for the future generations because, in the worst scenario, increased consumption means increased production, which leads to increased materials and energy use and increased emissions. Nevertheless, consumption volumes still primarily depend on the prevailing purchasing power, which is independent from consumption facilities. In addition, alternative patterns of consumption (e.g. consumption of virtual products or consumption based on renting or sharing) can change the suggested relationships between consumption, production and environmental impact.

In the cases studied, it can be argued that sustainability will emerge in social ways, such as by (among other things) encouraging a lively urban atmosphere, providing improved housing availability, providing improved consumption facilities, and facilitating more social interaction and social control: outcomes that are typically viewed as being the social benefits of denser urban structures (Burton, 2000; Nasar & Julian, 1995; Talen, 1999). Nevertheless, the relationship between urban densification and social sustainability seems to be complex and sensitive to the local context (Kyttä, Broberg, Tzoulas, & Snabb, 2013; McCrea & Walters, 2012). All the three expected negative social outcomes of the case developments are closely linked to higher urban density. According to several authors (e.g. Bramley & Power, 2009; Heinonen et al., 2011; Van Der Waals, 2000) the frequently assumed environmental and social benefits of the compact city structure tend to be overestimated.

To some extent, the findings of the study are supported by previous research. A case study by Theurillat and Crevoisier (2013) brings forth that there is a clear dissociation in time between the qualitative aspects of sustainable development and the quantitative aspects of financial returns that come into play at the very end of the planning process, by which time everything has been defined from a qualitative point of view. Another case study, by Krueger and Buckingham (2012), shows that "*urban greening is dispensable in the face of certain economic and political conditions*". Furthermore, a multiple case study in Sweden concludes that recognised hindrances, such as a dependency on short term project funding and a lack of strategic resources over time, constrain the possibilities for integrating sustainability into municipal work (Keskitalo & Liljenfeldt, 2012). Finally, the effects of urban intensification policies have been recognized to be more complex and far-reaching than the policies themselves suggest (Williams, 1999).

According to Nilsson (2007), sustainable spatial planning is extremely complex today, and local authorities seek to limit this complexity by dividing social, economic and environmental considerations into separate processes. She argues that this does not comply very well with the original idea of sustainability, but it helps planners to avoid the difficult choices and decisions that the integration of sustainability themes would require. In addition, sustainable development is typically promoted through actions that deviate only slightly from current planning practices, and alternatives that clearly differ from the standard are often not even discussed (Naess, 2001). Even if future generations are the inspiration for the definitions of sustainable development (e.g. Bithas, 2011) they seem to be ignored in sustainable urban planning if these three cases are taken as evidence.

Flyjberg (2006) states that "*a scientific discipline without a large number of thoroughly executed case studies is a discipline without systematic production of exemplars, and a discipline without exemplars is an ineffective one*". The results of this study, for its part, demonstrate that cities are being developed further in order to facilitate consumption-centred urban lifestyles, consumption seeming to be the main environmental problem globally (Bithas & Christofakis, 2006; Grimm et al., 2008; Rees & Wackernagel, 1996). However, the findings are not absolute: only three cases were examined, and the qualitative analysis conducted was, even if consistent, still fundamentally subjective. In addition, this research mainly paid attention to environmental issues. Further research is needed to evaluate the contribution of constantly improved consumption facilities to social sustainability, as well as to investigate if the municipal economy issues that seem to dominate the CBD development process support wider economic sustainability.

Conclusions

Given that urban planning is recognised as an important instrument for facilitating sustainable development, a multiple case study was conducted in Finland to examine how environmental sustainability is integrated into the CBD development process. The analysis resulted in two key findings. Firstly, environmental sustainability is considered in the beginning and at the end of the linear planning process but it does not appear to be integrated into the decision-making phases. Secondly, urban densification is promoted as a sustainable development practice, although its anticipated environmental benefits are not always explicitly stated. Furthermore, the expected environmental outcomes of urban densification may in fact be contradictory to the aims and objectives specified at the beginning of the planning process. The results of this study show that the Finnish CBD development process strongly promotes higher urban density and the enhancement of commercial services but hardly contributes to environmental sustainability. Further development in cities occurs to make them more functional and convenient as concentrated centres of consumption.

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The geographical borders of the CBD development site in Vantaa

The geographical borders of the CBD development site in Mikkeli

The geographical borders of the CBD development site in Hyvinkää

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Role of Urban Planning in Encouraging More Sustainable Lifestyles

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Abstract: Where urban planning is used to promote environmental sustainability, it has traditionally focused on reducing emissions from housing and traffic. However, cities are increasingly being recognized as consumption centers of the global economy, as the origin of demand, and as the point of termination for complex economic supply chains. Based on results produced by a hybrid life-cycle assessment model, which attributed the end-to-end emissions of supply chains to end users, consumption that is not related to housing or ground transportation was found to account for 30% of regional greenhouse gas emissions on average. In highly urbanized areas, the figure was even higher, at 45%. Furthermore, a literature review indicated that most environmental assessment tools for local city-level and subcity-level urban planning are neither able to identify the environmental impacts of personal consumption nor the relationships between urban structures and personal consumption. Thus, this study concludes that there is an apparent gap between the needs and the means of the regional environmental management of urban areas. **DOI: 10.1061/(ASCE)UP.1943-5444.0000196.**

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Introduction

The unsustainable nature of indefinite global economic growth, given the associated increase in private consumption volumes, is hardly questionable (e.g., Simms et al. 2010). However, mitigating the negative environmental impacts of consumption by encouraging more sustainable lifestyles is a strategy that is rarely adopted to improve the environmental sustainability of cities and other residential areas (Daffara 2011; Arikan et al. 2012; Singh et al. 2012). Environmentally-aware urban planning has traditionally concentrated on avoiding urban sprawl (Naess 1995; Nino and Baetz 1996; Churchill and Baetz 1999), on reducing the volume and emissions of traffic (Chi and Stone 2005; El-Gafy et al. 2011; Geels 2012), and on improving the energy efficiency of buildings (Li et al. 2011; Conte and Monno 2012). Nevertheless, a pure focus on eco-efficiency gains in transportation and housing may have only a minor positive impact on the environmental sustainability of urban areas, or possibly even a negative one, if the overall system of production and consumption is not understood.

As a result of globalization, the extraction of resources, production of materials, manufacturing of industrial goods, consumption of products, and disposal of waste are increasingly taking place in different corners of the world. Long and complex global supply chains eventually terminate in cities, which can thus be regarded as the demand and consumption centers of the global economy (Ramaswami et al. 2008; Tukker et al. 2009). According to several authors, traditional, geographically-restricted methods of eco-efficiency evaluation cannot therefore produce sufficient information for the effective management of environmental sustainability in urban environments as they fail to take into account the global traceability of emissions, and past studies have proposed the need for a new consumption-based analysis of urban areas (Turner and Baynes 2010; Wiedmann et al. 2011; Heinonen 2012).

In addition, there exists a certain amount of debate as to whether or not making improvements to material- or energy-efficiency in individual areas of society does in fact have a positive environmental impact by reducing the consumption of energy and materials overall (Schipper 2000; Schipper and Grubb 2000; Schandl and Turner 2009). Theoretical arguments in literature, as well as empirical evidence, suggest that efficiency gains in production can produce a strong rebound effect, whereby economic gains passed to the consumer are "reinvested" in yet further private consumption. The net impact on the environment can therefore be worse than if no efficiency gain was made in the first place (Huesemann 2003; Polimeni and Polimeni 2006; Herring 2006; Turner 2009).

Furthermore, even though higher urban density may correlate with increased carbon-efficiency of transportation and housing services, recent research has demonstrated that, in several cases, urban density is not a valid indicator for overall carbon-efficiency, let alone for environmental sustainability (Heinonen et al. 2011; Heinonen and Junnila 2011a). It can therefore be argued that; rather than taking the limited approach to environmental sustainability typically employed in urban planning today (compressing urban settlements, building new energy-efficient housing and discouraging private vehicle use), a more holistic, consumption-based approach should be adopted to progress environmental sustainability in builtup areas.

Countless efforts are currently being undertaken to adapt existing instruments of urban planning to the concept of sustainability (Wallbaum et al. 2011). A closer look at some of the international schemes that are available to assess regional sustainability (e.g., BREEAM for Communities, CASBEE for Urban Development, and LEED for Neighborhood Development) reveals that locating a comprehensive range of shops and services in the nearby

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vicinity of housing units is considered to be sustainable practice, in that the environmental impacts of the journeys made to obtain goods and services should be reduced. However, Turner and Baynes (2010) suggest that achieving overall environmental gains by applying resource efficiencies (in this scenario, increasing the efficiency of shopping journeys) is feasible only if there is a general societal change towards consuming less and working less. Otherwise, due to the rebound effect of reinvested savings, increased efficiency or productivity in general (e.g., in material and energy use) may not yield a commensurate level of reduction in the absolute volume of resources used or production of wastes and emissions (Turner and Baynes 2010).

According to Wagner (2010), most emissions accounting frameworks do not take embedded greenhouse gas (GHG) emissions into account. Nevertheless, interest in consumption-based pollution prevention and resource conservation has grown significantly in recent years (Holden and Linnerud 2007; Wiedmann 2009; Wiedmann et al. 2011). Baynes et al. (2011) have compared the approaches to quantifying the ongoing direct energy demand of cities (top-down regional approach) and to understanding total energy demands, including those embodied in goods, of household consumption (bottom-up input-output approach). As for greenhouse gas budget calculations, several studies have already juxtaposed consumption-based carbon footprints and production-based territorial emission accounts in order to demonstrate the effects of trade (Turner and Baynes 2010; Wiedmann et al. 2011; Heinonen 2012).

In addition to this, a number of studies have looked into the mechanism of feedback effects of the embodied greenhouse gas emissions at a national level (Su and Ang 2011) as well as into the limitations of taking regional diversity into account in national consumption-based ecological footprint and land-use accounting (Zhou and Imura 2011). Lenzen et al.'s study (2004) shows how differences in the lifestyles exhibited in inner and outer areas of Sydney, Australia, lead to differences in energy use characteristics. Weber and Matthews (2008) have analyzed American household consumption and its environmental impacts, and Schultz (2010) compares city-scale direct- and indirect greenhouse gas emissions in Singapore. However, it has not yet been widely investigated whether this approach has been or could be adapted to local city- and sub-city level urban planning.

