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Are lessons from eco-towns helping planners make more effective progress in transforming cities into sustainable urban systems: a literature review (part 2 of 2)

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ABSTRACT

Eco-town developments have been the testing grounds to improve upon the urban policies and practices in the Northern and Western European countries since the early 1990s. It has been widely discussed as to whether or how they have helped transitioning of towns and cities into more sustainable systems in the larger urban context through educational, experiential, societal diffusion and changes in governance processes. The countries in different cultural and geographical contexts with rapid urbanization rates, seek to establish similar developments with relatively less knowledge of the contextual and procedural differences in the eco-towns' processes or the reasons for their varying levels of impact. This article was prepared to summarize and systematize the insights that have been obtained from 'eco-town' based urban developments implemented in the Northwestern Europe with particular emphasis given into the examples from The Netherlands, Sweden and Germany. The review of the relevant literature was conducted with the focus on: *a.* the context in which the demonstration eco-towns were developed since the emergence of planned communities in the early 20th century, *b.* the typologies, processes and frameworks through which the eco-towns were initiated, built, governed and evolved. The authors analyzed the wide diversity of frameworks and processes that have played roles in the relative successes and/or failures. The review provided insights into their procedures and the aspects associated with the diffusion of the lessons into the broader urban planning and development methods. The findings suggested that the political commitment, timing, financial aspects, physical qualities, stakeholder involvement and environmental planning were key elements in achieving the eco-towns' goals. Future research is recommended to critically analyze the impacts of these historically new urban development models and frameworks in order to create more effective approaches for achieving positive outcomes for all societies within ecological boundaries.

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1. Introduction

Urbanization and urban development in the 20th century were driven by economic growth policies based on resource-intensive processes that caused rapid degradation of our eco-systems and are decreasing human well-being for many inhabitants. It is estimated that cities contribute 40–70% of the annual greenhouse gas (GHG) emissions attributed to anthropogenic sources while they consume about 75% of the total energy (Boone and Ganeshan, 2012,

p.14). It is further estimated that the buildings account for 40% of the overall global energy consumption, which in turn release about 30% of all energy-related GHG emissions (UNEP, 2014, p.9). This and many other urban processes cause extensive air, water and solid waste pollution problems in the rapidly developing urban regions in emerging economies (UN-Habitat, 2011).

In an effort to address these social and environmental implications caused by unsustainable urban growth policies, alternative design and development models emerged as grassroots movements in the early 1960s. These included co-housing projects and intentional communities (Sanguinetti, 2014; Lietaert, 2010), which also contributed to the emergence of the eco-villages and eco-communities during the course of next three decades in the Northwestern Europe, the United States and subsequently around

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the world. While some of these developments were initiated with social ambitions, such as social interaction, cooperation, participatory design and governance (or for better quality of life) (Kirby, 2003; Van Schyndel-Kasper, 2008), others did so for environmental stewardship (Miller and Bentley, 2012) or resource efficiency as their main drivers (Baas et al., 2014, p.27). These community-led initiatives, despite their wide recognition for socially and ecologically sustainable design principles somewhat failed to make significant impacts/contributions to the mainstream design and urban planning paradigms. Together with the release of the Brundtland Commission's 1987 Report, more concerted efforts began in order to address sustainability and the concept of sustainable development (SD) although there remained contested views in terms of the limitations of their definitions.

Subsequently, the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit in Rio held in 1992, emphasized all dimensions with regards to sustainable urban growth and addressed issues pertaining not only to the ecological aspects but it also covered social and societal aspects to more thoroughly attain sustainability (Seyfang, 2003, p.224). The most significant document released from the Earth Summit was the Agenda 21 (UNCED, 1993), which has been used as the foundation for many Local Agenda 21 (LA21) urban development activities around the world. Such activities were also the foundations for the "Eco-towns" that were planned and implemented to fulfill multiple roles, among which they were designed to serve as catalysts for the broader society to make changes toward more sustainable town and city development and transformation processes.

Some countries in Europe, including but not limited to The Netherlands (de Vries and Rashevskaya, 2009; van Hal, 2000; Duijvestein, 2005), Sweden (Vernay, 2013; Kasioumi, 2011; Khakee, 2007), Denmark, Germany (Frey, 2010; Freytag et al., 2014; Williams, 2013) and Spain (Kyvelou et al., 2012) as well as in Japan (Low, 2013), China (Chang and Sheppard, 2013; Caprotti, 2014a, 2014b; de Jong et al., 2013), Australia and the United States (Miller and Bentley, 2012), have been and are taking progressive urban change initiatives, in different scales or ambitions (Rapoport and Vernay, 2014), to determine if building demonstration eco-developments can showcase innovative approaches in urban planning and implementation, which can be used to guide new urban developments and re-developments. However, due to their relatively short history and due to the fact that these experimental projects are ongoing dynamic processes, relatively few, in-depth studies have been done with regards to their frameworks and processes or their environmental and social impacts. Therefore, it was deemed to be valuable to analyze the key similarities and differences procedurally, conceptually and contextually among those planned communities with respect to their initial goals and outcomes and to build upon their experiences.

This paper is the second one of a, two-part review of the literature on the evolution of urban planning and development trends since concerns emerged on the negative social, economic and environmental impacts of industrial revolution. The first article reviewed the emergence of key concepts of sustainability and sustainable urban developments and also highlighted different conceptual approaches.

In this second article of the series, the authors expanded upon the emergence of the demonstration eco-town developments in the Northwestern European countries that were initiated during the 1990s. Their frameworks and processes were investigated and the challenges, opportunities and lessons derived were explored. The authors explored whether and/or how the insights obtained will contribute positively for planning and implementing more advanced developments in other contexts. Therefore, the authors highlighted the potential contributions of the evolving concepts and approaches so that better urban development policies and practices can be established more effectively in other cultural and geographical contexts.

1.1. Scope of the literature review

The literature review was based upon journal articles, conference papers, grey literature and research-based findings that were relevant to the historical evolution of the sustainable development concepts with particular emphasis on eco-towns that were initiated during and since the 1990s. This research was conducted from the following perspectives: Firstly, the emergence of sustainable developments was reviewed based upon papers published between 1983 and 2013. Secondly, the relevant articles on eco-town developments within the Northwestern European countries, with emphasis on Sweden, Germany and The Netherlands, were comparatively evaluated with particular focus upon their objectives, frameworks, processes and results.

1.2. Terminology

Sustainable development (SD) refers to '*the use of resources concerning all activities in relation to human development while preserving the environment for present and future generations*' (WCED, 1987). In the context of urbanization and its processes, sustainability as a concept has been found to challenge numerous policies of urban growth within a system that is based on consumerism. Economic, environmental and social implications of growth policies since the early 20th century became prominent with *the Brundtland Commission's Report* (World Commission on Environment and Development, 1987). In that report, the following challenges were projected to become critically important in terms of development, which needed urgent attention: a. human population growth, b. food and arable land scarcity, and c. various other social and economic implications (WCED, 1987; Gilland, 1983, p.203). According to Birkeland (2012), the Report contributed positively in many ways to raising awareness of sustainability, however only within a '*neoclassical economic framework*' (Birkeland, 2012, p.168). She further noted that it also had shortcomings with regard to the built environment as it failed to underscore the "*centrality of cities*" in *environmental issues and/or solutions*, despite the fact that other researchers, including Wolman (1965, 1971), have already discussed these aspects (Birkeland, 2012, p.169).

In this literature review, the term "*eco-town*" was focused upon demonstration urban development projects initiated as part of SD initiatives in the 1990s. They were and are being implemented at district scales in the proximity of the existing urban fabric or as an integrated development with mixed-use properties to provide its citizens a better quality of life through environmentally sound planning and implementation and through integration of innovative urban systems, technologies and improved governance. Similar to Barton's (1998) definition of eco-neighborhoods, the term 'Eco-town' was initially used generically within the urban context, which recognized the 'ecological imperatives' and also highlighted energy efficiency, transport efficiency, environmental quality and community creation as key goals (Barton, 1998; pp.164–167). However, the eco-town initiatives varied widely in size, scope, objectives and implementation models depending on the cultural and geographical contexts. Therefore, the review of relevant literature also included searches for the terms such as: '*low-carbon developments*', '*smart cities*' and '*eco-cities*', which increased the number of relevant papers found published in this field, some of which were associated with the eco-towns as identified in this paper.

