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Going green vs going smart for sustainable development: Quo vadis?

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Abstract

To date, sustainable development has been the most important discourse informing planning, a powerful rhetoric for solving environmental problems that shows confidence in human ingenuity and technological advancements. However, recent advances in information and communication technologies, are prompting the development of smart(er) approaches to (sustainable) development, which might be signifying a departure from the more traditional, or perhaps earlier, greener narratives underpinning sustainable development. Within this context and informed by analysis of the literature, this paper aims to reflect on the extent to which ideas of going green and going smart are converging or diverging from the path towards sustainable development. This is done using convergence theory and Bennet's typology (1991) of similarities as an analytical framework. The findings suggest that the convergence of greening and smart ideas for sustainable development might be better achieved if smart-centric approaches to policy- and planning are subsumed in the overarching vision of environmental quality and resilience, with green approaches to urban development setting the path and driving decisions towards a sustainable future.

Key words:
Going green, going smart, sustainable development, ecological modernisation, convergence, Divergence.

1. Introduction

There is no doubt that to date, sustainable development has been the most important discourse informing and guiding the philosophy of planning, and planning interventions (Hamdouch and Zuindeau, 2010). Since its formal introduction in the mid-1980s by the World Commission on Environment and Development (WCED) with the publication of the so-called Bruntland Report, it has accrued a long history, and is now firmly rooted in public policy and on a statutory basis in planning in many countries around the world (Owens and Cowell, 2011). Though many ambiguities in terms of meaning and about how it should be operationalised remain unsolved and unclear, sustainable development still provides decision-makers with a powerful rhetoric based on which people's standards of living can be ameliorated, whilst at the same time avoiding uncompensated future costs. Thus, it presents a win-win solution to environmental problems that shows confidence in human ingenuity and technological developments, as reflected in the Bruntland Report itself (WCED, 1987): "(…) accumulation of knowledge and the development of technology can enhance the carrying capacity of the resources base (…)" (p.45); "(…) we have the ingenuity to change (…)" (p.205). There is therefore an underlying assumption, which can be likened to ideas of ecological modernisation, that a more productive use of natural resources aided by technological advancements and institutional change can lead to future sustainable growth and development.

Further, that the economy can benefit from moves towards environmentalism, if innovative structural product and process changes are pursued and progressed.

The mobilisation of sustainable development through planning has essentially resulted in the development of greening strategies and approaches which acknowledge that the environment is a source of goods and services to use and an asset to enhance; and in planning and decision-making outcomes being, to a certain extent, less environmentally damaging than they might have been otherwise (Owens and Cowell, 2011). Greening efforts have been implemented in particular through the "integration principle" (Pollack and Hafner-Burton, 2010), based on which an integration-led approach to policy-making could help position the environment at the heart of policy-making across sectoral policies and departments (Hertin and Berkhout, 2003; Russel and Jordan, 2007), rather than as a policy add-on following an "end-of-pipe-approach" (Lenschow, 2002). Further, different types of environmental appraisal instruments have been introduced to assist, inform and/or test the greening of policies and plans, and help foster change towards more sustainable and environmentally conscious patterns of development (Gazzola, 2013; Jha-Thakur et al., 2009; Owens et al., 2004). However, recent developments and growing pressures in fields such as climate risk, coupled with innovations in practice, are suggesting a move away from "traditional" environmental (protection) concerns and greening efforts (Davoudi, 2014); and are re-emphasising or reminding us about the ingenuity of humans in advancing technological and scientific progress to assist with the transition to a low carbon economy, in the name of energy and resource efficiency use (While et al., 2010).

Advances of information and communication technologies throughout the globe are raising questions about the extent to which they can be instrumental in fashioning a more sustainable way of living. A development vision that is rapidly taking shape and consolidating, and becoming popular in both the academic and policy literatures, is that defined by the idea of "going smart". Worldwide, cities are being prompt to realign their services and manage their assets, including transportation linkages, mixed land-uses and urban and community services, more efficiently and provide real time responses to challenges as and when they occur, by harnessing and integrating technologies, such as ICT (Information and Communication Technologies) and the IoT (Internet of Things) (Albino et al., 2015). The application of these technologies is intended to enhance the performance, quality and delivery of urban services to reduce costs and tackle inefficiencies, carbon emissions and resource consumption on the one hand; and on the other hand, generate long-term positive effects on the economy, and citizens and government relations (Komninos, 2014; NYC, 2015), by enabling citizens to become active participants of a community (Department for Business, Innovation & Skills, 2013).