Businesses too are found to be showing an increasing interest in consumption-based carbon footprint accounting (Larsen 2011), and the dislocation of emission sources from the end user is no longer escaping the attention of the environmentally aware public either (Wiedmann 2009). Theoretical discussion and case studies both suggest that by seeing urban structures as part of a sociotechnical system, in continuous interaction with the human and natural environments, sustainable infrastructure development may help communities to achieve sustainability (Fischer and Amekudzi 2011). The purpose of this study is to examine whether the consumption-based, lifecycle-wide approach to environmental assessment is compatible with the regional environmental management of urban areas and to investigate whether this approach could be useful in reducing the environmental impacts of personal consumption and encouraging more sustainable lifestyles.

The research segments private consumption into personal-, housing- and transportation consumption. The term *personal consumption* is taken to exclude any personal expenditure related to housing or to ground transportation and includes all other expenditure on goods and services. First, this study attempts to estimate what proportion of city- and sub-city level carbon footprints can be accounted for by personal consumption. Carbon footprint, being one of the most widely employed environmental metrics, is used as simplified indicator of negative environmental impacts within this part of the study. Past data from the application of a hybrid life cycle assessment model to multiple case areas is used to estimate the proportion of the carbon footprint from each area that can be attributed to personal consumption. Second, this study aims to investigate whether the tools for the regional-level evaluation of environmental sustainability are able to recognize consumption-based emissions and resource use. The analysis is conducted using Finland as a case study.

The research shows that personal consumption can account for a remarkable share of greenhouse gas emissions but is not factored into the dominant regional environmental sustainability management practices. Findings of the study are compared with international literature in the field, and it is concluded that identifying the environmental impacts of personal consumption and the relationships between urban structures and lifestyle-related private consumption is essential in order to effectively manage environmental sustainability in urban areas globally. The remainder of the paper is structured as follows: the next section introduces the research methods and the study design. The findings consist of two sections, *Share of personal consumption in carbon footprints* and *Consumption-based approach in regional environmental management*, that link up in the discussion section. Finally, the last section concludes the paper.

Methods and Study Design

The study consisted of two parts, each of which employed different research methods. In the first part, quantitative data was used to estimate the share of the annual, consumption-based per capita carbon footprint that can be attributed to personal consumption. Carbon footprint was used as simplified indicator of negative environmental impacts within this part of the study because of the availability of case data. In the second part of the study, 33 regional evaluation tools for environmental sustainability were qualitatively examined to investigate whether they are able to identify the environmental impacts of personal consumption and the relationships that exist between urban structures and lifestyle sustainability. Finland was used as a case study throughout.

The first part of the study was conducted using a multiple case study approach. The total carbon footprints for the 13 case areas examined in this paper were taken from four previously published studies (Heinonen et al. 2011; Heinonen and Junnila 2011a, b, c). For these past studies, an application of a tiered hybrid life cycle assessment (LCA) was developed in order to take advantage of the accuracy of the selected process data, while still benefitting from the comprehensiveness of the input-output based LCA method, which is especially suited to analyses of the urban environment (Crawford 2011). The model allocates the greenhouse gas emissions of all production and supply chains to the consumer or end user of each utility, regardless of the geographic occurrence of the emissions.

The Carnegie Mellon University economic input-output life cycle assessment (EIO-LCA) was adopted as the basis of this hybrid approach, as it was the most disaggregated model available and provided output tables for 428 industry sectors (CMU Green Design Institute 2008). The nature of Finland, as a small and open economy where more than half of the value of private consumption relates to imported goods, supported this choice of methodology. The key subsector data from the output matrices were substituted with process data, while the rest of each matrix was left untouched to maintain the full coverage of the hybrid model. For example, the production phase emissions of energy, electricity, and heat were

calculated from the production data of local power companies, using the energy method.

The primary source for the statistical input data used for the calculations was the most recent Finnish consumer survey, which was conducted in 2006 and comprises consumption data for nearly 10,000 consumers in Finland (Statistics Finland 2007). In order to provide data that was best suited to the aims of the study and that fit with the industry sectors available in the input-output model, the consumption sectors in the survey were aggregated from nearly 1,000 original data categories to create 43 in total (or 59 in the case of the Helsinki downtown core, which was assessed with an updated version of the model; see Heinonen et al. 2011). In addition to the Finnish consumer survey, further, case-specific data was provided by the case organizations.

The hybrid LCA model was streamlined to take into account only one impact category—global warming—when calculating the annual, private consumption-based per capita carbon footprint. Because these calculations were based on private consumption, publicly financed services were not taken into account. A description of the construction of this hybrid model is presented in more detail in earlier publications, along with analyses of the strengths and weaknesses of the hybrid and EIO-LCA models, and of the applicability of the hybrid model to the Finnish economy (Heinonen et al. 2011; Heinonen and Junnila 2011a, b, c).

The framework for the second part of the research was based on a literature review. A past study has identified a total of 33 tools for the evaluation of environmental sustainability in urban areas that have the potential to be applied on a regional scale, and that are applicable to the local conditions in Finland (Säynäjoki et al. 2012). The tools were classified first by the main area of assessment: either (1) *material and energy flows*, (2) *pollution loads and environmental impacts*, (3) *eco-efficiency*, or (4) *ecological and social sustainability*. Second, the tools were classified by the scale of their applicability, and for the most part, they can be applied to investigations either on a neighborhood and town level or on a municipality, city, and state level. In this study, that toolbox of sustainable urban planning was examined qualitatively, tool by tool, to investigate whether the evaluation tools are able, and intended, to identify the environmental impacts of urban planning; not just on issues related to housing and traffic, as is typically so, but also on personal consumption and lifestyle sustainability.

Share of Personal Consumption in Carbon Footprints

Analysis was carried out on previously published consumption-based carbon footprint calculations for 13 geographic case areas. As the intention of the study was to determine the contribution of personal consumption to the regional greenhouse gas emissions in any urban environment, a variety of Finnish regions were selected as case areas. The case areas differed in size, location, and the population's average income, encompassing a city quarter, five cities, the capital region, two groups of towns, three groups of municipalities (all the regions of a certain type), and the whole country. All 13 case areas are presented in more detail in Table 1. For the national level analysis of all the regions of a certain type, Finland was divided into four levels of urbanization. This analysis leaned more on national census data than specific case data. Several of the case areas overlapped with others, for instance, Finland as a whole—the largest of the case areas.

In past publications, the hybrid LCA model divided the total carbon footprint into approximately 50 consumption classes, which were further aggregated into between 5 and 10 consumption sectors, with an aim to exhibit the breakdown of the emissions and indicate the level of association to more urban structure- or lifestyle-related carbon consumption. This aggregation approach was further developed for the purpose of this study, with the annual consumption-based per capita carbon footprint being broken down into three main categories, presented in Table 2. To estimate the proportion of regional greenhouse gas emissions that can be attributed to personal consumption (that excludes any expenditure related to housing or to ground transportation and includes all other expenditures on goods and services) in any urban environment,

Table 1. Case Areas

Case area	Area type	Population	Density (per km^2)	Private consumption[a] (€)	Carbon footprint[a] (t CO_2e)
Finland	Country	5,400,000	20	14,300	10.2[b]
Rural areas in Finland	Group of municipalities[c]	1,120,000	5	12,200	9.0[d]
Semi-urban areas in Finland	Group of municipalities[e]	860,000	16	13,800	9.9[d]
Cities in Finland	Group of municipalities[f]	3,210,000	87	15,200	10.9[d]
Helsinki metropolitan area	Capital region[g]	930,000	1,327	17,600	12.5[d]
Helsinki	City	565,000	3,000	17,400	12.4[b]
Helsinki downtown core	City quarter	165,000	10,000	20,200	14.7[h]
Espoo	City	235,000	740	18,800	14.4[b]
Porvoo	City	48,000	70	15,900	10.3[i]
Vantaa	City	197,000	780	16,000	11.1[b]
Tampere	City	206,000	340	15,000	10.9[b]
Urban towns around Tampere	Group of towns	64,000	80	13,800	10.1[b]
Rural towns around Tampere	Group of towns	69,000	20	13,800	11.1[b]

[a]Annual per capita.
[b]Source: (Heinonen and Junnila 2011b).
[c]Municipalities where population is less than 15,000 and where less than 60% of inhabitants live in urban areas, or where population is less than 4,000 and where 60 to 90% of the inhabitants live in urban areas were categorized as rural areas.
[d]Source: (Heinonen and Junnila 2011a).
[e]Municipalities where population is 4,000 to 15,000 and where 60 to 90% of the inhabitants live in urban areas were categorized as semiurban areas.
[f]Municipalities where population is more than 15,000 or where more than 90% of the inhabitants live in urban areas were categorized as cities.
[g]The only Finnish metropolitan area consists of three cities: Helsinki, Espoo and Vantaa, forming the capital region.
[h]Source: (Heinonen et al. 2011).
[i]Source: (Heinonen and Junnila 2011c).

Table 2. Three Main Consumption Categories and the 10 Subcategories

Housing	Ground transportation	Personal consumption
Building and property	Private vehicle use	Consumer goods
Heat and electricity	Public transportation	Leisure goods
Maintenance and operation		Health, medical & training services
		Leisure services
		Travelling abroad

the share of the total carbon footprint represented by each of these three consumption categories was calculated for each of the 13 case areas.

As can be seen in the first column of Table 2, the main category, *housing*, is broken down into three subcategories; *building and property*, *heat and electricity*, and *maintenance and operation*. *Building and property* encompasses, for example, the construction of buildings and municipal infrastructure. *Heat and electricity* represents the total energy use in private homes, including both individual household energy usage and the household's share the communal building energy. *Maintenance and operation* comprises emissions relating to all repair-related construction work, maintenance services such as cleaning, the supply of water, treatment of wastewater, and waste management.

Similarly, as can be seen in the second column of Table 2, the *ground transportation* category is broken down into two subcategories; *private vehicle use* and *public transportation*. The *private vehicle use* category incorporates not only fuel-related emissions, but also any emissions relating to the manufacture of purchased vehicles and vehicle maintenance. The *public transportation* category consists of any emissions relating to train, coach, and subway and tram journeys, including associated heavy infrastructure and maintenance operations. It is important to note that flights and sea-based travel are not included in the *ground transportation* category, but in *personal consumption* instead.