The terms, 'Regeneration' and 'regenerative design' were explored by J T Lyle (Lyle, 1994; Reed, 2007; Birkeland, 2012) as early as 1994 along with many other approaches in ecological design including but not limited to 'positive development', 'biomimicry', 'permaculture' or 'cradle to cradle' (Birkeland, 2012, 2014, p.168). Regeneration, in the context of built environment, was described by Cole (2012a) as the renewal and rebirth of a place after 'major acts of devastation' or the deterioration of the conditions that existed previously (Cole, 2012a, p.1). 'Regenerative development' refers to urban developments that are contextualized within a symbiotic human and nature relationship, forming a mutually beneficial environment (Mang and Reed, 2012, p.36) whereby, the inhabitants live and improve the 'system of the place' within which they live.

1.3. Methodology

This article addressed 'eco-town' development from two perspectives: Firstly, the published materials on eco-towns from around the world were reviewed. Secondly, the collected data were categorized according to relevance, type and quality. The review was done between 2008 and 2014 with regard to eco-town developments that were initiated during and after the 1990s. During this period, many initiatives were initiated globally, however due to the relatively small amount of material with qualitative and quantitative information; the initial literature review was limited to fourteen eco-developments of varying sizes, scopes and in eleven different locations. The data were analyzed and, comparatively evaluated. Subsequently, the research conducted on the selected cases between 2010 and 2014 was focused upon the examples with ex post evaluations from the Northwestern European countries. The evaluation of the selected cases included procedural, conceptual and contextual aspects (see Table 1) in order to clarify the differences and/or the similarities of the development processes, hence the level of applicability of their development models for future developments in other contexts.

Furthermore, the literature on the concepts of sustainable development, 'Ecological Modernization' (EM), 'Positive Development' (PD) and 'Regenerative Sustainability' were reviewed during the same timeframe with particular emphasis on the urban policies and urbanization processes. The search terminology was developed based on the key topics that were found to be relevant within the scope of this review, which consisted of but were not were limited to:

- *Eco-town*
- *Eco-town development frameworks*
- *Eco-municipalities*
- *Eco-development*
- *Eco-neighborhood*

Table 1
Evaluation criteria for comparative analyses of eco-town development processes.

Procedural	■ How were they initiated? ■ How were the processes governed? ■ How was stakeholder engagement/involvement ensured and implemented? ■ How was the project funded? ■ …
Conceptual	■ How was the design process managed at the architectural, urban planning and environmental model levels? ■ How was the conceptual framework established? ■ ………
Contextual	■ What was the context within which the eco-town was initiated and implemented with regard to size, scale, population, demographics and governance? ■ What were the initial goals and objectives?

- *Eco-villages and eco-village networks*
- *Sustainable urban districts*
- *Low-carbon development*
- *Eco-cities*
- *Smart cities*
- *Regenerative design and development*
- *Positive development principles*

These analyses included published materials from major databases including the information obtained from university libraries, electronic databases, official government and NGO websites as well as the organizations and institutions that were selected for in-depth analyses of eco-town processes addressed in this paper. Primarily, English language documents were searched and analyzed. Moreover documents in the German, Dutch and Swedish languages were found to be valuable; therefore they were analyzed after being translated via Google's Translation tool. Peer reviewed papers were downloaded and indexed using the reference management software (Papers version 2.0). The sites accessed were saved and dated where available.

2. Brief background on SD in relation to the initiatives of eco-town developments

Subsequent to the Rio Summit in 1992, some European countries adopted urban policies to mitigate the environmental impacts of urbanization processes by establishing and encouraging long-term local action plans such as the International Council for Local Environmental Initiatives (ICLEI)'s LA21. One of these efforts came as a result of the *Charter of European Cities and Towns: Towards Sustainability* (CEC, 1994) that underscored the need for social justice, sustainable economies and environmental sustainability (Burton, 2001). This charter, also known as the 'Aalborg Charter' (AC), clearly stated the need to involve all citizens as key actors in the decision-making processes and also the need to train and educate the public including the elected officials in the concepts of sustainable urban developments (CEC, 1994). As a major step, The AC was initially signed by eighty local authorities and later by an additional 253 international organizations, which pledged to take specific action towards transitioning into sustainable towns and cities. This led to the adoption of Local Agenda 21 processes for developing long-term action plans. As a result of the campaign, many initiatives from local to national levels were built, one of which became known as the **Eco-towns** in Europe.

Despite the complex nature of efforts to establish sustainable developments, demonstration projects *including the eco-towns* have evolved into being testing grounds for policy makers, academics and professionals to learn how to establish improved urban development practices in relation to their frameworks, processes, planning, implementation methods and assessment of the perceived quality of life of the eco-town's residents.

3. Eco-town initiatives

'Eco-town' is an evolving term along with the definition of sustainable communities, which is being refined and improved, through the *physical*, *ecological*, *technological*, *economic*, *psychological* and *social* changes that are occurring in societies. In the context of this paper, 'eco-towns' refer to '*mixed-use developments*', which were integrated within the urban area as part of a wider spatial plan to provide their people, the services and facilities and businesses to sustain them. They were connected to make extensive use of the existing urban infrastructures while having claimed to provide a relatively better quality of life for their residents, as they co-exist in the broader urban eco-system in which they were established (Kyvelou et al., 2012, p.562).

The terminologies for 'eco-towns' have varied according to the types, concepts, policies, programs and initiatives that were integrated within the different cultural and geographical contexts. For example, the Department of Communities and Local Governments (DCLG, 2006) in the UK, defined eco-towns as settlements of between 5000–15,000 homes in the form of a neighborhood or groups of neighborhoods where any larger size would refer to eco-cities. In the context of other European nations such as Sweden, Germany, The Netherlands and Spain, the term "eco-town" was understood to be a development with mixed-use properties and with environmentally friendly planning, implementation and integration of innovative urban systems and technologies. The definition in Europe was associated more generically with eco-developments that were built and/or which are being built to demonstrate sustainable urban development models upon which this paper is focused.

Kyvelou et al. (2012) characterized European examples as the 'eco-neighborhoods' (pp. 562–564) with populations of around 7500 people. Their definition of the projects from the 90s in the European context also referred to the demonstration projects that were built to promote a learning, experiential process for stakeholders. These developments exhibited high levels of technical/technological solutions (recycling of water, integrated renewable energy systems etc.) and opportunities for decision-makers to test their policies and choices in governance (Kyvelou et al., 2012). Earlier, Barton (1998) categorized eco-developments in different scales from individual units to the size of villages and towns. His typology involved rural to urban settings from various geographical contexts. Hodson and Marvin (2010) investigated eco-towns within the context of integrated eco-urbanism which they referred to as the places with integrated local food, water, waste and energy systems that supports and sustains healthy lifestyles in general (Hodson and Marvin, 2010, p.303). Moreover, the characterizations of eco-developments go beyond the size and scope of eco-towns (at least beyond the ones that are discussed in this paper) such as those that were initiated and/or which are being built in the size of cities and even regions (Caprotti, 2014a, 2014b; Joss and Molella, 2013; de Jong et al., 2013). In other parts of the world, the term was often defined more broadly, not only for residential developments but also for industrial town developments depending on the program or initiative they represent (see Section 3.1).

Even in the case of demonstration eco-towns, European examples were found to follow a number of different approaches with regards to their objectives, environmental policies and in their design. The drivers were found to differ according to location, time and conditions in which the projects were introduced (See Table 2).

As expanded upon in the first article of this two part literature review series, in the Western European and Scandinavian contexts, the early steps to help cities make the transition toward more sustainable patterns involved various programs some of which were supported by governments and local authorities and some were simply initiated by communities themselves. These initiatives

varied in size, scope & scale within neighborhoods and within larger contexts (Barton, 1998; Kyvelou et al., 2012). Some of the initiatives that were started with moderate budgets and resources, gained popularity while some others that were planned to help the leaders to gain insights and experiences, initially failed in aspects such as energy, water management, construction, materials, transportation, biomass & biodiversity due to their limitations in societal and governance contextualization. Some of the early Dutch developments were basically a 'live and learn' process (see Section 4.1), designed and built to understand the leverages for making positive changes and for overcoming the social, political and economic barriers throughout The Netherlands' evolving environmental policies (Keijzers, 2011) since the 1970s.