However, the take up of the concept of smart cities and more in general of *going smart,* could be signifying a departure from more traditional, greener narratives underpinning sustainable development. They aim to find ways or better solutions, for "sustaining" modern lifestyles, thus for perpetuating existing conditions and/or increasing natural resource and energy consumption albeit more efficiently; rather than positioning the environment at the heart of policy-making and central to planning interventions for sustainable development. Questions can therefore be raised about the extent to which going green and going smart concepts overlap or better converge in their quest for sustainable development, or differ or diverge leading to different directions or interpretations of sustainable development that might prioritise, for example, environmental primacy or efficiency discourses. Against the backdrop of ongoing and/or transiting narratives within our understanding of

sustainable development, this paper aims to reflect on the correlation between the ideas of "*going* green or greening" and "*going* smart", looking in particular at how they are informing planning- and policy-making. Though fully cognisant of the inextricable links between these ideas and literatures, to fulfil the paper's aim the focus is repeatedly shifted from one to the other to gain better insights into such links and correlations, which are then unpacked and discussed using convergence theory and Bennet's typology (1991) of similarities as an analytical framework.

2. Overview

With the introduction of sustainable development, came the recognition that green issues cannot be tackled in isolation from people's everyday lives. Planning is about people, and understanding their ethical position in relation to the environment within the context of everyday living is part of what planning does and is about. Therefore, it is not surprising that under the sustainable development rhetoric, planning has played a key role in mobilising sustainable development by going both, "green" and/or "smart". In order to develop an understanding of how these ideas are influencing planning and people's choices, a brief overview of each of these ideas is provided and their links are subsequently explained by borrowing ideas from convergence studies.

2.1. "*Going* green"

Initial global enthusiasm for sustainable development resulted in green issues finding a place in policy- and decision-making processes in countries around the world, as reflected in the setting of environmental objectives in policies and in the consideration of environmental changes resulting from policy implementations. Agenda 21 for example, legitimised the role of planning suggesting that policy- and plan-making should aim to "(…) ensure socially responsible economic development while protecting the resource base and the environment for the benefit of future generations" (UN, 1992, p.66). Whilst in practice this has led to different interpretations, it is generally agreed that preserving "(…) intact the environment as we find it today in all its forms" is a requirement (Beckerman, 1994, p.194). This requirement is particularly evident in debates that took place in Europe in the 1990s, with expressions such as the "greening of public policy" or "environmental policy integration" (EPI) populating policy and academic literatures at that time (Hertin and Berkhout, 2003; Lenschow, 2002; Russel and Jordan, 2007). They aimed to readdress the balance between environmental and socio-economic issues in planning for sustainable development, so that the primacy of the environment would be acknowledged (Lafferty and Hovden, 2003). Put simply, they called for the systematic incorporation or integration of environmental issues throughout all governmental institutions and policies; a greening effort that would also affect those values, norms and practices underpinning and informing policy-making and planning. However, difficulties in agreeing on what greening or environmental integration meant in practice led to the failure of these efforts (Lenschow, 2002).

Notwithstanding this, after years of implementation, greening efforts are still relevant and a widely supported principle within the European context for example, though in everyday practice it "remains surprisingly fragmented" (Jordan and Lenschow, 2010, p.148). More recently, triggered by the latest global financial crisis and in response to calls for finding new ways to address future uncertainties, the idea of going green has made somewhat of a comeback (Gazzola, 2013), as indicated in the use of expressions such as green development, green economy, green budgeting or green growth, to name a few. A renewed interest in discourses about environmental limits and the

revisiting of the ecosystem services concept has prompted policy-makers to look at the environment as instrumental for relaunching the economy and for enhancing society's quality of life (FitzRoy et al., 2012). In a global economy that is essentially defined by its commitment to the pursuit of (economic) growth, it is somewhat ironic that it is the monetarisation of ecosystem services that is helping to put environmental issues back onto public policy agendas (Slootweg and van Beukering, 2008), though the extent to which this is resulting in genuine greening efforts is being questioned (Conniff, 2012; Turpenny et al., 2009).

The idea of going green has a long history, with priorities changing through time, and in response to social and political circumstances. Based on Dryzek (2005), when framed within a sustainable development discourse, going green can be underpinned by powerful rhetorical notions, such as the idea of progress and the direction that improvements should take, and the oratory of reassurance, in that "we can have it all: Economic growth, environmental conservation, social justice; and not just for the moment, but in perpetuity. No painful changes are necessary" (ibid., p.157). Though these notions have given rise to various criticisms, there is still belief that sustainable development can be instrumental in the pursuit of going green and of advancing the environmental agenda (Lafferty, 1996), and that competing values can be reconciled as claimed by ecological modernisation. Coined in the early 1980s, ecological modernisation is both a policy discourse (Hajer, 1995) and an analytical approach. It looks at the environment and at advances in environmental policy as having positive influences on economic development in terms of efficiencies and technological innovations, which in turn could provide opportunities for environmental gains (Gouldson and Murphy, 1996). This is to be achieved by enabling modern societies to identify and manage existing and emerging environmental problems (Murphy and Gouldson, 2000); therefore, empowering people to (choose to) change their lifestyles. Within planning, policies representing major shifts towards the application of renewable energies and the transition towards low or zero carbon initiatives/solutions are often labelled as examples of ecological modernisation.