Finally, as can be seen in the third column of Table 2, the third and the last main category, *personal consumption*, is broken down into five subcategories. *Consumer goods* represents both the day-to-day consumption of everyday things such as food and beverages and the consumption of durable goods, for example clothes and shoes. *Leisure goods* and *leisure services* refer to more personal, lifestyle-related expenses, for example telecommunication, restaurant visits, and beauty treatments. *Overseas travel* includes any emissions relating to air transportation, sea-based travel, and overseas accommodation. Finally, the *health, medical and training services* represents any emissions related to expenditure on any of these services. It should be noted that this only includes expenditure on private services of this nature, which in Finland represents a minor segment of this sector on the whole.

Overall, personal consumption was found to account for between 24 and 46% of the carbon footprints of the areas assessed. Housing accounted for between 43 and 59% and ground transportation for between 11 and 23%. Table 3 summarizes the breakdown of the annual consumption-based per capita carbon footprint for each of the 13 case areas, and presents the proportion of the total carbon footprint accounted for by each of three categories; housing, ground transportation and personal consumption; expressed as a percentage.

Rather surprisingly, personal consumption was found to account for a significantly larger share of carbon footprint than ground transportation, regardless of the type or size of the case area. Further yet, it was found that the higher the level of urbanization, the more significant is the share of greenhouse gas emissions that personal consumption seems to account for. Within the downtown core of Helsinki, the capital of Finland, it was even the case that more greenhouse gas emissions could be attributed to personal consumption than to housing.

Table 3. Distribution of Carbon Footprints of the 13 Case Areas to the Three Main Consumption Categories, Presented in Order of Highest-Lowest Proportion of Personal Consumption

	Distribution of carbon footprint		
Case	Housing (%)	Ground transportation (%)	Personal consumption (%)
Helsinki downtown core[a]	43	11	46
Helsinki[b]	54	12	34
Helsinki metropolitan area[c]	53	13	34
Espoo[b]	51	15	34
Tampere[b]	50	18	32
Porvoo[d]	48	21	31
Vantaa[b]	55	15	30
Cities in Finland[c]	54	16	30
Finland[e]	53	18	29
Urban towns around Tampere[b]	50	23	27
Semi-urban areas in Finland[c]	53	21	26
Rural areas in Finland[c]	52	23	25
Rural towns around Tampere[b]	59	17	24
	43 . . . 59	11 . . . 23	24 . . . 46

[a]Data source: (Heinonen et al. 2011).
[b]Data source: (Heinonen and Junnila 2011b).
[c]Data source: (Heinonen and Junnila 2011a).
[d]Data source: (Heinonen and Junnila 2011c).
[e]Data source: (Heinonen 2012).

It was in the rural towns around the city of Tampere that personal consumption accounted for the smallest proportion of all consumption-based greenhouse gas emissions with a share of 24%. Here, transportation and housing accounted for 17 and 59%, respectively. The share of the carbon footprint attributed to personal consumption was highest within the downtown core of Helsinki, where the portion of the total was found to be 46%. Here, transportation accounted for only 11%, but housing could be attributed to a larger, 43% share. The median share of personal consumption was 30%, the average value was 31%, and the standard deviation of the results was 5.7 percentage points, demonstrating a relatively wide dispersal of results overall.

Consumption-Based Approach in Regional Environmental Management

The investigation as to whether the environmental assessment tools are able to identify the environmental impacts of personal consumption, and whether they identify a relationship between urban structures and lifestyle sustainability focused on three main areas. First, it was investigated whether the tools are able to measure the environmental impacts, pollution loads, or material or energy flows relating to the personal consumption of the inhabitants of the area under evaluation. Second, it was examined whether (in addition to reducing the impacts of production and transportation) the tools intend to promote urban planning that encourages more sustainable lifestyles amongst inhabitants, thus diminishing the negative environmental impacts of personal consumption. Third, it was assessed whether the evaluation tools simply consider urban density to be a valid indicator of environmental sustainability in urban areas, as opposed to taking a more holistic view of regional environmental sustainability. Recent research has suggested, for example, that

lifestyles in downtown areas with high urban density may in fact be more carbon intense than more dispersed suburban living, due to higher overall personal consumption volumes (Heinonen et al. 2011), and that rural lifestyles could possibly be less carbon intense than urban lifestyles, despite higher levels of private driving (Heinonen and Junnila 2011a), hence this third aspect of the investigation.

The results of the analysis show that the vast majority of the environmental sustainability evaluation tools do not deal with consumption-based, lifecycle-wide scoping. The full findings on the ability of the environmental sustainability assessment tools to identify the environmental impacts of personal consumption, and to identify relationships between urban structures and lifestyle sustainability, are summarized in Table 4.

Even though the analysis found that 29 of the 33 environmental sustainability tools that were examined are unable to measure personal consumption related environmental impacts, pollution loads, or material or energy flows, four of the tools available in Finland were specifically developed for regional consumption-based calculations: a national environmentally extended economic input-output LCA model and three input-output based hybrid models. The environmentally extended economic input-output LCA model, ENVIMAT (Environmental Impacts of Material Flows), is upheld by the Finnish Environment Institute and can be used as a national basis for hybrid models of consumption-based pollution loads and environmental impacts calculations. Two ENVIMAT-based tools, Ecocity Evaluator and KUHILAS, are already able to measure regional greenhouse gas emissions that are related to personal consumption. The Aalto hybrid LCA, which was used for the case studies in this research, offers a parallel in that it is also able to measure consumption-based regional carbon footprints, however it is based on an alternative input-output model, EIO-LCA.

Moreover, it was found that none of the eight regional eco-efficiency evaluation schemes and none of the 13 ecological and social sustainability assessment tools utilizes any available methods for calculating consumption-based greenhouse gas emissions (that could possibly be modified to cover other environmental impacts too). It can be concluded therefore, that none of them have the intention of directing urban planning to diminish the environmental impacts of personal consumption and that none of them can be used to promote urban planning that encourages more sustainable consumption. Furthermore, six of the tools—EU Ecocity, HEKO, LEED-ND, Metka, Seutukeke, and YKEVAKA—were found to consider urban density to be a valid indicator of environmental sustainability in urban areas.

Discussion

The purpose of this research was first to estimate the share of regional carbon footprints that can be accounted for by personal consumption and second to investigate whether the tools, which are currently available for the assessment of regional environmental sustainability, can recognize the environmental impacts of personal consumption. The results of the study show that personal consumption accounts for between a quarter and a half of regional consumption-based GHG emissions in Finland. Furthermore, it was found that most tools for the evaluation of regional environmental sustainability are not designed to identify the environmental impacts of private consumption or the relationships between urban structures and lifestyle-related private consumption. Thus, an apparent gap exists between the needs and the means of regional environmental management. Even if it is clear that reducing the environmental impacts of personal consumption is essential, the evaluation tools mainly seem to overlook the issue, and therefore so most probably do the regional environmental management strategies of the areas that utilize them.

Remarkably, less than 25% of the regional carbon footprint was found to be related to ground transportation (within the Helsinki metropolitan area this was even lower, at only 11 to 13%). Thus, changes to personal consumption habits seem to have more potential to positively impact the environment than do improvements to the efficiency and volumes of ground transportation. Given that Finland is quite a scarcely populated country in the very north of Europe, it could be assumed that housing and ground transportation should account for an even bigger share of total GHG emissions than in countries with a milder climate and a higher population density. Personal consumption in other countries may therefore account for an even more significant share of total GHG emissions than in Finland, but this cannot be confirmed without case studies from multiple countries. The share of personal consumption seems to somewhat increase and the shares of housing and ground transportation seem to somewhat decrease as the total private consumption increases across the cases. However, this study cannot reveal such clear correlations.

Moreover, it is rather surprising that well-known and widely used international urban eco-planning schemes do not tend to measure consumption-based environmental impacts. More evaluation tools were found to consider urban density as a valid indicator of environmental sustainability than to be able to direct urban planning to diminish the environmental impacts of personal consumption. Furthermore, the idea of high urban density can evidently be seen as an environmental rationale for the assessment criteria of most of the tools, even if it was not used as a direct environmental indicator. Nevertheless, it can be assumed that moving forward, these existing methods for assessing the environmental sustainability of urban environments could be used as a framework to develop sophisticated models for the calculation of material and energy flows, pollution loads, and environmental impacts. It is likely to be essential at some point to incorporate the best available techniques for calculating environmental impacts into the widely used ratings systems for overall regional environmental sustainability.

To some extent, the findings are supported by previous research and seem to be valid globally. According to Peters and Hertwich (2008), in most developed countries territorial emissions are smaller than consumption-based emissions. Lenzen et al. (2004) state that the majority of attempts to reduce the environmental impacts of cities concentrate on direct effects, such as domestic energy consumption and local transportation, supporting urban consolidation. According to Schultz (2010), in Singapore, a city-state of compact settlement structure and extremely high public transportation utilization rate, indirect, consumption-based greenhouse gas emissions exceed direct emissions by a factor of 4 to 5. Weber and Matthews (2008) have published calculations that estimate personal consumption to account for more than one-third of American households' consumption-based carbon footprint. According to Heinonen et al. (2011), the share of greenhouse gas emissions that the consumption of tangible goods and services seems to account for is high enough, and has a large enough impact on the overall consumption volume of the average resident of an area, to replace urban density as the key factor in mitigating carbon consumption in inhabited areas.