The lessons learned from these experiences were due in part to proper monitoring, which helped the Dutch, to design and implement, subsequent, high quality eco-developments such as 'Stad van de Zon' in Heerhugowaard and Nieuwland in Amersfoort. Similar initiatives were taken in Sweden and Germany. Sweden's Green Welfare State (Lundqvist, 2000, p.23) was designed to create sustainable communities along with local and central governmental initiatives to develop eco-towns as part of their urban development programs. As illustrative of these efforts, urban developments such as Augustenborg in Malmö, Hammarby Sjöstad in Stockholm, Sweden, Vauban and Rieselfeld in Freiburg, Hafen City in Hamburg, Kronsberg in Hannover, Germany were developed and can be named among some of the many initiatives globally.

Other governments such as Spain, China or UAE developed eco-town initiatives after the 90s to experiment and showcase implementation of progressive approaches in their urban development policies and practices. Due to the general consensus among Northwestern European nations on the need to address climate change and related impacts on their populations from a broader and more holistic perspective, more significant progress was made in this region than in other regions.

3.1. Eco-towns in the Asian context

In the context of Asian countries, the Japanese initiatives were the most widely recognized and researched as part of the eco-town initiatives, however with significant contextual differences in the vision, scale, goals and frameworks. Japan's plan to develop eco-towns was introduced in 1997, with the objective to achieve economic stimulation through waste reduction and recycling with increased use of renewable energy sources (GEC, 2005). Financial support for their eco-towns was provided by the National Government and by city administrations in collaboration with the Ministry of Environment (MoE) and Ministry of Economy, Trade and Industry (METI), for projects that were anticipated to be environmentally sound. Most of their projects were identified as either hardware or software projects. The hardware projects consisted of integration of material's recycling and reuse in industrial production, while the software projects were associated with information technology, planning and engineering.

Since the Kyoto Protocol, Japan's 'eco-towns' program achieved significant progress through implementing policy changes to foster the adoption of extensive innovative urban solutions mainly through promoting the 'reduce, reuse and recycle' (3R) approach in their heavily industrialized cities. This approach was regarded as progressive, especially in the context of the "dense population, geographical closeness of industry, business and settlements and a highly developed transport infrastructure." (Bahn-Walkowiak and Bleischwitz, 2007, p.9). The key results in terms of the achieved rates of participation and implementation of the program were mainly because they developed local initiatives through strong commitment of the national government and local authorities. They also developed and

Table 2
Comparative elements of eco-town initiatives evaluated for this literature review.

Drivers for initiation of the development	The main objective	The scale/level	The leadership
- Political consensus	- Sustainable growth	- Individual	- Governmental/ (Ministry)
- Business interest	- Environmental care	- Community	- Local level/ (Municipality/ community)
- Local initiative	- Eco-efficiency	- Neighborhood	- Corporate level (Investor/ developer)
- Community initiative	- Urban regeneration	- Municipality	
—	—	- Metropolitan	
—	—	- National	

implemented regulations, provided economic incentives and facilitated active participation of stakeholders at the community level. Among the 26 eco-towns in Japan, *Kawasaki*, *Naoshima*, *Kitakyushu* and *Minamata* were the most researched Japanese eco-towns (Norton, 2007, p.6). Despite the similarity of the use of the term 'eco-town', the Japanese initiatives were launched to establish innovative approaches in industrial production and administration, thereby, to help to develop more sustainable industries, not primarily for providing more sustainable communities for their inhabitants.

In the Asian context, China's approach to planning and developing eco-towns was within a different framework from that of Japan's industry driven approaches. Compared to Japan's very urbanized and land-strapped cities, China is rapidly becoming an urbanized society due to its economic growth policies since the early 80s (Chen, 2007). The administrative boundaries are changing and are constantly pushing the rural citizens to become urban dwellers as the new mega-cities emerge (Kojima, 1995; Zhang and Song, 2003). Especially in the last two decades, Chinese states and cities have experienced very rapid transformations fueled by the political economy, which often '*ignored welfare provisions or other basic needs*' of the broader public (Xu and Yeh, 2005, p.303). One of the main reasons for this could be the allocation of state power to local governments that enabled them to start their own land development companies in partnership with private commercial developers and to therefore, be able to initiate many large scale projects in short time horizons (Ben-Joseph, 2009, p.2693). The political and economic factors were mostly the drivers rather than the environmental concerns in their rapid rate in creating new mega city projects in the Chinese states (Hald, 2009). However, more than 40 eco-town/eco-city projects were initiated (Knox, 2010; Ben-Joseph, 2009, p.2697) but they were significantly different in the initiation and development processes and frameworks in comparison with their European counterparts.

Chinese efforts to improve their urban planning and implementation policies are being increasingly based upon lessons from the experiences in *the Erdos-Dongshen*, *Huangbayiu* or *Dongtan Eco-towns*. It was learned that they needed to give greater attention to participatory and more holistic design processes. They learned that community participation was vital from the start of any project, in order to obtain societal acceptance of innovative systems and technologies (Zhang et al., 2011). Although greater attention was required to the social and environmental aspects in the rapidly developing regions of China, the environmental degradation and its impacts on biodiversity, climate change as well as on the quality of life of communities have not been adequately addressed.

The Chinese efforts to create multiple mega-cities may require more across the board, bottom-up decision-making processes in order to achieve sustainability on all social, political, economic and environmental levels (Zhang et al., 2013). Both in theory and in practice, the European models followed relatively more holistic systems thinking approaches than those used by their Chinese counterparts. These less holistically planned systems pose multiple challenges in design, governance and implementation due to the rapid urbanization's unintended consequences such as short-term political and economic interests dictating the processes, instead of sound ecological and sociological principles being used to help to ensure that the new developments are more sustainable in both the short and in the long-term (Zhang et al., 2013).

4. Comparative approach of analysis of the findings of the review of literature of the eco-town developments in Northwestern Europe

As expanded upon in Section 3, the eco-towns were and are being implemented in various sizes, scopes and contexts around the world. Due to the extensive amount of data that would need to be gathered and analyzed in order to more comprehensively evaluate their processes, a global assessment was considered not feasible. Instead, the authors focused on the Northwestern European examples with ex post evaluations most of which were published in peer reviewed journals. In that context, the review of the relevant literature revealed several factors that were identified to play a role in their implementation processes. These factors were categorized into three groups in order to clarify how they performed in terms of achieving the initially desired goals of the projects. They also helped the authors to better study and analyze these outcomes comparatively and in relation to the evaluation of various models and frameworks used in the eco-town development processes.

From the review, it was found that the context in which the eco-towns were initiated, designed, developed as well as their governance models strongly influenced their relative successes and failures. The findings are reviewed in the following sections and the insights from these findings were formulated to help future eco-town planners to avoid potential problems and to build upon the success-factors.

4.1. The drivers for planning and implementing of eco-towns

In the early European context, the drivers were very similar. They usually focused on a few goals such as providing affordable housing, improving energy efficiency through renewable and integrated energy production, waste reduction, and water recycling. These earlier models, which were usually conservative in size and scope, were mostly community level, alternative movement initiatives located in the periphery of cities or on rural land (Kyvelou et al., 2012, p.563). The projects of the 90s were implemented by governments to showcase their commitment to establish sustainable development through initiatives such as the Ecolonia in Alphen aan den Rijn (Barton, 1998; Vernay, 2013), Ecodus in Delft (de Vries and Rashevskaya, 2009) and Nieuwland in Amersfoort in the Netherlands (de Zeeuw et al., 2010). Similarly, in Sweden, the examples included projects such as Malmö Bo 01, Hammarby Sjöstad and others (Femenias, 2008; Femenias et al., 2010) while in Germany, Rieselfeld and Vauban in Freiburg are among the most recognized and researched developments (Ornetzeder and Rohracher, 2006; Freytag et al., 2014; Scheurer and Newman, 2009).