In this context, progress in eco-innovations are essential, as through environmentally friendly technologies, resource productivity and resource efficiency could be increased, and the long-term requirement and ambition for environmentally friendly (sustainable) development achieved (Jänicke, 2008). According to Hajer (1996, in Gouldson and Murphy, 1996), this would be a rather optimistic outcome, as it suggests a willingness to pursue and embrace radical and meaningful changes which could transform the way in which we live and operate as a society in the quest for sustainable development. The importance of the environment to society's well-being and to the global economy, coupled with the escalating and worsening of environmental problems, would justify such a stance and the continued need to "go green". In a number of cases progress has been achieved in the making of sectoral policy choices, with the development of pro-environment smart technologies contributing to reducing human-induced environmental impacts and resource consumption; but good or best practice is not enough to satisfy greening credentials, particularly if they are countered by worsening environmental conditions or overtaken by consumption growth (Midden et al., 2007).

Hajer (1995) also presents a more pessimistic outcome, which looks at ecological modernisation as a technocratic project, which means continuing with the status quo and mitigating the effects of greening efforts to protect established ways of doing things or maintaining existing centres of power (ibid). In other words, aspiring to what Farley and Smith (2014) called a "business as usual plus" approach or "faux sustainability", which is the simple perpetuation of existing conditions based on

high consumption levels and protection of material privileges (Sachs, 1992). Findings by research conducted by Murphy and Gouldson (2000) show how the potential for promoting radical innovations in legislation is not being maximised, with regulations restricting the implementation of environmental control measures, and structural limits "seriously" affecting the extent to which ecological modernisation can be viewed as a smart "solution to environmental problems over the longer term" (p.43). Research also shows how technological advancements are having profound impacts on peoples' lifestyles and choices, making certain choices such as owning and driving a car, more attractive (Midden et al., 2007), with smart technical efficiency gains making up the "plus" effect towards sustainable development, whilst also perpetuating the "business as usual" stance.

On this basis, can smart solutions assist policy in going beyond the aspirations of faux sustainability or "business as usual plus" to meet the greening expectations of sustainable development?

2.2. "*Going* smart"

The idea of "going smart" within the field of urban planning is likely to have its origins in the smart growth movement of the late 1990s (Bollier, 1998). It advocated for an intelligent, efficient and intentional planning approach to the distribution and development of urban settlements in response to mounting problems of urban sprawl, traffic congestion, aging utility lines, neighbourhood vulnerability to the effects of climate change, urban degradation and other multi-faceted socio-economic challenges (Rodriguez-Bolivar, 2015; Townsend, 2013). From the mid-2000s, fuelled by technological progress and advancements, the concept of "smart city" rapidly evolved. Initially understood as a pragmatic engineering-based attempt to improve the operation of individual urban infrastructure and/or services through technology innovations, it rapidly evolved into considering the wider interactions that occur between the many systems within a city; albeit without an underpinning theory or understanding of the systems to be connected (Cavada et al., 2016). A more contemporary understanding of going smart entails solving urban challenges by harnessing arrays of data from ICT and internet-connected devices. In fact, smart city has been defined as "a new concept and a new model, which applies the new generation of information technologies such as the internet of things, cloud computing, big data and space/geographical information integration, to facilitate the planning, construction, management and smart services of cities" (ISO-IEC, 2015, p.2). Smart city initiatives have now asserted the transformational power of smart technology, marked by the increasing ubiquity of sensors that collect and in some cases share or communicate data that can be used in almost infinite ways (e.g. weather sensors determining speed limits for road safety – Haugh and Grosanic, 2016; indoor and outdoor air quality sensors for managing health exposure – Kumar et al., 2016; Pilla and Broderick, 2015; distance sensors facilitating alignment of vehicles – Liu et al., 2017). The idea of going smart is also increasingly being positioned at the heart of city governmentality and living (Rodriguez-Bolivar, 2015). According to Deakin and Al Waer (2011), through community involvement citizens can improve the collective intelligence of a city's institutions and their functioning through e-governance by means of participation and co-design. The upshot is the capacity to learn, adapt and innovate, and thereby respond more effectively and promptly to changing circumstances by improving the intelligence of a city, whilst meeting market demands (i.e. of citizens) (see also Hollands, 2008).