According to Zagonari (2011), "urban land use is a dominant factor that exacerbates or mitigates human health and well-being." The ways in which the negative environmental impacts of personal consumption could be mitigated through urban planning have not been widely reported in academic literature. Further research is therefore needed to clarify how the location of developments

Table 4. Classification of Environmental Evaluation Tools (Data from Säynäjoki et al. 2012)

Name of tool	Origins of tool	Main target of assessment	Scale of applicability		Able to measure personal consumption related environmental impacts, pollution loads, or material or energy flows	Intended to direct urban planning to diminish the environmental impacts of personal consumption	Considers urban density as a valid indicator of environmental sustainability in urban areas
			Neighborhood and town level	Municipality, city and state level			
Aalto hybrid LCA	2010, Aalto University, Finland	Pollution loads and environmental impacts	—	x	x	x	—
Beyond Vuores	2007, Technical Research Centre of Finland	Ecological and social sustainability	x	—	—	—	—
BREEAM for Communities	2009, BRE Global, United Kingdom	Ecological and social sustainability	x	—	—	—	—
CASBEE-City	2011 (in English), JSBC, Japan	Ecological and social sustainability	—	x	—	—	—
CASBEE-UD	2006, JSBC, Japan	Ecological and social sustainability	x	—	—	—	—
CitySim	2009, Technical Research Centre of Finland	Material and energy flows	x	—	—	—	—
EcoBalance	1992, Technical Research Centre of Finland	Eco-efficiency	x	—	—	—	—
Ecocity Evaluator	2010, Eero Paloheimo Ecocity Oy, Finland	Pollution loads and environmental impacts	x	x	x	x	—
EcoProp	1999, Technical Research Centre of Finland	Ecological and social sustainability	x	—	—	—	—
ECOREG	2004, Finnish Environment Institute	Ecological and social sustainability	—	x	—	—	—
EkoPassi	2011, Technical Research Centre of Finland	Eco-efficiency	x	—	—	—	—
Ekotaajama	2011, Technical Research Centre of Finland	Ecological and social sustainability	x	—	—	—	—
ENVIMAT	2009, Finnish Environment Institute	Material and energy flows; pollution loads and environmental impacts	—	x	x	—	—
EU Ecocity	2006, EU	Ecological and social sustainability	x	—	—	—	x
FRES	2008, Finnish Environment Institute	Material and energy flows; pollution loads and environmental impacts	—	x	—	—	—
HEKO	2010, Technical Research Centre of Finland	Eco-efficiency	x	—	—	—	x
KASVENER	1997, Finnish Environment Institute	Material and energy flows; pollution loads and environmental impacts	—	x	—	—	—
KUHILAS	2011, Finnish Environment Institute	Material and energy flows; pollution loads and environmental impacts	—	x	x	x	—
KULE	1990, Technical Research Centre of Finland	Material and energy flows	x	—	—	—	—
KulMaKunta	2006, Technical Research Centre of Finland	Eco-efficiency	x	x	—	—	—
KyläPassi	2011, Technical Research Centre of Finland	Eco-efficiency	x	—	—	—	—
LEED-ND	2010, USGBC, CNU & NRDC, USA	Ecological and social sustainability	x	—	—	—	x
LIPASTO	1996, Technical Research Centre of Finland	Material and energy flows; pollution loads and environmental impacts	—	x	—	—	—
MenTouGou	2010, Technical Research Centre of Finland	Ecological and social sustainability	x	—	—	—	—
Metka	2008, Technical Research Centre of Finland	Eco-efficiency	x	x	—	—	x
NILIM tool	2011, National Institute for Land and Infrastructure Management, Japan	Ecological and social sustainability	x	x	—	—	—
PIMWAG	1997, City of Helsinki, Finland	Eco-efficiency	x	—	—	—	—
PromisE	2006, Technical Research Centre of Finland	Ecological and social sustainability	x	—	—	—	—
Seutukeke	2010, Finnish Environment Institute	Ecological and social sustainability	—	x	—	—	x
Urban zone (UZ)	2008, Finnish Environment Institute	Pollution loads and environmental impacts	x	x	—	—	—
WinEtana	1990, Technical Research Centre of Finland	Material and energy flows	x	—	—	—	—
YKEVAKA	2010, Strafica & Technical Research Centre of Finland	Eco-efficiency	x	x	—	—	x
YKR	1999, Finnish Environment Institute	Material and energy flows	x	x	—	—	—

Note: The "x" symbols are used to show which tools (listed in the first column) fit the criteria introduced in the header of columns 4-8.

and the nature of different urban structures affect not only the energy-efficiency and emissions related to housing and ground transportation, but also the environmental impacts of personal consumption. According to Bithas and Christofakis (2006), the majority of cities are environmentally unsustainable when assessed by the general conditions of environmental sustainability.

Even though urban planning is not able to change everything and while there is still a need for environmental improvements in ground transportation and housing (Winston 2010), the whole picture should be understood when making material- and energy-intensive city development decisions. For example, if only the contribution of ground transportation to the total carbon footprint is taken into account when making greenhouse gas reduction calculations and the bigger picture is missed, we may in fact be harming the environment and the globe's ability to sustain life while actually trying to preserve it. It is also important to consider the perspective of time. The need for greenhouse gas reduction, for instance, is most urgent right now, and the carbon payback time of new energy-efficient buildings is often measured in decades (Säynäjoki et al. 2011). Research has also shown that in many industrial economies, carbon intensity has been continuously decreasing for more than a century but at the same time, overall carbon emissions have grown exponentially (Grubler 1998).

Reducing greenhouse gas emissions is used as a common example of a negative environmental impact here, but the point remains that a focus changing lifestyles and consumption habits could therefore be a more immediate way of affecting a positive change in all areas of environmental sustainability management, and not just carbon reduction. According to Laurent et al. (2012), some products show strong and others a poor correlation between carbon footprint and other environmental impact categories, and resource depletion and toxicity-related impacts in particular cannot be reliably estimated using carbon footprint as an indicator for environmental sustainability. Therefore, further research is needed to investigate the impacts of personal consumption at the regional level on other environmental issues, for example the depletion of renewable and nonrenewable resources, land and water use issues, stratospheric ozone depletion, acidification, aquatic and terrestrial eutrophication, photochemical ozone formation impacting ecosystems and human health, and impacts of toxic substances on aquatic and terrestrial ecosystems as well as on human health.

According to Seadon (2010), "waste is a result of inadequate thinking." Consumption of energy and materials, as a driver of economic growth and consequently as a driver of environmental degradation, could be viewed in a similar way. According to Lorek and Fuchs (2011), the potential for strong sustainable consumption governance depends on a much better societal acceptance of degrowth. Companies naturally affect social dynamics, particularly as they directly impact urban consumption and lifestyle through advertising and the provision of goods and services (Whiteman et al. 2011). Several studies have already indicated that economic degrowth, while increasing, or at least sustaining quality of life, is possible (e.g., Jackson 2009; Spangenberg 2010; Simms et al. 2010). Therefore, companies would also have power to encourage less energy- and material intense service and sharing-based consumption and more sustainable lifestyles.

Conclusions

Efforts to make improvements to the environment through urban planning have concentrated on reducing the environmental impact of housing and traffic. In this study, it has been shown that "the forgotten share," personal consumption, might offer a significant potential for environmental improvement. This could be encouraged through urban planning, and more research is needed to define the actual connections between urban structures, habitation options, sustainable personal consumption, and lifestyle sustainability. Hopefully, understanding factors such as the carbon-intensity of consumption alternatives may help urban planners to design areas that support more sustainable consumption. Nevertheless, the role of sociodemographic parameters, which is indisputably a major one, must not be dismissed. Moreover, it is concluded that the tools currently available for regional environmental assessment do not sufficiently take into account this potential.

Several studies have stated that reducing economic growth while maintaining or increasing quality of life is possible. However, current urban sustainability planning, which focuses almost exclusively on making environmental efficiency gains in the areas of housing and traffic, is not able to address the environmental challenges that arise from personal consumption and the rebound effect. This research advocates that by adopting a stronger focus on the governance of personal consumption and through adopting more diverse methods to encourage sustainable lifestyles, the environmental management of urban areas could be significantly more effective.

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Article

The Power of Urban Planning on Environmental Sustainability: A Focus Group Study in Finland †

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† The research material has been utilised in a preliminary study, and some preliminary results have been presented at CIB International Conference on "Construction in a Changing World", Dambulla, Sri Lanka, 4–7 May 2014.

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Abstract: Sustainable communities are promoted as a desirable policy goal and, in particular, local authorities are encouraged to contribute to climate change mitigation through urban planning. Furthermore, recent research takes a broad perspective on the environmental sustainability of urban areas and considers the environmental impact of all consumption. A focus group study was conducted in Finland for the purpose of examining how increased environmental awareness influences urban land use. The 32 participants of three focus groups were professionals of urban planning and environmental sustainability, at both a municipal and a state level. The main finding was that urban planning is viewed as being unable to support environmental sustainability in the broader sense. In general, the participants did not see a connection between urban structure and sustainable lifestyles and only the influence of planning on housing and daily journeys was recognised. Three main reasons for this were identified. Firstly, environmental sustainability in its broader definition is seen as too complex for urban planners to influence alone. Secondly, the dominance of short-term economic issues in decision-making and the lack of co-operation

from other stakeholders to achieve environmental aims demotivate land use planners. Thirdly, the prioritisation of urban density may overrule alternative means of promoting environmental sustainability, such as the encouragement of sustainable suburban or non-urban lifestyles.

Keywords: environmental sustainability; urban planning; municipalities; focus groups; strategic environmental assessment; decision-making; urban density; sustainable lifestyles

1. Introduction

The very purpose of urban planning is to prepare for the future, or more ambitiously, to create better futures [1]. Over the past century, massive urban population growth has occurred on less than 3% of the global terrestrial surface but the environmental impact has been widespread: 75% of greenhouse gas emissions can be attributed to cities and the ecological footprint of the cities is tens to hundreds of times larger than the actual urban area occupied [2]. Attention has been drawn to the importance of urban planning as a means through which to address the global environmental challenges given rise to by cities, and transforming urban areas into sustainable communities is becoming an increasingly common vision [3,4].

Sustainability schemes, such as the British BREEAM for Communities, the Japanese CASBEE for Urban Development and the American LEED for Neighborhood Development, are already being used for the certification and benchmarking of urban areas. Sustainable communities are promoted as a desirable policy goal and local authorities are encouraged to contribute to, in particular, climate change mitigation through urban planning [3,5]. Nevertheless, there are competing discourses on environmental sustainability and a lack of certainty about what it might mean in practice [3,5,6]. Urban planners often appear to struggle with the issue of how to promote area-specific urban environmental quality through municipal land use planning [7,8].

For the purpose of examining and describing the correlations between urban form and environmental sustainability a wide variety of indicators, such as compactness, centrality, density, porosity, complexity, patch size, land consumption per capita, land-use mix and accessibility, has been developed [9–14]. Recently, Schwarz [12] analysed the urban form of more than two hundred European cities to investigate how many different indicators are actually needed to describe the variety. He applied both landscape metrics and population-related indicators, and concluded that a minimal set for urban form consists of seven indicators that are: the area of the discontinuous urban fabric, edge density, mean patch size, number of patches, compactness index of the largest patch, population number, and population density.