The eco-town projects initiated in the early and mid 1990s in the Northwestern Europe, were designed to establish urban development models tentatively with circular metabolisms (Girardet, 1996). They had different drivers that included holistic environmental agendas for urban transformation, social justice or economic equity (Kyvelou et al., 2012). Some of the projects were introduced because they were designed to take advantage of "*events*" such as the Olympic Games or EXPO fairs that were referred as the "*situations of opportunity*" (Svane, 2007b) and could therefore, enhance the image of the host cities (Kyvelou et al., 2012, p.564). In contrast, some eco-towns were developed based on decades of planning to be integral to national commitments for transitioning their cities to become models of forward-looking urban development procedures and policies.

Additionally, recently, countries such as the UAE and China have been working on developing city scale projects designed to develop and test replicable models, which Hodson et al. (2010, p.310) refers as the '*global financial products*'. Due to their size, technological and economic dimensions, it is not yet clear if they are replicable in other contexts (Hodson and Marvin, 2010). Furthermore, due to their relatively short history, the environmental performance of their integrated systems and technologies is still being studied

(Pandis Iveroth et al., 2013), and assessed with little emphasis on 'quality of life' consequences. Moreover, transferability of the lessons and replicability of these examples in different spatial and temporal contexts require in-depth investigations in terms of their appropriateness as they pose complex political, economic and cultural aspects (Guy and Marvin, 1999, p.273; Williams, 2010, p.130).

The following section of this paper highlighted the similarities and differences found with respect to the elements that influenced the outcome of the eco-towns' development processes and gained knowledge into their frameworks with particular emphasis given into the Northwestern European context. Subsequently, the authors evaluated the effectiveness of the current principles upon which the eco-towns and similar initiatives were introduced in order to transition rapidly growing cities into sustainable urban forms.

4.2. Vision/design/frameworks

As stated in Section 4.1, the demonstration projects in Europe were implemented in response to diverse drivers. Besides the goal to resolve affordable housing shortages in the 80s and early 90s, the early models were initiated to experiment with and to test innovative urban solutions. The more recent examples were however, designed and built to showcase more holistic integrated mixed-use urban developments. For example, Hammarby Sjöstad in Stockholm, Sweden, was developed as part of a scheme to decontaminate a brownfield site, which was once used for industrial activities. Vauban in Freiburg, Germany, was a showcase settlement project for energy efficient housing and reduced car use that was developed on a former army base. The Rieselfeld, also in Freiburg Germany, was built on the site of a former sewage works. Similarly Hafen City in Hamburg, Germany, was designed to fulfill the needs for environmentally sound development in a mixed-use, integrated district that was part of the vision to rehabilitate a waterfront area. For example, Nieuwland development in Amersfoort, The Netherlands was developed to test building integrated photovoltaic systems, whilst maintaining high standards of social and environmental sustainability. Stad van de Zon in Heerhugowaard, also in The Netherlands, was built on previously vacant land in order to create a CO_2 neutral community. Among these examples and others, the character, affordability, connectivity and improved physical, social and environmental qualities were crucial objectives of their planning and design.

Some of the most significant cases were developed to establish sustainable neighborhoods or were strongly influenced by the relative degree of democratic, transparent and inclusive governance structures, and by their design and development processes (Kyvelou et al., 2012; Toussaint, 2012; Pandis Iveroth and Brandt, 2011; Svane, 2007a; 2007b; Femenias, 2008; van Hal, 2000). Although the principles and frameworks had common threads (see Table 2), it was found that they varied in their implementation models depending on the community, the place or the conditions during which they were planned, developed and implemented (Peterson, 2008). Consequently, diverse profiles, typologies, processes (Kyvelou et al., 2012) as well as different frameworks (See Table 3) were developed and used.

After in depth research, these frameworks were found to stem from basic principles similar to those stated in The Freiburg Statement on New Urban Neighborhoods (See Box 1). Despite Barton (1998)'s skepticism, which he referred as 'a rather nostalgic idealism' and 'counter to dominant market trends' (p.162), these principles applied to almost all eco-town processes and frameworks that were used in the contextualization of Western and North European eco-developments.

Table 3
Diverse types of sustainability frameworks that were adopted for building sustainable communities and urban developments that were reviewed for this document.

Sustainability tool/framework	Objective(s)/focus area
Bioregional One Planet Framework	To establish sustainable communities
LEED for Neighborhood Development	To build sustainable urban developments
DPL's Sustainability Profile	To establish sustainable urban planning
ICLEI's set of tools for sustainable local change	To create sustainable local governments
Cambridgeshire's Quality Charter for Growth	To establish a framework for sustainable urban growth
Charter for New Urbanism	Set of principles for Sustainable Urban Developments
New Zealand Urban Design Protocol	Green urban design protocol
Eco DISTRICTS	Establish Sustainable neighborhood/district
Regenerative Design Methodology	Create regenerative urban developments
Positive Development Assessment Tool/Framework	Bio-physical design-based systems approach
(…) and more	(…)

Box 1
The Seven Principles of the Freiburg Statement on New Urban Developments.

- Heterogeneous social composition, with special attention to the needs of children, elderly and low-income groups;
- A pedestrian-dominated public realm to facilitate 'good social life' and provide an attractive human-scale environment;
- Diversity of use; housing, work, shopping, civic, cultural and health facilities in a fine-textured, compact, low-rise urban fabric;
- Active and frequent participation of all segments of the population in planning and design of the area, thus an incremented not authoritarian design process;
- Architectural identity that is rooted in the collective memory of the region, reflecting characteristics most valued by the local community;
- Pedestrian, bicycle and public transport networks within the neighborhood and linked to the city as a whole, thereby discouraging automobile use;
- Ecologically responsible development principles consistent with social responsibility and cutting energy use and pollution.

(**Making Cities Livable, 1996**), (Barton, 1998, p.162)

Subsequently, the 'Hannover Principles' were developed by McDonough and Partners (1992), and addressed a more relevant and refined set of principles that resonated with the severity of the environmental challenges discussed in the urban contexts. These principles, which formed the theoretical background for the EXPO 2000 (McDonough, 1992; McDonough and Braungart, 2012), stated the basic steps as to how the urban developments should be envisioned both physically and philosophically.

1. Insist on rights of humanity and nature to co-exist.
2. Recognize interdependence.
3. Respect relationships between spirit and matter.

4. *Accept responsibility for the consequences of design.*
5. *Create safe objects of long-term value.*
6. *Eliminate the concept of waste.*
7. *Rely on natural energy flows.*
8. *Understand the limitations of design.*
9. *Seek constant improvement by the sharing of knowledge.*

The Hannover Principles, Design for Sustainability (McDonough, 1992)

The initiators of eco-town developments have emphasized similar other sets of principles, visions and mission statements that were found to reflect their sustainable development values. Based on the review of relevant literature; the authors of this paper highlighted the common elements that were found to influence the outcome in the following sections and subsequently addressed the aspects that require further investigation and testing.

4.3. Environmental management/goals and objectives of eco-towns

Based upon ex-post studies, clearer insights on the implications and actual achievements revealed that the 'goal achievement' has varied depending upon many factors including but not limited to the governance model, stakeholder involvement, systems design and decision-making or funding. In fact, almost all elements of the eco-town development processes were found to influence the outcomes (van Hal, 2000, p.143) either positively or relatively less successfully depending on the extent to which they were included.

The literature review showed that peer-reviewed evaluations of eco-towns were limited and only in a small number of cases critical analyses of the 'goals achieved' have been performed and published. Or the evaluations are not very reliable due to the lack of initial data from that site at the beginning of the eco-town's development (Pandis Iveroth and Brandt, 2011, p.1061; Peterson, 2008, p.10). In some cases, the data were too generalized to the urban context in which the eco-towns were situated and the official reports provided little or no specifics on the eco-town's actual achievements, therefore, it was difficult to assess the relative success or failure within the timeframe of the analyses. This literature review revealed that the key reasons why the initial goals of eco-town initiators may or may not have been achieved, depended on the way they were contextualized and how their development processes were managed as a result.