In political discussion, the term urban density is often taken to roughly represent an appropriate combination of the more specific indicators for urban form [15]. An area of high urban density is typically both compact in structure and densely populated. Nevertheless, for land use planners, high urban density tends to be interpreted comparatively and in local use it often refers to the intensive use of available urban space rather than to building urban structures in densities that are considered high on a world scale [16,17]. In the context of urban planning, dwelling density, density of green space,

road density, traffic density, population density and employment density are commonly used specifications of urban density [15].

Many scholars and practitioners hold the view that the prevention of urban sprawl through combining high population density with the compactness of urban structures has an important role in developing environmentally sustainable societies [17–20]. Short distances facilitate walking, cycling, and public transportation, which can reduce the use of motor vehicles. Smaller apartments require less space heating, and dense housing can use waste process heat from industry and power plants. In addition, density enables cost- and eco-efficient centralised sewer systems, waste collection and material recycling. On the other hand however, high urban density is claimed to deteriorate the environmental and spatial quality of the built environment [20,21]. Furthermore, the environmental advantages of compactness may be over-estimated or even be nullified due to the negative environmental impact of consumption that tends to increase with urban densification [16,22–24]. As such, recent Nordic studies, among others, call for a broader view on the environmental sustainability of urban areas whereby the environmental impact of all consumption would be considered [25–27].

State level governing institutions outline decisions about urban form, urban planners shape them and local authorities (councillors on planning committees) approve the decisions [15,17]. Local autonomy in land use planning is high, and the outcome of the successful implementation of environmental policy at a municipal level should be sustainable urban development [17]. Nevertheless, according to Bulkeley [28], there is a gap between rhetoric and action in environmental governance at a city level. The gap stems from issues of institutional capacity and factors of the political economy [28]. Jordan and Lenschow [29] point to a disconnection between policy and practice when it comes to environmental policy integration. A widespread political commitment to environmental sustainability has been recognised at a general discursive level, but agreement around its positive meaning in day-to-day decision-making is sparse [29].

Given that most studies have focused on the technical challenges of urban sustainability, the related political struggles have not yet been widely researched [30,31]. Furthermore, analyses have often been restricted to the local scale and ignored the multilevel political system through which the environmental governance of local economies is conducted [32,33]. The extent to which municipal land use planning can address the challenges of environmental sustainability should thus be examined [3].

The purpose of this focus group study is to examine how professionals in urban planning and environmental sustainability in Finland experience the steering effect of increased environmental awareness on urban land use. The more specific research questions are:

(1) Why is environmental sustainability assessed in urban planning?
(2) How does environmental assessment steer decision-making in urban planning?
(3) What is the role of urban planning and urban planners in environmental sustainability?
(4) How is urban density considered in terms of environmentally sustainable land use?

This paper focuses on urban areas, which can be regarded as the demand and consumption centres of the global economy and thus as the root cause of environmental degradation [34,35]. The term *land use planning* (as opposed to *urban planning)* also incorporates the management of non-urban territory, where the effects of environmental degradation, such as land degradation, biodiversity loss and the disturbance of nitrogen and phosphorus cycles, to name but a few, can be observed. This intrinsic link

between actions in urban areas and environmental consequences in non-urban areas should therefore be recognised.

The paper is structured as follows: Section 2 introduces the research methods and the material used. The results of the analysis are presented in Section 3, and the findings are discussed in Section 4. Finally, Section 5 concludes the paper.

2. Research Design

As the focus of the study was not solely on what people think but on how they articulate, rationalise, challenge each other's views and potentially question their own views, it was opted to conduct research based on in-depth group work. For the purpose of data collection, focus groups were organised to bring together an inclusive set of urban planning professionals and to enable informal interactive discussions. Three focus groups were conducted in the city of Helsinki in April 2013.

2.1. Focus Group Method

The first use of focus groups in an environmental context was by Burgess and Harrison [36], whose analysis identified a need for organisations to match their practices with their environmental rhetoric. Earlier, in the 1920s, focus groups were being used for market research [37] and in the 1950s to assess the public's response to wartime propaganda [38]. The groups are 'focused' in the sense that all interviewees take part in a collective activity and are distinguished from the broader category of group interviews by 'the explicit use of the group interaction' as research data [39]. Morgan [40] defines focus groups as "*a research technique that collects data through group interaction on a topic predetermined by the researcher*". The interaction often takes unexpected turns and may provide researchers with surprising insights and unexpected findings [41].

Given that the interaction in focus groups typically forces the participants to explain the reasoning behind their thinking, the method allows the researcher to observe not only how people theorise their own point of view but also how they do so in relation to other perspectives [39]. Focus groups are particularly useful in studies where the researcher seeks to uncover attitudes, perceptions and beliefs [41]. It is critical, however, to recognise certain problems of group dynamics and to be cautious especially when making claims for empowerment and inclusivity [42,43]. The facilitator has to ensure that all participants have an equal chance to contribute, even if often being unable to uncover all the complex interrelationships within the group. When a participant is asked to explain a view, there is a risk that probes are eliciting merely rationalisations as opposed to the real reasons. To overcome this, provocation and open questions can be used carefully to develop the discourse [43,44].

2.2. Thematic Analysis of Focus Group Data

While focus groups are widely used as a data collection technique, the method has been criticised for the lack of established guidance for data analysis and interpretation [45]. Given the general intention of focus groups, the analysis differs from more traditional survey methods in that less importance is attributed to the use of counts and statistics and a rich investigation of content takes

precedence [45]. In addition, the group can serve as the fundamental unit of analysis, such that single responses are seen as being expressed in a larger social context [46,47].

According to Guest *et al.* [48], thematic analysis is the most useful data analysis technique in capturing the complexities of meaning within a qualitative data set. Put simplistically, thematic analysis moves beyond counting words or phrases and focuses instead on identifying and describing themes. However, previous research has demonstrated that informal and sometimes poorly described forms of thematic analyses are commonplace in many focus group-based studies, whereby the selection of interesting quotes forms the basis of data reduction [45,49].

For the purpose of increasing the specificity and transparency of the data analysis process, Massey [45] suggests that the data derived from the raw material of focus group transcripts falls into three levels, which fit the thematic approach to latent data analysis: *articulated*, *attributional* and *emergent*. *Articulated* data arises in participants' direct responses to the questions that the researcher poses to guide the discussion. In contrast, some hypotheses or research questions may be more successfully addressed without direct questioning [47,50]. The resulting *attributional* data extends beyond the questions posed *in situ*, and is derived instead from the research questions or hypotheses that are brought indirectly into the study, with the expectation that the most critical issues will surface in the conversation. Finally, *emergent* data contributes to new insights and hypothesis formulation and is the unanticipated product of group interaction [45].

According to Massey [45], the analysis of focus group data should neither confuse nor conflate the information that arises from each of the three levels introduced above. A researcher should make the intentions explicit and identify the kind of data that will be most relevant to the purpose of the study.

2.3. Data Collection

The intention of this study was to learn more about the attitudes and opinions of the participants, which is one of the traditional uses of the focus group method [51]. The research objectives necessitated the focus group participants to extensively represent the urban planning professionals in Finland. To ensure an adequate sample and to reduce bias, the focus groups were conducted as part of a workshop that offered the participants additional value; their participation in the study was not the sole grounds for their attendance. The overall theme of the workshop was to introduce and discuss the aims of a research project, launched to develop a new national eco-efficiency evaluation scheme for land-use planning in Finland. The workshop was designed to support the focus group study, and the participants were informed about the research purposes and the applied techniques of data collection.

The group participants consisted of 32 urban planning professionals and related specialists from fourteen Finnish cities, the Finnish environment ministry, two architectural firms, four consulting companies, one of Finland's largest energy companies, a market leading construction company, the Green Building Council Finland and the Finnish Association of Building Owners and Construction Clients (RAKLI). Participants were divided into three separate focus groups, detailed in Table 1, each of which was moderated by a researcher. A limit of 12 participants was placed on group size in order to provide all participants with a chance to contribute.

Table 1. The organisations represented by the participants of each focus group.

	Focus Group 1		Focus Group 2		Focus Group 3
1	The city of Helsinki	1	The city of Espoo	1	The city of Vantaa
2	The city of Tampere	2	The city of Tampere	2	The city of Tampere
3	The city of Joensuu	3	The city of Lohja	3	The city of Lohja
4	The city of Lappeenranta	4	The city of Kokkola	4	The city of Kotka
5	The city of Pori	5	The city of Kouvola	5	The city of Lahti
6	Construction company #1	6	The city of Kuopio	6	The city of Mikkeli
7	Energy company #1	7	The city of Lappeenranta	7	Ministry of the Environment
8	Green Building Council Finland	8	Green Building Council Finland	8	RAKLI
9	Consulting company #1	9	Architectural firm #1	9	Architectural firm #2
10	Consulting company #2	10	Consulting company #3	10	Consulting company #2
		11	Consulting company #4	11	Consulting company #4

Each listing represents an individual participant.

To standardise the leadership of the discourse, the three moderators followed the same specific procedures, which were printed and distributed to the moderators only. The instructions for the probes and prompts were designed on the one hand to reflect the purpose of the study and on the other hand to allow for different group dynamics. In addition, an oral presentation with visual elements was developed to guide the group discussions.

The presentation, given to all participants as a single group, prior to the commencement of the individual group sessions, provided background information on the study and posed a series of direct questions that discussions were to focus on:

(1) *Why is environmental sustainability assessed in urban planning?*
(2) *How does environmental assessment steer decision-making in urban planning?*
(3) *What is the role of urban planning in environmental sustainability?*

Perhaps even more important were the more specific questions that were not directly posed:

(4) *How is the power of urban planners to promote environmental sustainability limited?*
(5) *How is urban density considered in terms of environmentally sustainable land use?*

As mentioned above, some research questions may be more successfully addressed by means other than direct questioning. Questions (4) and (5) were considered too leading to be asked directly. Instead, it was hypothesised that these issues would emerge in the conversations, inspired by the direct questions that were purposefully couched in more general terms. The intention here was to allow the participants to approach the subjects voluntarily, perhaps from an unexpected perspective, and to collect *attributional* data.

As is typical of focus groups, even though they were conducted according to the same guidelines [39–41,43], each conversation had its own dynamic and direction. The moderators' role was to enhance interaction and to ensure that all participants had an equal chance to contribute. Within these limits, much of the discussion was left to the participants in order to learn what they found interesting and important. Nevertheless, occasionally the moderators attempted to develop the discourses by encouraging the participants to explain their views, or even through discreet provocation. The group discussions, each approximately an hour in length, were audio-recorded and manually

transcribed and also video-recorded. In parallel with the recordings, the moderators made notes concerning mainly the atmosphere, the interaction and the participants' reactions.

2.4. Data Analysis

A thematic analysis was conducted on the data that emerged from the focus groups: the video and audio recordings of the three discussions, the transcripts and the notes made by the three moderators. The data was interpreted at two of the three levels Massey [45] suggests: *articulated* and *attributional*. No *emergent* data was identified.

As the first data display, a set of codes was developed to represent the identified themes and was manually applied to the transcripts (raw data) as summary markers for later analysis. Two of the focus group discussions consisted of a similar amount of exchanges between participants: one had 64 individual spoken lines and the other had 68. The third one was far more discursive and 120 spoken lines were noted. Given that interaction was considered to be an important element of the data, rather than dividing the raw data into transcripts of individual lines, the codes were applied to transcripts of a full discursive exchange. Each of the five questions listed above was allocated its own code, and any chunk of text that was even slightly related to one of the questions was marked with the respective code. It was often the case that the same piece of data was demarcated with multiple codes. Any transcribed lines which did not contribute to any of the six questions were set aside. This formed the main method of data reduction.

As the second data display, relevant parts of the data were manually grouped by each theme's code and a secondary, more specific categorisation was conducted within each question's data set. Here, more explicit citations were extracted from the larger, catalogued chunks of text. The citations that required sub-coding were itemised in tables. The citations were generally a sequence of words revealing one or several distinct messages, either from a single contributor or from a piece of interaction within the group. A citation could be made up of a phrase, a part of a phrase or several consecutive phrases. The video recordings, audio recordings and moderators' notes were also evaluated for the purpose of understanding the overall context of the data and for appreciating the nuances. The second data display was manually re-arranged into the third, the third into the fourth and so on. Open coding was used to sort and to re-sort the data. The sequence of the data displays aligns with the incremental condensation of the data to the point that conclusions could be drawn.

Massey's [45] distinction between *articulated* data and *attributional* data informed the means by which the analysis was conducted. *Articulated* data is said to be directly linked to specific questions, posed prior to the study, whereas *attributional* data spontaneously arises from its assignment to meaning, based on the interpretation of its relevance for issues of interest. In this study, questions 1–3 are *articulated*, whereas questions 4–5 are *attributional*, and arose only following the initial analysis of the data. Both data types can provide insights into the participants' thinking but *attributional* data cannot be considered to be a direct answer to a direct question. On the other hand, *attributional* data gains relevance and value in particular based on the attribution. The analysis and the presentation of the results were structured in a way that respects the data type and the insights that were established from the group interaction.

3. Findings

Many Finnish cities are seen to have ambitious greenhouse gas (GHG) reduction targets and it appears that urban planners have an essentially unlimited mandate to devise sustainable solutions. Nevertheless, it was ascertained from the discussions that short-term economic interests have a tendency to dominate decision-making. This, in combination with the complexity of the environmental issues faced and a perceived lack of co-operation between necessary stakeholders in environmental matters, has left environmentally oriented urban planners somewhat dispirited. However, it seems that the power of urban planners is further restricted by their own beliefs. It was persistently stated in all of the groups that there are limits to what can be affected through land use planning, and participants appeared more eager to state the limitations of their power than to discuss how their work could tangibly contribute towards environmental sustainability. Surprisingly, participants did not identify a connection between urban structure and sustainable lifestyles outside of the realms of housing and daily journeys. Furthermore, it was found that urban density is considered by the participants to be an imperative characteristic of urban structures if they are to promote environmental sustainability. The findings are presented in more detail in the sub-sections below and finally summarised in Table 3 at the end of the section.

3.1. Assessment of Environmental Sustainability in Urban Planning

Given that the first research question—"*Why is environmental sustainability assessed in urban planning*?"—was posed directly to the participants, the findings here are based on *articulated* data.

In some cities urban planning has rather ambitious greenhouse gas reduction targets, for example:

> "*Our climate strategy is very ambitious*." (Group 1)
> "*The ambition to build carbon-neutral districts has a strong position in the city strategy*." (Group 1)
> "*We have joined the network of carbon-neutral municipalities, and even our decision-makers are aware of the greenhouse gas reduction targets*." (Group 2)
> "*Our aims of eco-efficiency are included in the city strategy, in the mayor's program and in the climate programs, and the target is to make more eco-efficient land-use plans*." (Group 3)

However, in some others, environmental issues are still not considered to be a high priority, for example:

> "*There are not necessarily any greenhouse gas reduction targets, nor a climate strategy. It is easily vague the way that anything can be proved to be sustainable by suited defaults or weights*." (Group 3)
> "*In my opinion, all issues other than environmental sustainability have been promoted more rapidly in decision-making. In some cities environmental sustainability is a political priority but in some others it depends very much on the officers on duty. We have had strategies and targets but nobody has ever been responsible for implementing them. It depends on who is involved and interested*." (Group 3)

Even if consultant companies provide a selection of environmental assessment schemes, in some cities environmental sustainability is not assessed. Instead, planning is based on common knowledge (or beliefs), for example:

> "*Practically, nothing is assessed. Quite a lot has been done on gut feeling, without better knowledge."* (Group 2)
> "*Common knowledge, what we have had of land use planning. If we had knowledge based on research, we could—people talk about these things so much nowadays."* (Group 2)
> "*We tried. One student of environmental engineering prepared an assessment tool as a part of his thesis. We tested it but it leads to irrational results."* (Group 2)
> "*We were close to buying into one of the Finnish commercial evaluation schemes. A variety of tools exists."* (Group 2)

The participants repeatedly expressed three reasons why environmental sustainability is or should be assessed in urban planning: (1) to increase the environmental knowledge of the people involved in the planning and decision-making process; (2) to prove that certain alternatives are environmentally more sustainable than others; and (3) to enable or to promote or not to prevent environmental sustainability. All the three reasons were seen both to have their own justification and to enable more specific improvements. The more detailed reasoning and the contribution of each group is presented in Table 2.

Table 2. The detailed reasons for assessing environmental sustainability in urban planning.

(1) To increase the environmental knowledge of the people involved in the planning and decision-making process, in more detail:	**Which focus groups identified the detailed reason:**		
To understand environmental consequences	Group 1	-	Group 3
To label environmentally sustainable urban structures	-	Group 2	Group 3
To gain broader understanding (of greenhouse gas emissions)	Group 1	-	-
To examine the environmental benefits of high urban density	Group 1	-	-
(2) To prove that certain alternatives are environmentally more sustainable than others, in more detail:	**Which focus groups identified the detailed reason:**		
To justify higher urban density	Group 1	-	Group 3
To find differences	Group 1	Group 2	-
To enable benchmarking	Group 1	Group 2	-
For marketing purposes	Group 1	Group 2	-
To facilitate negotiations with stakeholders	-	Group 2	-
(3) To enable or to promote or not to prevent environmental sustainability, in more detail:	**Which focus groups identified the detailed reason:**		
To enable or to promote environmental sustainability	Group 1	Group 2	Group 3
Not to prevent environmental sustainability	Group 1	-	-
To reduce greenhouse gas emissions	Group 1	-	Group 3

When the groups were asked what in particular should be assessed, the GHG emissions of traffic and housing (the energy use of buildings, in particular) strongly dominated the discussions. In addition, when asked to name sources of GHG emissions, building infrastructure was mentioned once and energy production several times.

3.2. The Steering Effect of Environmental Assessment to Decision-Making

The second research question—"*How does environmental assessment steer decision-making in urban planning?*"—was directly posed and thus all the related results are based on *articulated* data.

No real disagreements were observed during the discussions about decision-making. Even if participants did not always totally agree, the tendency during the discussion was to add new viewpoints and perspectives rather than to prove someone else wrong. The interviewees did not seem to hold back and quite openly discussed the problems they experienced in their work, as if among colleagues.

The participants repeatedly expressed that short-term economic interests dominate municipal decision-making, for example:

> *"Climate change has been a minor factor in decision-making."* (Group 1)
> *"It is euros that drive it. The municipal economy dominates. Unfortunately very few people think about the bigger picture, even in an economic sense." "Yes, that is the traditional way to make decisions in municipalities."* (Group 2)
> *"It is obvious what the decision-makers think of when eco-efficiency and cost-efficiency are against each other." "What do they think of? Let us know." "Of costs."* (Group 1)
> *"If municipalities were involved in carbon trading, low-carbon land use plans would most probably proceed at a good pace."* (Group 2)
> *"Win-win solutions [both environmental and monetary benefits] work well."* (Group 3)
> *"In my opinion, the politicians spend all their time on economic considerations. They do not have time for environmental issues."* (Group 3)

Furthermore, environmental issues were found complex in general and very complex to quantify, which was seen to deteriorate their position in decision-making, for example:

> *"Environmental issues are too complicated for an ordinary person who still has to deal with them. Contradictory information makes the challenge unbearable."* (Group 1)
> *"The message should be simple enough that the decision-makers could understand it."* (Group 2)
>
> *"It would be easier for the decision-makers to make good decisions if we could prove our arguments."* (Group 3)
> *"For decision-making, it must be proven that something is more environmentally sustainable than something else."* (Group 1)
> *"We do not have metrics for measuring eco-efficiency."* (Group 3)
> *"Environmental sustainability is a relatively new aspect in decision-making, and the environmental considerations do not have a common unit, which would be as easy to understand as euros in an economic framework."* (Group 1)
> *"Municipalities set some (greenhouse gas emission reduction) targets and then afterwards try to figure out, with the help of consultants, if they are being achieved, and if not, which actions should be taken. Currently we don't really have tools in place that could advise land use planners to mitigate the climate change."* (Group 2)

"It is still unclear when and how the improvements should be done to truly have an effect." (Group 1)
"Both urban planners and decision-makers need better knowledge." (Group 1)
"We need better knowledge to prove things—to justify our suggestions." (Group 2)

However, one of the groups also itemised how the dominance of short-term economic interests in decision-making can be challenged: Firstly, environmental considerations have to be presented as numbers. If strong evidence, based on reliable measurements, calculations and benchmarking, is presented as simply as possible, it has a chance to be taken into account. Strong volition, determination and activity also aid progress and increased environmental knowledge within the decision-makers was seen as being an important factor. Secondly, in order to resonate, the environmental aims should support or to be included in the city strategies and political agendas, and not conflict with them. Sometimes the environmental work should be initiated from strategy level as opposed to being initiated from actual land use planning tasks themselves. Thirdly, a widely recognised and respected environmental assessment brand that carries a strong image from a marketing perspective can facilitate environmentally oriented decision-making. The British BREEAM was mentioned as a good example, and positive experiences were seen to have a key role.