The most significant findings in terms of the 'environmental plans' of eco-towns reviewed were:

a. The environmental goals that were identified through design panels comprised of environmental supervisors, designers and experts in their respective fields were found to have significantly improved the level of goal achievement since they were introduced early in the process (e.g. In Nieuwland in Amersfoort, The Netherlands and also in the case of Vauban in Freiburg, Germany)
b. Furthermore, establishing ambitious environmental objectives helped to ensure that they were achieved due to the development and implementation of a clear vision and a working framework that effectively supported the goal achievement in that geographic and cultural context. One of the strongest factors that contributed to the project's success in terms of the environmental goals was identified as the participation of people in forming their own place of residence (*For example, Vauban in Freiburg, Germany*) (Sperling, 2002; Kronsell, 2013; Frey, 2010)
c. In the case in which the detailed environmental plan was established later in the development process, it was found to cause conflicts with the design and implementation due to lack

of proper stakeholder involvement in the process *(In Hammarby Sjöstad in Stockholm, Sweden)* (Vestbro, 2005; Pandis Iveroth and Brandt, 2011).

In conclusion, a sound and realistic environmental agenda that is introduced as early as possible in the planning process is an important element that yields significantly improved impacts on the outcomes of the development. However, commitment of the government agencies and administrations is also critically important in terms of ensuring that the environmental measures are designed to achieve the goals. Moreover, during subsequent literature assessments of additional cases, other factors, which are elaborated upon in Section 5, were found to play critical roles in helping to establish successful eco-town developments.

4.4. Financial plan/funding of eco-towns

Planning and funding of large-scale developments such as eco-towns require sound financial planning in terms of operationalizing the design, administration and development from the beginning through the implementation processes. Therefore, commitments from the local administrations as well as from the central governments are vital to ensure continuity of such long-term developments, thereby minimizing financial risks due to changes in the political climate, project champions and the actors involved. Such changes were observed in Hammarby Sjöstad in Stockholm Sweden (Brogren and Green, 2003) and resulted with significantly less commitment to the original vision, goals, and objectives to adjust to the changed expectations (Pandis Iveroth and Brandt, 2011). As stated in Section 4.1 however, urban events such as the Olympic games, Expo fairs and national programs are critical '*situations of opportunity*' (Svane, 2007b) that often create synergies for all economic, political and social justifications, hence the consensus for the development of eco-towns. In the case of Hammarby Sjöstad, despite the loss in the Olympic bidding, the political commitment from both the City of Stockholm (Svane, 2007a) and the Swedish government's Ministry of Environment played a positive role as they were politically and financially committed through the Local Investment Program (LIP) designed to encourage implementation of eco-cycle districts (Lundqvist, 2004; Bylund, 2006).

In Dutch cases however, long-term planning, experimentation and operationalization were involved in order to address housing and urban development projects. For example, the finance for the developments was traditionally provided through the government funding agencies or banks set up by municipalities (SUNN, 2011), such as the Bank Nederlandse Gemeenten (BNG) with strong commitment of the local and regional administrations. In the early experimental and demonstration projects, overall funding was provided through a combination of local, regional and central governmental programs (*Interview in Vathorst i-Centrum, 2013*). Together with the adoption of public-private partnerships (PPP) as a model after the mid 1990s, funding mechanisms became increasingly formulated through loans acquired by the development companies (consortium) thus making the market indicators, the environmental ambitions, the project goals and economic feasibilities, crucial additional variables in the already complex development processes. This change occurred not only in The Netherlands but also in other parts of Europe together with the increased involvement of the market sector in the spatial decision-making, which used to be predominantly centralized in governance and implementation (Heurkens, 2012, p.115).

In the cases studied however, the funding was initially provided through governmental programs and city administrations, especially in land acquisition, urban and infrastructure planning and

installation. With regard to the PPPs, which became widely accepted and is increasingly used by local and national governments as a model, it was found to be integral to understand the local conditions and the needs of communities (Kyvelou and Karaiskou, 2006, p.601) in order to achieve successful implementation of projects including eco-towns. It was further emphasized by the relevant literature that the use of public finance along with public participation through strong democratic local leadership were essential elements to attract private investment, which is instrumental for urban development and regeneration (Adair et al., 2000, p.147). Kyvelou and Karaiskou (2006) further addressed the critical issues pertaining the PPP models with regard to achieving sustainability goals. The local authority's control over the design and development processes was found to be essential. Other essential elements in conducting successful PPP processes included but were not limited to the level of expertise of the private parties, the local authority's negotiation skills and knowledge during which innovative solutions and standards are decided; moreover the local government should be able to set the standards and to monitor the process, while ensuring good collaboration with the public parties (Kyvelou and Karaiskou, 2006). In this context, an alternative approach, which is the Public-Community Partnership (PCP) was found to be successful as it was implemented in the development of Vauban, Freiburg. This resulted in collaborative and participatory design and development in which the future residents were involved as the building groups thereby helping to ensure the quality and standards. This is amplified upon in Section 4.6.

4.5. Design and development of eco-towns

Physical qualities with distinctive architecture were attributed to the increased citizen interest in the development and they help to ensure success of the projects. However the design culture/process has evolved and is still evolving from being *a user-centered* into becoming a '*for*' and '*with*' *user design* process (Sanders, 2002) by the mainstream since the mid 1990s. The eco-town developments being experimental and experiential developments in the Northwestern European context, the participatory culture in which designers and other stakeholders were engaged and involved from the beginning to the completion, evolved more effectively than if these elements were not present. Both in the design and development, it was found that eco-town development models had inclusive, multi-disciplinary design and development processes. The level of stakeholder participation (see Section 4.6) among the cases however differed and consequently resulted in achieving different levels of outcomes than initially expected.

For example, in Amersfoort, the Netherlands, Nieuwland development's architectural and urban characteristics were influenced much from the environmental measures, which in turn created a rather different sense of place for the early residents than has been perceived for the conventional settings of the Dutch neighborhoods. The design principles were found to be rather restrictive and the building integrated PV technologies were relatively new for the architects (Jadranca and Horst, 2008), which in turn resulted in somewhat monotonous patterns. These initial perceptions were found to have changed through the evolving design processes as the designers and community gained shared experience and knowledge with increased level of confidence and consensus (interview with Prof. Kees Duijvestein 2013).

In the Hammarby case, due to elements such as the location as well as characteristics of surrounding sites, the project has become highly popular (Vestbro, 2005) despite the regulations for ambitious environmental goals that were introduced at later stages (Pandis Iveroth and Brandt, 2011, p.1059). On the one hand, the design attributes such as large openings to make good use of the surrounding views were found to create conflicts with the environmental goals (see Box 2) of the project (Johansson and Svane, 2002, p.209). On the other hand, the building codes were found to require investments that were perceived to be too expensive for the developers to justify for sales to end-users (Svane, 2007a, p.4). For example in Hammarby Sjöstad, the environmentally friendly building materials were initially claimed by the developers to be 25–30% higher than the conventional methods and materials (Rutherford, 2013, p.13). Rutherford (2013) also noted that only an increase of 2–5% in costs was reported, at least by one of the major developers while this cost was reflected as a 15% surplus in the sales price of the built units. Because the environmental model in Hammarby Sjöstad was introduced relatively later than in other similar projects, it was far more difficult to establish and conduct a sustainability agenda in its true meaning, consequently, compromises had to be made. It is important to highlight that the cost of innovation has almost always been priced higher than the actual values especially when introduced without large-scale experimentation or testing through substantial period of time. The developers tend to cover unforeseen direct and indirect costs that can occur due to more than expected levels of maintenance and/or replacements. These problems can cause serious losses not only financially but also in terms of credibility and trust. In Hammarby Sjöstad, the lack of a clear environmental agenda and the developer-oriented approach resulted in the significantly higher costs per dwelling as was highlighted by Rutherford (2013). For example, in Vauban, higher environmental standards were also claimed to cost more (about 13% for the passive house standards as calculated in 2009) (City of Freiburg, 2014) but the building groups that were established from future residents helped lower the overall building expenditures by 15–25% when compared to the average rates in the city of Freiburg at that time (City of Freiburg, 2013). As Femenias (2008, p.7) suggested, '*the participation of a large range of actors and stakeholders in the design and development stages with an integrated approach*' is key to achieving successful implementation of eco-town developments. Such participation was found to be valuable in creating consensus among interest groups and for reducing goal conflicts (Box 2).