The participants stated for example:

"Decision-makers understand numbers. As long as we lean on qualitative reasoning, economic considerations dominate the environmental ones." (Group 3)
"One must be like a horn to bring those (environmental) issues forth—to create an atmosphere that this is important." (Group 3)
"If our solutions fit the definitions of policy, the chances are better that they will be accepted." (Group 3)
"It can be a self-reinforcing process. Increased understanding and obvious results make it easier and it can affect the strategy. The new strategy can then facilitate further improvements." (Group 3)
"A good example of obvious results in one city helps the progress in the others." (Group 3)

3.3. The Role of Urban Planning and Urban Planners in Environmental Sustainability

Only part of the third research question—*What is the role of urban planning in environmental sustainability?*—was revealed to the focus groups, relying on *articulated* data. The other half of the question—*What is the role of the planners, or more specifically, how is their power to promote environmental sustainability limited?*—was discussed spontaneously, as expected, encouraged by the moderators, thus providing *attributional* data.

According to the *articulated* data, in the context of current Finnish urban planning, improved environmental sustainability mainly refers to climate change mitigation. Other environmental issues were rarely mentioned in the discussions. Even if the participants often used the terms "eco-efficiency" and "environmental sustainability" they typically considered solely greenhouse gas emissions. Furthermore, it was dominantly stated in all the groups, still in an *articulated* sense, that only certain things can be affected through land use planning. Similarly to when the groups were asked what should

be assessed (question 1), the GHG emissions of traffic and the heating energy use in buildings dominated the discussions about the role of land use planning in environmental sustainability. In addition, it was highlighted that land use planning can only enable, not force environmental improvements.

Based on the *attributional* data that emerged from the focus groups, all of the land use planners from different cities and municipalities shared an ambition to design environmentally sustainable urban environments. It is often the land use planners who conduct or subcontract the environmental assessment of urban developments. However, the participants were more eager to name what they do not have power to influence than how their work could tangibly contribute to environmental sustainability. Private driving outside of cities and in particular personal consumption and leisure related choices were seen as impossible to affect. It appears that the power of urban planners to promote environmental issues can be limited not only by formal restrictions or other people but also by their own beliefs. The participants expressed rather contradictory views and opinions about the power of land use planning.

On the one hand urban planners can suggest almost anything, for example:

> *"We must remember that a land use planner can ordain just anything. Land use planning truly has the means to make a difference."* (Group 2)
> *"Basically we create the options but do not make the decision between them. The decision-makers very rarely add anything to the plans but they may well not let something through."* (Group 3)

On the other hand, the lack of co-operation and joint environmental aims restrains their mandate in the environmental management of urban areas, for example:

> *"Land use planners do not make all the decisions. We arrange the traffic but do not choose the fuel for the combined heat and power production."* (Group 1)
> *"We can impact urban structure but not of how private companies and municipal decision-making support our solutions. The planned bus routes may not materialise and the schools may be disbanded."* (Group 2)
> *"Even decision-making does not always lead to operation. We wait for something to happen but everything happens so very slowly."* (Group 3)

Contradictory views and opinions about the power of urban planning concerned for the most part energy production, the location of schools and kindergartens, public transportation routes and the location of supermarkets. For example:

> *"The route selection of bus companies cannot be affected in any way, nor can the network of schools and kindergartens. Reservations can be put into the land use plans, but different logic applies to how they are closed down." "I think it is true, but the need to travel and the means of transportation, that we do have power on. I would not be as pessimistic considering the routes of public transport either—cities and municipalities do have the possibility to get involved in developing those services." "Yes, if they want to." "And the locations of markets and schools and kindergartens are defined in particular by land use planning." "But we cannot affect the thing that they may be closed down."* (Group 2)

Rather surprisingly, the participants did not see a connection between urban structure and lifestyles or consumption choices, with the exception only of housing and daily journeys. For example:

> *"Could you name something important that you would like to affect through land use planning?" "People's lifestyles, but it is not an easy thing." "Yeah, people's behaviour cannot be affected in any way."* (Group 2)
> *"We cannot affect people's lifestyles."* (Group 3)
> *"People's leisure time is an impossible field—something we cannot affect."* (Group 2)

Only once one of the participants touched upon the land use planner's power to influence personal consumption:

> *"Then I started to think about electric cars. Their batteries work better if the cars are not left outdoors in freezing temperatures. Should we include in land use plans orders to build heated garages underneath the apartment houses or something similar—it would be a way to affect."* (Group 2)

In addition, the issue of affecting people's behaviour was once discussed as a joke:

> *"If travelling is bad, how about a community that we would build huge pentagons everywhere, where shopping malls, apartments and working places would be located all inside the same walls and there would be a public recreational area in the centre of the building? Blocks like that." "You are not allowed to leave." "You need a special permission to leave." "In some eastern countries there are those huge houses." "A closed ecosystem." "Effectively limits travelling."* (Group 2)

3.4. Urban Density

Care was taken to ensure that the fourth research question—*"How is urban density considered in terms of environmentally sustainable land use?"*—was not articulated at all, for the purpose of allowing the issue to bubble up in unexpected contexts. Therefore, the findings here are based on solely *attributional* data.

It was found that density is considered to be an imperative characteristic of sustainable urban structures. Promoting higher urban density is seen to be the most straightforward means of land use planning for environmental improvements. The participants generally found increased environmental knowledge useful for examining the environmental benefits of high urban density. Their desire for environmental assessment was mainly to be able to justify higher urban density. However, the effectiveness of compacting urban populations was also questioned in two of the three focus groups.

In each group, urban density was spontaneously named as a hot topic in land use planning:

> *"These questions of higher urban density are surely topical in every city, in one way and another." (Group 1)*
> *"The important thing is the land use efficiency: the difference between higher density through complementary construction and sprawl through new housing areas. Land use planning has an important stand there." (Group 2)*

"The basis for higher urban density is the same everywhere: to grow inwards, if it is the right thing to do." (Group 3)

In each group, high urban density was viewed as a key issue in the environmental sustainability of urban structure, and evidently the dominant belief was that it has a strong positive impact to environmental sustainability:

"We have a problem in that if we compress the city structure it almost always means that some green areas that are important for some people will be touched. It is inevitable. We are accused all the time of stealing green areas under the guise of climate change mitigation. To defend our proposals we should be able to measure total environmental sustainability, I think. We might for example have a low-carbon solution that is not disastrous for the local eco-system services either." (Group 1)

"Because cities grow anyway, if we plan denser urban structure the environmental benefit is the prevention of urban sprawl. We assume it to be extremely effective climate change mitigation." (Group 1)

"*I believe that there are multiple reasons why complementary construction is very ecological, perhaps even more ecological than we currently think."* (Group 1)

"Because we have to let people build detached houses, density is very low in new residential areas and respectively the estimate of environmental sustainability is very bad." (Group 1)

"It is important to bring the message to the decision-making process that complementary construction is far more environmentally sustainable because it might be an alternative to a new residential area. We show that because density is low in new residential areas they cannot be environmentally sustainable." "Exactly, that urban density is a key issue." (Group 1)

"The question is, how to make people willing to live densely, close to each other." (Group 2)

"*The more rural the municipality, the more difficult it is for the land use planners to reason higher density. We need to be able to show people that it is important environmentally."* (Group 3)

"Even if higher urban density is a priority it is not being realised properly. We need to be able to show the negative environmental impact of urban sprawl." (Group 3)

"The old wooden cities are relatively dense and thus environmentally sustainable per se*."* (Group 3)

Nevertheless, the positive impact of high urban density to the environmental sustainability of urban structure was also questioned in two of the groups:

"[…]—if higher urban density really improves environmental sustainability." (Group 1)

"There are contradictory results concerning whether density is ideal." (Group 1)

"At which point is urban density taken too far to the point that it deteriorates the local ecosystem services? Could it be that in some cases less radical density might be better environmentally?" (Group 3)

> *"There should be a comparison of whether it's better to grow inwards or outwards in each case. In those cities where there is still land available and thus other alternatives to growing inwards, the other alternatives should be considered."* (Group 3)

3.5. Summary

The main findings are summarised in Table 3.

Table 3. Summary of the main findings.

Research question	Data type	Main findings
(1) Why is environmental sustainability assessed in urban planning?	Articulated	In many Finnish cities urban planning has rather ambitious greenhouse gas reduction targets. However, environmental sustainability is not always assessed. Environmental sustainability is, or should be, assessed for three main reasons: (1) to increase the environmental knowledge of the people involved in the planning and decision-making process; (2) to prove that certain alternatives are environmentally more sustainable than others; and (3) to enable or to promote or not to prevent environmental sustainability.
(2) How does environmental assessment steer decision-making in urban planning?	Articulated	Short-term economic interests dominate municipal decision-making. Environmental issues are complex in general and very complex to quantify, which deteriorates their position in decision-making. The domination of short-term economic interest in decision-making can also be challenged. First, the environmental considerations have to be presented as numbers. Second, the environmental aims should support or to be included in the city strategies and political agendas, not to conflict with them.
(3) What is the role of urban planning and urban planners in environmental sustainability?	Articulated	In the context of current Finnish urban planning, improved environmental sustainability mainly refers to climate change mitigation, more specifically to the greenhouse gas (GHG) emissions of traffic and housing (the energy use of buildings, in particular). It was highlighted that land use planning can only enable, not force environmental improvements.
	Attributional	The land use planners from different cities and municipalities share the ambition to design environmentally sustainable urban environments. On the one hand, urban planners can suggest almost anything. On the other hand, the lack of co-operation and joint environmental aims restrains their mandate. The power of urban planners to promote environmental issues can also be limited by their own beliefs. The participants did not see a connection between urban structure and lifestyles or consumption choices, apart from housing and daily journeys.