In Vauban in Freiburg, Germany and in Stad van de Zon in Heerhugowaard, The Netherlands, the three elements of ecological modernization, adapted from Ole Jensen and Gram-Hanssen's categorization of sustainable building design (Femenias, 2008; Ole Jensen and Gram-Hanssen, 2008), became integral procedural elements in these developments:. 1. The governance (*types of*

Box 2

Orjan Svane's categorization of goal conflicts with regard to the Project Team's efforts in establishing environmental objectives in Hammarby Sjöstad, Stockholm.

> Svane (2007b, pp.80–81) *elaborated on the goal conflicts in three main categories, which were identified as internal, external and procedural. The internal goal conflict was described as a situation during which two or more environmental objectives could not be met at the same time. The external goal conflict was defined as the situation in which the economic and environmental objectives clashed so that the environmentally friendly building technologies or materials would be too expensive. As a result the residents wouldn't want to pay for the extra costs. The procedural goal conflict according to Svane, occurred when the environmental objective(s) were in conflict with the rules, the decision-making or the governance model.*

cooperation and roles of actors); 2. Standardization (*standards, tools, models*) and 3. Visibility (*measurement, monitoring*). These helped to ensure that the design and development measures were more attuned with the project's vision and objectives and also with the end-user's perceptions about the place in which to live. In summation:

- The design processes were found to work well with multi-actor involvement with multi-disciplinary and holistic approaches, especially when the stakeholders included potential future residents and not only the interest groups, during the design and development stages.
- Competitions, workshops and on-going consultations with involved parties were vital steps for consensus building, which supported the development and implementation of successful designs and appropriate development strategies.

4.6. Stakeholder involvement in the planning and implementation of the eco-town

As stated in Section 4.3, stakeholder involvement was found to be as vital as the environmental model, which has profound impact on both the design and the quality of the development in relation to the desired social, physical and environmental outcomes. The literature review revealed that active citizen participation and engagement are core concepts in the northwestern countries in Europe since the 1990s, particularly concerning matters of urban policies and developments (Loopmans, 2010, p.798). With regards to the demonstration project processes, strong stakeholder participation, both in width and depth, were found to positively impact the outcomes (Edelenbos, 2005, pp.428–429). As defined by Edelenbos, the '*width*' of participation as one dimension, which was essential to determine if adequate opportunities for participation were made available; and if so, was the participation made accessible to all and how frequently were the participants informed during the process? The '*depth*' of participation was assessed with regard to the extent that the citizens or future residents could influence the decision-making and the realization of the outcomes.

Public involvement was found to be important not only in the planning but also during and after the implementation (Shepherd and Bowler, 1997, p.727). In spite of the potential downsides identified with regards to time delays and costs incurred through public participation (Solitare, 2005, p.920) it was also suggested that conflicts are inevitable and that the '*conflict resolution process*' can become a productive, cooperative vehicle by which to improve the process and to improve the results of environmental decision-making (Shepherd and Bowler, 1997). Referring to the Vauban's development process, Kronsell (2013) noted that the social learning can take place when citizen participation is provided early, is truly inclusive and built on the ideas of the engaged citizens (Kronsell, 2013). In that regard, the question emerged as to whether the objective should be to create the highest quality environmental plan (*such as those that were created through centralized top-down decision-making approaches*) or to produce a plan that will be efficiently implemented and supported in the future (Brody, 2003, p.415). Selection of the key stakeholders and efficiently empowering their participation were found to increase the chances of implementing a successful eco-town with an environmental plan that will be supported and implemented in the long-term. According to Shepherd and Bowler (1997)'s characterization of environmental conflicts, establishing an environmental plan requires consensus, and "*acceptability depends on public perceptions and opinion*" (Shepherd and Bowler, 1997, p.729).

In the Dutch and German examples, participation was encouraged and supported increasingly over time, to a large extent, while in the Swedish development examples (See for example; Khakee, 2002) participatory culture already existed with the exception in Hammarby Sjöstad (Kasioumi, 2011, p.104). Among the examples in the Northwestern European context, it was found that effective participation of diverse interest groups in decision-making and implementation increased consensus and long-term applicability of the environmental agenda.

4.7. Governance of eco-towns

Government support in policy-making, financial backing and legal attributions were essential for empowering city administrations to become committed in both the design and implementation processes of eco-town developments and similar initiatives. Besides local authorities' strong control over the developments, particular emphasis was given to providing access to information on a continuous basis as well as to engaging communities in the process through workshops with multi-disciplinary project teams (Scheurer and Newman, 2009). The governance models of **eco-towns** initiated in the 1990s in Northwestern European countries were relatively more de-centralized and interactive, similar to the environmental governance in The Netherlands as characterized by Driessen et al. (2012), with regards to their actor formations, institutions that were involved and the way the decision-making processes were formulated. Especially, with regards to the demonstration eco-town developments, the role of local and regional administrations was found to be integral for providing the authority to ensure that the multi-actor partnerships were established within the environmental measures and guidelines.

For example, in the Nieuwland development, the public-private partnership was formed between the municipality and the market sector (developers) whereby, the environmental supervision played a central role in terms of ensuring the standards and also the quality during the design and development process. In Nieuwland's development, The Netherlands Agency for Energy and the Environment (NOVEM) and the EU's program for the promotion of energy technology in Europe (THERMIE) have supported these measures in order to promote building integrated energy systems at district levels. In Vauban, Germany, the collaboration between the government and the local administration initiated a broad participation of the agencies such as ICLEI, EU LIFE Program, the German Environment Foundation and the future residents from an early stage of the planning and design. Federal and State subsidies provided low-interest loans along with tax breaks which further motivated the community building projects (Sperling, 2002). In the Swedish examples, the Local Investment Program (LIP) provided subsidies to a number of applications to build eco-cycle district projects including Hammarby Sjöstad.

In order to efficiently conduct the design, development and decision-making processes, legally appointed bodies similar to the Forum Vauban in Freiburg and others such as KuKa in Kronsberg and GlashusEtt in Hammarby Sjöstad were established. These '*catalytic agencies*' (Kasioumi, 2011) encouraged citizen participation, stakeholder engagement and more importantly facilitated institutional capital building through broad exchange of information and alliance-building among the key actors.

Also, the planning approaches were found to have differences along with different impacts on the desired outcomes (Williams, 2013). Community involvement and inputs from other stakeholders during the vision and design stages onwards, generated significant impacts with regards to end-user motivation, in the decision to become a resident and/or it influenced their lifestyle choices and behavioral patterns. Governance, as a result, was found

to be more effective when a shared vision was developed and implemented that included the committed parties rather than only forcing, regulating, or encouraging implementation of pre-developed plans (Williams, 2013, p.696; Vestbro, 2005).

4.8. Monitoring of progress toward achieving the goals of eco-towns

The review confirmed that documentation, follow-up and evaluation aspects were addressed as core elements in all eco-town demonstration projects (Femenias et al., 2010) in order to assess whether the initial goals and objectives were met. Thorough evaluation design requires sound baseline data (Bamberger and White, 2007, pp.64–65) so that comparative analyses can be made on a time-series basis as the eco-town evolves. However, this process was often not well managed and was frequently neglected due to the overwhelming amount of other work, especially during the beginning of the projects. With regard to all future eco-town developments, it is essential to conduct the baseline data gathering process before the project is started so that a solid foundation is established for monitoring progress or lack of progress toward achieving the goals.

It was also found to be critical to include independent researchers to conduct sound scientific and reliable evaluations of eco-town initiatives so that the '*stakeholder/beneficiary*' bias is avoided (Femenias et al., 2010). Along that line, Bamberger and White (2007) underscored that the rigor of the evaluation process as well as the constraints involved with regards to budget and time in primary data collection have great significance in monitoring the eco-town's successes or failures. The researchers found that it was possible to reduce time and data acquisition costs by partially using, available secondary data sources in the evaluation processes (Bamberger and White, 2007; White, 2006, pp.16–17).

Anticipated environmental performance of eco-towns was largely based on theoretical models that were developed during the planning and development stages (Pandis Iveroth and Brandt, 2011, p.1062). The actual performance, based upon sound data analyses that were supported with qualitative interviews among the residents, revealed that the differences between projected consumption and the actual consumption were very different as illustrated in the case of Hammarby Sjöstad (Vestbro, 2005). Similarly, in other developments, it was found that the environmental models used to estimate waste, water and energy usage, calculated the efficiency levels of the buildings and the development as a whole. The user behavior however, significantly affected the performances of the systems; hence the achievement level of environmental goals was also affected. Therefore, eco-town coordinators should perform thorough and prompt evaluations of the data obtained from the monitoring processes and perform monitoring and assessments based on behavior of the residents. They should provide feedback, reports, and other information to all relevant eco-town stakeholders on a regular basis.

5. Discussion

The systems and technologies implemented in the demonstration projects were excellent examples of how integration of diverse energy, water, waste and transportation modalities and infrastructure options may help citizens to reduce their carbon, water and other footprints as they conduct their daily activities within urban environments. The eco-town projects reviewed for this paper were developed to demonstrate innovative, integrated approaches at the local scale that could be/are being adopted and implemented effectively if the system was designed and implemented holistically. However the question as to whether the initial goals and objectives have been met in terms of all social, physical and environmental levels is very broad and requires extensive longitudinal data with in-depth research. Within the limits of this literature review, some aspects of eco-town projects were clarified with regard to their contributions to documenting the gaps between the promises and visions of the planners and the realities experienced by the people who actually live in them.

■ *What lessons were learned that could help others to establish better eco-towns in the future?*

With regards to '***commitment***' on all political, financial and institutional levels, eco-town projects were built not only as show-case flagships but also to introduce innovations in building technologies, urban systems, planning and, to serve as educational opportunities for the wider society. Due to a large number of actors/stakeholders involved in their initiation, funding, development and administration, it is very important to ensure that the parties, including the citizens, are continuously engaged, committed, empowered and informed. Eco-town projects have been initiated as part of local and national policy initiatives and sometimes as part of the nation's commitment to demonstrate their willingness to transition to more sustainable town and city structures and functions. In such cases the city administrations have sometimes made good use of opportunities such as major urban events to promote and showcase their eco-town projects. Although such eco-town projects were introduced after long planning and experimentation, the ***timing*** of the implementation was found to play a significant role in building shared vision, consensus and momentum. This was true if national policies and/or local initiatives played key roles in their initiation.

Participatory design supported with workshops, 'speak out' sessions (Sarkissian and Bunjamin-Mau, 2009), competitions were found to help raise awareness, and to increase the sense of community ownership and commitment to the eco-town projects. In this process, ***catalytic agents*** such as those discussed in Section 4.7, helped to coordinate stakeholder interactions, organize events and inform and engage citizens to help to ensure a strong forum for involvement and empowerment of all stakeholders.

With regard to the importance of the structure and timing of the environmental plan as discussed in Section 4.3, establishing goals and objectives as early as possible provides a better foundation upon which to build commitment to fulfill the required standards and to achieve the objectives. This helps to create consensus among the designers, developers, and residents. Eco-towns based upon environmental and social plans with clear goals and timetables established at the beginning of the development reduced conflicts among the actors during the development as well as after resident occupancy.

■ *Have the initial goals and objectives been achieved in terms of social, physical and environmental impacts compared to conventional urban developments? If so how and if not why not?*

With regards to reducing fossil-fuel dependency by replacing conventional design and construction methods with innovative solutions, the eco-towns have helped to foster work to improve environmental performance. Such changes included but were not limited to improvement in buildings with innovative systems and technologies; urban heating systems, improved waste recycling and management and enhanced variety of transportation options and in some cases emphasis was made on integration of renewable energy systems to help to reduce reliance upon the fossil carbon-based energy systems.

Moreover, most projects were designed to educate, involve and empower residents so that their behavior helped the eco-towns to

achieve mutually agreed upon goals. Holistic planning and good governance were found to be essential to eco-town success in terms of accomplishing goals whether they are improvements in the use of energy, water, management of wastes or recycling. Some of these goals however, were never met or had only marginal significance in terms of the overall environmental plan and objectives.

For example, the literature review on the performance levels of the eco-towns revealed that the resident behavior played a significant role in achieving environmental goals. In Stockholm's Hammarby Sjöstad, it was found that the factors that affected the results occurred due to the residents' behavior, conflicting with the operational goals and procedural factors in relation to the design and development of the project; such as the car ownership per dwelling (Vestbro, 2005) or consumption levels of electricity and water (Pandis Iveroth and Brandt, 2011).

In the cases where the planning and design stages involved multi-stakeholder participation and even future residents' inclusion in the decision-making process, the environmental goals were achieved relatively more effectively, compared to those that followed top-down governance. Therefore, the consensus among actors as to how to efficiently integrate the soft legislation (regulations) with the lifestyle changes was found to be pivotal for achieving the environmental goals of the projects. Vauban in Freiburg for example, was considered to be one of the more successful developments in terms of its goal achievements; this was found to be due to its contextualization/conceptualization and governance. Vauban accomplished a high level of success in building consensus among all stakeholders. This provided an improved level of standards in the building technologies used, in the resident's lifestyles and behavior due to commitment to the shared vision (Kasioumi, 2011). The main reason the residents chose to move into the developments was because they had the opportunity to influence the design of their property, their residential environment and the community in which they would live (Scheurer and Newman, 2009). Together with impressive achievements in water and waste recycling, Vauban's success can be attributed to the Public—Community—Partnership (PCP) model established by the Forum Vauban, which empowered community participation in the process from the beginning phases of planning of the Vauban development. As a result, these two examples were found to be particularly valuable because they represent significantly different approaches in initiation, frameworks and processes as well as in their sizes, and results.

It is worth noting that these two examples also raise the question of causality, which this study did not seek to answer. However, significantly, participatory processes (especially in the design stages), such as in Vauban's development, may attract the residents that are willing to adopt and maintain more sustainable lifestyles. This in turn, can increase the level of success in terms of achieving environmental, social and economic goals. In the case of Hammarby Sjöstad, participation of residents in the design and/or development processes was found to be almost none and this might have

resulted in the residents' selection mostly due to the desired physical qualities of the development rather than the environmental aspects.

In that context, among the eco-developments built in The Netherlands, the consumption levels of both the electricity and gas were found to differ among the dwellings of the residents who participated in the development process and those that did not. A study published by V&L Consultants (2009) revealed that the usage of gas, water and electricity decreased significantly for the residents' homes who were involved in the process compared to both the reference homes in the surrounding urban areas and the dwellings (within the eco-development) with residents who were not engaged in the development process (de Vries and Rashevskaya, 2009).

These and other findings helped the authors of this paper to better understand the types of variables that were found to influence the outcomes, more specifically the level of achievement in environmental goals. However it is important to note that the objective was not to generalize the results, but rather to transfer the insights gained through the review of the existing literature. Therefore, the authors sought to summarize the findings in two forms of eco-town development processes as shown in Table 4.

The insights gained from this literature research revealed several procedural factors that contributed positively to achievement of the goals for eco-town developments. Among the most significant examples in the Northwestern Europe (more specifically the eco-town developments researched in Germany, The Netherlands and Sweden), the review revealed that the most notable factors influencing the level of success were as summarized in Table 5.

Furthermore, the research conducted among the eco-town related studies documented a number of shortcomings in the existing body of literature. Most researchers focused on aspects such as the environmental performances, innovative systems and technologies and the development frameworks or the extent of actors that were involved in these rather complex processes. This issue was similarly addressed by Seuring and Müller (2008) underscoring the lack of an integrated perspective in understanding sustainable development, in their review of supply chain management related literature, in which they highlighted the need to include the social issues while investigating the interrelations of all three dimensions (Seuring and Müller, 2008). With regards to the literature review conducted in the context of eco-town developments; social outcomes and societal dimensions were found to be mostly neglected, despite the extensive amount of published material that already existed in 'societal level of analysis, values related to sustainability and the elements of good society' (Sirgy, 2012, p.563).