Table 3. *Cont.*

Research question	Data type	Main findings
(4) How is urban density considered in terms of environmentally sustainable land use?	Attributional	Urban density is a hot topic in land use planning. High urban density is seen to be a key issue in the environmental sustainability of urban areas. The dominant belief is that densification has a strong positive impact on environmental sustainability. Increased environmental knowledge is seen to be useful, for examining the environmental benefits of high urban density and for justifying higher urban density, amongst other things.

4. Discussion

A focus group study was conducted in Finland to examine how the professionals of urban planning and environmental sustainability, at both a municipal and a state level, experience the steering effect of increased environmental awareness on land use. According to Nielsen and Jensen [52], local authorities are in a unique position to steer society development and to promote sustainability. Nevertheless, the main finding of this study is that the participants see urban planning as being unable to support sustainable lifestyles in the wider meaning. The power of urban planning to impact environmental sustainability appears to be underestimated in that greenhouse gas emissions of housing and daily journeys are the dominant elements of environmental sustainability that are taken into consideration. The analysis identified three main reasons for this underestimation: (1) The relationship between land use planning and inherently immeasurable environmental sustainability appears to be too complex in the sense that urban planners cannot identify the means or to quantify the benefits of supporting more sustainable lifestyles; (2) The dominance of short-term economic issues in decision-making as well as a lack of co-operation with other planning stakeholders and the absence of joint environmental objectives demotivates land use planners; (3) The prioritisation of urban density may overrule alternative means of promoting environmental sustainability, such as the encouragement of sustainable suburban or non-urban lifestyles.

The first and the second constraints appear to strengthen one another: Due to the complexity of environmental issues, the enthusiasm to get involved is scarce and instead simple short-term economic considerations rule decision-making, especially in smaller cities where resources are very limited. The urban planners carry the burden of proving numerically that their proposals are environmentally sustainable and of creating an atmosphere in which the issue of environmental sustainability carries weight. This burden is too much for them to handle alone. The results of this study indicate that there is a communication gap between the scientific community and the local urban land use professionals. It seems that scientific knowledge about sustainability is not fully applied to support local planning and decision-making. Scientific results could potentially facilitate what the participants of the focus groups called for: to be able to prove their arguments, and to support sustainability's position in decision-making.

The third constraint—that urban density is considered to be the quintessential factor of sustainable urban planning—actually responds to the problems occurring from the first and the second constraints by (a) enormously simplifying the connection between urban planning and environmental sustainability and (b) providing potential win-win solutions with both environmental benefits and

monetary savings for the municipality. The connection between urban planning and environmental sustainability could not be simpler or any easier to quantify than that "the higher the density, the more sustainable the development". In addition, if people are packed into dense urban areas, for example municipalities' costs for school transportation for children and taxi and ambulance services for senior citizens can be significantly reduced. Also the price of urban land may increase.

However, despite all its benefits, the belief that higher urban density is more sustainable eventually undermines the power of land use planning to impact environmental sustainability. Cities are increasingly regarded as the demand and consumption centres of the global economy and many scholars propose a consumption-based approach for the environmental analysis of urban areas [34,35,53,54]. Recent research in Finland has suggested that, due to higher overall consumption volumes, lifestyles in dense urban areas may in fact be more carbon intense than more dispersed suburban living and that rural lifestyles could possibly be less carbon intense than urban lifestyles, despite higher levels of private driving [22–24]. It was clearly stated in all of the focus groups that there are limitations to what can be impacted, in terms of environmental sustainability, through urban planning, and in particular personal consumption and leisure related choices were seen as impossible to affect. Urban planners would like to support sustainable lifestyles but it is evidently difficult in the consumption centres they create.

Even if municipalities are actively engaged in developing organizational capacity in sustainability, they have a relatively low level of financial and managerial capacity in this regard and tend to rely more on internal strategies and a top-down approach of acquiring technical expertise from professionals [55]. A case study by Book *et al.* [56] shows that the state remains a crucial actor in sustainability governance. The local authorities' duty is to interpret national density policies, should they exist, at the municipal and neighbourhood scales with an understanding of the local context [15]. In Finland, high urban density is included in most political agendas of urban regeneration nationwide and is the core of national land use guidelines for environmentally sustainable societies.

To some extent the findings and the inferences are supported by previous research. The focus groups found environmental issues to be complex in general and very challenging to quantify, which is seen to deteriorate their position in decision-making. According to Jordan and Lenschow [29], the state of the environment—both at the moment and in the long run—is a highly complex matter, affected by a multitude of factors. Furthermore, a multiple case study on the experiences of sustainability processes in Swedish municipalities by Keskitalo and Liljenfeldt [57] shows that the complexity of sustainability issues may make it difficult to cover the intended scope of local sustainability processes and may discourage people from working on them.

An additional finding was that the lack of co-operation between stakeholders in urban planning processes and an absence of joint environmental objectives restrain the mandate of urban planners to promote sustainability. Nielsen and Jensen [52] argue that decision makers can either promote or hinder the transition to sustainability at both a municipal and a state level. The focus group results also indicated that short-term economic interests dominate municipal decision-making. According to Theurillat and Crevoisier [58], there is a clear dissociation in time between the qualitative aspects that are crucial for environmental sustainability and the quantitative aspects of economics that are considered at the very end of the process, by which time everything has been defined from a qualitative point of view. Book *et al*. [56] summarise that it is difficult enough to find a solution either

to economic competitiveness or to environmental sustainability, and finding a common solution or balance between the two is even more daunting.

According to Bulkeley and Betsill [3], tackling environmental problems at a municipal level is important for multiple reasons. One is that cities are sites of concentrated high consumption and waste production. Another is that local authorities are both willing and able to take on board the complex agenda of sustainable development. The main concern rising from the results of this study is indeed, if the land use planners do not see a connection between urban structure and lifestyles related consumption patterns, how are they able to limit the urban trend of high consumption and production of waste?

The study includes multiple uncertainties concerning all the three phases of the research process: data collection, data analysis, and the inference leading to conclusions. Firstly, focus groups were used as the only source of data collection, and only three homogenous groups were arranged. The choice was based on Massey's [45] idea that, "while surveys typically address the degree to which certain standards have been met across the community, focus groups may provide clues as to what the standards are". This study does not claim to have statistical validity, but rather to have provoked important interactive discussion and reported the findings respectively.

An additional consideration is that focus-group based research is never a direct and straightforward process of generating data, conducting the analysis and interpreting the results. Instead, the manner in which focus groups are used defines what can be known and how things are known [41]. Data collection and analysis was a careful and thorough process, which especially attempted to distinguish the *attributional* data (and the research themes that were only partially revealed) from *articulated* data (and firmly grounded research themes), as Massey [45] suggests.

Thirdly, the focus group method gives emphasis to the power of articulation and may thus favour the participants who perform well in articulating their opinions while those less articulate will less readily share or communicate their opinions [59]. Even if the moderators were advised to encourage the more introverted members of the groups, not everyone had equal input into the research data. However, this issue was well understood and any finding that was reported was required to be supported by both the textual data sets and by the general understanding the researchers had gained from their participation in the focus group meetings and from secondary viewings of the video recordings. Although in the results section brief, disconnected citations are used to illustrate the most interesting content of the group discussions, during analysis phase the whole data set was interpreted in the wider context of the discussion.

It would have been interesting to analyse the focus group data with respect to the varying backgrounds of the participants and thus to examine the differences in conception among different professionals. However, the data set appeared not to be adequate for such analysis. Given that both *articulated* and *attributional* data were collected, the group discussions were purposefully rather unstructured and different professionals did not necessarily express their views even-handedly. Furthermore, the samples of different professions were so small that other more personal qualities and characteristics, as opposed to factors relating to professional background, might have been the dominant influencing factor in their conceptions. Therefore, although the participants of the study appeared to adequately represent the professionals of urban planning and environmental sustainability as a whole, the number of participants of each specific profession was insufficient to represent a valid sample.

Fourth, the interpreted results from the focus group meetings were not verified with the participants. According to Morse *et al.* [60], several methodologists have warned against member checks, seeing them more as a threat to validity. Given that the results are typically synthesized, decontextualized and abstracted, individual participants are actually unlikely able to recognise their particular experiences and thus unable to judge the analysis to be correct or not. In the worst case, member checks may force the researcher to keep the level of analysis inappropriately close to the data [60]. Finally, the inference leading to conclusions cannot be justified by anything else than the logic of thinking that is based on proper understanding of the larger context of the themes and on familiarisation of the relevant literature, which is described in detail above to allow critical review.

5. Conclusions

This study suggests that land use planners are not by themselves able to deploy the full potential power of urban planning to impact environmental sustainability. Attempts to reduce private driving and the heating energy use in buildings through higher urban density may lead to situations where the alternative patterns of land use are ruled out—patterns that could potentially support sustainable lifestyles and reduce the overall environmental burden of all consumption. Purposeful co-operation, ambitious and jointly-held environmental objectives, critique on prioritising short-term economic considerations over long-term environmental concerns and better quantification of environmental sustainability through consumption-based approach to the environmental evaluation of land use are all needed to create better futures in the form of sustainable communities.

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Author Contributions

Eeva-Sofia Säynäjoki is responsible for initiating, executing and writing the paper. Jukka Heinonen and Seppo Junnila provided comments and suggestions on the paper.

Conflicts of Interest

The authors declare no conflict of interest.

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The immeasurably valuable ecosystems of the Earth are under threat. Both the source of and the potential solution to the global ecological decline can be traced to urban areas, where population and consumption concentrate to become the demand centres of the global economy. This dissertation casts a critical eye on the success of current urban planning policies in creating environmentally sustainable communities. Urban planning is generally intended to support sustainable lifestyles, but the targeted environmental improvements are limited to ground transportation and housing. The simultaneous creation of increasingly convenient and concentrated centres of consumption produces contrasting effects, and current strategies of urban regeneration carry a risk of actually increasing the environmental burden through the effects of increased consumption. A broader perspective on urban environmental sustainability is required in order to provide greater success in the promotion of sustainable development through urban planning.

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