While these aspects were found to be less emphasized in the context of demonstration eco-town development processes, earlier and also less ambitious developments such as the eco-villages, eco-neighborhoods and community-based initiatives were found to

Table 4
Evaluation matrix of two types of eco-town development processes to build more livable and sustainable communities and urban developments.

	Stronger form	Weaker form
Initiation	Both institutional and community initiatives + Economic and political consensus with long-term planning at the policy level	Economic/business interest + Political consensus around opportunistic events and occasions
Funding	Governmental, Institutional + Private funding	Institutional + Private funding
Design	Participatory/with and for user-designed involvement	Top-down/User-centered
Development	Public-private partnerships (PPP), Public-community partnership (PCP)/Multi-stakeholder involvement with early adoption of environmental plan	More market oriented with flexible environmental plan/entrepreneurial urban projects (EUP)s[a]
Governance	Decentralized − interactive/Bottom-up decision making with implementation of the shared vision from the very beginning phases.	Centralized/Top-down decision-making, encouragement or regulation of implementation of the pre-developed plan/vision

[a] Ben-Joseph (2009, p.2692) defined the EUPs as the mega projects such as those in India, UAE and China, which are based upon new standards beyond the local codes and regulations in order to achieve their visions while resulting in similar aesthetics and characteristics regardless to their location, climate or culture.

Table 5
Factors that were found to influence the level of success of eco-town developments.

Political commitment	Provides the much-needed financial and regulatory conditions required to establish the size and scope of innovative projects such as the eco-towns.
Timing	Utilizing opportunities and proper timing, for introducing initiatives that require consensus among all political, public, financial and other actors who are involved or affected by the processes, helped to establish the essential elements such as finance, publicity and demand.
Financial model	The local municipal and national funding agencies allocate the necessary funds combined with private–public–partnerships (PPP) further strengthen the multi-actor engagement in the process.
Physical qualities	Elements such as the architectural characteristics, environmental qualities and urban amenities help to establish the local identity with which one feels satisfied or unsatisfied in the context of perceiving a sense of place and belonging. Enhancing the physical and social characteristics of the development within which the residents experience and evaluate their life compared to other urban settings were found to be an important QOL factor in the success rate.
Stakeholder involvement	Stakeholder involvement and empowerment from the very early stages of the planning, development and throughout the process helped to raise participants' awareness of their impacts on the outcome and therefore, resulted in higher levels of environmental performance within the projects due to responsible behavior among the residents.
Environmental model	Clear definitions of the goals and objectives with realistic plans and timetables to operationalize them helped to increase confidence and support from the diverse stakeholders. Also, early introduction of the plan with involvement and empowerment of all political, local and financial aspects were found to be essential for achieving the goals.

have emphasized environmental/technical as well as the social dimensions. As discussed by Baas et al. (2014) in the Swedish cases and further explored by Van Schyndel-Kasper (2008) more internationally, the bottom-up efforts in establishing developments involved environmental stewardship, strong community values and providing better quality of life for all members of the community. Important commonalities were found among the eco-village examples including the themes of 'systemic thinking, ecosystem health and overall sense of respect for all human and non-human inhabitants' (Van Schyndel-Kasper, 2008, p.17) some of which future eco-town planners may potentially adopt.

6. Conclusions and recommendations

In this two-part series of literature review articles, the urban development trends and the concepts that emerged and evolved along with the phenomenal transition of urbanization processes, starting from the late 19th century until present times, were reviewed. In this paper, the authors specifically focused upon the processes of the demonstration eco-towns that were developed in the Northwestern European context and sought to determine if they have helped or may help urban planners and municipal governmental leaders to accelerate the transition to more sustainable societies. It was found that it is important to assess the potential for the lessons learned from these developments to be applied in other parts of the same countries as well as in other countries. Furthermore it was important to ascertain what is transferable and what may need to be adapted to the climatic, geographic and cultural contexts of new settings.

Eco-towns, by nature, were perceived as urban development models that were designed and built to demonstrate a variety of advanced environment-friendly features. As the security or insecurity of energy, food and water provision for rapidly developing nations becomes more urgent, urban development models, some of which have much in common with the eco-town developments, began to gain momentum especially, among countries that can afford to build one or more to test and demonstrate their efficiency as well as their applicability. At the present rapidly increasing urbanization rate, it is critically important to take collective action with bottom-up participation and top-down commitment to establish more demonstration projects like the integrated eco-towns so that they become living examples in which to experience, learn, participate, enjoy and to mainstream the lessons learned from them. The challenges remain in terms of political and economic commitments as the true costs and benefits of these innovative urban models are not thoroughly understood by policy makers. Their implications on psychological, physiological,

sociological, environmental, and economic dimensions still require sound analyses and monitoring in order to compare and build upon the novel attributes of these urban development models with the conventional urban settings.

Revisiting Seuring and Müller's (2008, p.1706) review notes; they concluded (again with respect to their research topic of 'supply chain management' which became somewhat relevant in the context of eco-town developments") that there was "a deficit in the take-up of theoretical background" (Seuring and Müller, 2008) whereby, the development approaches became one dimensional rather than putting emphasis on all three dimensions of SD. As Birkeland (2012) suggested, the paradigm of Sustainable Development should seek to 'make everyone better off'. She noted that the existing assessment tools and methods focus more on the improvements of resource consumption levels, instead of on the net positive impacts that mostly allow "offsets which represent ecological losses rather than eco-positive gains" (Birkeland, 2012, p.165).

The policy frameworks upon which the demonstration projects were introduced still lack effective contextualization and therefore, a new approach is required in order to rapidly shift from a 'fragmented systems thinking to a holistic one'. Reed (2007) suggested that the role of designers and all stakeholders should be to create a whole system of mutually beneficial relationships to transition the eco-efficient design to a more effective movement that will help to regenerate the health of our environment of which the humans are a part. Such holistic approaches, one of which is called the 'regenerative' thinking or paradigm has been researched and emphasized by those such as du Plessis (2012); Reed (2007); Mang and Reed (2012); Hoxie et al. (2012); Cole (2012b, 2012a) and others. In line with the eco-town developments that were reviewed for their frameworks and processes in this study, regenerative design offers synergistic thinking that can positively contribute to the successes, hence the dissemination of the lessons and the results. As suggested by Cole (2012a), this approach requires a process-based framework rather than a product-based tool in guiding the design process, thus have various implications that could potentially emerge from the transition from green to the regenerative design. These aspects according to Cole (2012b, pp.51–52), were identified as:

■ *Re-establishing the design characteristics that were region-specific or indigenous in ways that offered solutions that were used perhaps traditionally but have largely been avoided by the mainstream architectural (also urban) design practices. By doing so, he emphasized, collective knowledge can be regained and subsequently adapted to the contemporary context.*

■ Secondly, the consensus among the stakeholders; whose involvement, participation and long-term commitment to the process has been pivotal in achieving the goals of the project in the first place.

■ Thirdly, creating the body of knowledge and re-setting of responsibilities among the diverse set of professionals/designers with holistic systems thinking, hence the design approach.

Furthermore, Birkeland (2014) suggested that a more comprehensive approach is needed to address the current paradigm's (SD)'s shortcomings. She emphasized that the 'physical development must also reduce the resource flows and transform the built environment on all scales' in order to tackle current global sustainability issues (Birkeland, 2014, p.6). Therefore, she proposed the Positive Development (PD) as a design-based theory (and also as a framework) to improve upon the alternative approaches (such as the regenerative) and to move beyond the restorative or reductionist thinking, especially deployed in the realm of mainstream urban planning.

Therefore, while the eco-town developments are increasingly becoming the testing grounds for all social, environmental, technological and economical aspects, they also require new approaches in order to address the implications of rapid urban growth. These potential implications were expanded upon in this two paper series of literature review and they were identified, in parallel, as the contributing factors for establishing successful eco-town developments. The transfer of the best practices and lessons gained from these urban development projects in the North-western Europe to other cultural and geographical contexts could be catalyzed through the integration of design-based thinking, which requires 'place' and 'culture' based contextualization and operationalization of goals central to improving the environment in which to live, thereby helping to create positive net developments for all inhabitants.

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