Going smart can therefore be understood as the intelligent management of man-made environments (Ahvenniemi et al., 2017; Angelidou, 2014; Bibri and Krogstie, 2017). Following

Caragliu et al. (2011), the emphasis is on improving administrative and economic efficiency whilst encouraging business oriented development and facilitating social inclusion through the delivery of public services. According to some, as the anticipated efficiency pursuits span the social, economic and environmental dimensions, from an ecological modernisation perspective, going smart can be seen to promote sustainable development (Ahvenniemi et al., 2017; Bifulco et al., 2016). By relying on human ingenuity and technological advancements, real-time generation and analysis of contextual and actionable data can enable urban systems to become increasingly knowable and controllable in new dynamic ways (Kitchin and Dodge, 2011; Shepard, 2011). The increased centralisation of administrative and operational data is breaking traditional data silos providing for a more integrated view of resources, services and infrastructures that can better guide daily functioning, operations, long-term planning and policy formulation for sustainable settlements (Bibri and Krogstie, 2017; Kitchin et al., 2016). This in turn, can connect organisations, eliminate duplication in planning processes, highlight existing data and knowledge gaps, identify which planning areas and sectors to coordinate and integrate, in ways that intelligently address environmental concerns and meet societal needs (Murray et al., 2011), creating a socio-ecological system in balance (Bibri and Krogstie, 2017).

However, recent studies suggest that there is still a disconnect between going smart and sustainable development (e.g. Ahvenniemi et al., 2017; Bibri and Krogstie, 2017), translating into a rather fragmented and somewhat *ad hoc* approach to smart city development (Anthopolous, 2017; Kitchin et al., 2016). Smart city developments are largely centred on the social and economic sustainability nexus, with the consideration and prioritisation of the environmental and social nexus not evidenced as yet, or at least not in a sufficient and systematic way (Ahvenniemi et al., 2017). Their aims are to pursue convenience of public services, efficient city management, liveability of the environment, smartness of infrastructures, and long-term effectiveness of network security, partly in response to recent climate change debates and the related role of cities. (Smart) responses to climate change are in effect becoming markers of cities' identities and an integral part of urban planning (Gustavsson and Elander, 2012), further legitimising the shift towards, and take-up of, smart(er) trends in urban modernisation policy and planning (de Jong et al., 2015). But this in turn, is weakening and reducing the scope of the environment (Gargiulo Morelli et al., 2013; Viitanen and Kingston, 2014), and the greening expectations underpinning sustainable development. As noted by de Jong et al. (2015), when "going smart" green terms are mainly used in reference to green spaces and recreational parks, excluding the consideration of other environmental and ecological issues, such as biodiversity. Following Janicke (2008), it could well be that the niche application of smart and eco-innovations and the reduced scope of the environment might be limiting the extent to which ecological modernisation perspectives can contribute to sustainable development through smart approaches, particularly if the smart or intelligent solutions put forward address symptoms rather than causes of environmental impacts. This has prompted Zaccai (2012) to question whether we can have it all, whether win-win solutions can be pursued and whether going smart is the way forward, as progress to date has been too slow to be considered effective (ibid., Janicke, 2008). Put more simply, "the 'efficiency revolution' is not enough" (Janicke, 2012a, p.20). By contrast, as reflected in the EU 2020 document "A European strategy for smart, sustainable and inclusive growth" (EC, 2010), win-win solutions can be possible if based on a realignment of the environment, the economy and climate change, whereby smart approaches to growth can be instrumental in addressing these three mutually reinforcing priorities. According to Janicke (2012a, p.18), the factors underpinning these

priorities, that is "innovation, knowledge intensity, resource productivity, and investment in environmentally friendly processes and products … with the added social dimension", could set the foundations for a new concept of sustainable development.

2.3. Going green versus going smart – quo vadis?

Based on the overview presented, it is apparent that the ideas of "going green" and "going smart" embody distinct conceptual perspectives, which have implications in practical terms on how they translate into policy discourses and contribute to sustainable development. At times, they appear to overlap or converge, for example in the understanding that scientific and technological advancements and innovations are a necessary condition of and for sustainable development; and in the need to look at people as solutions, who can introduce change if they *choose* to make it happen. On the other hand, they appear to diverge, for example in relation to the emphasis put on environmental sustainability, with discourses of environmental primacy guiding greening approaches and discourses of efficiency underpinning smart(er) approaches to growth. Whilst promoting future sustainable development might be their ultimate aim or vision, taking "going green" or "going smart" paths could therefore lead to different directions, or to solutions and dilemmas that might slow down progress towards sustainable development or even cause detours; thus, *quo vadis*? To reflect further on these issues, the paper explores the correlation between the concepts of going green and going smart by borrowing ideas from studies on convergence.

Generally speaking, convergence can be defined as an "increasing similarity over time" (Plümper and Schneider, 2009, p.991), set in motion initially by processes of industrialisation and modernisation, and more recently, by globalisation forces (Drezner, 2001; Plümper and Schneider, 2009). These processes are underpinned by a logic that generates economic and technological imperatives, contributing to the harmonisation of societies, the permeation of ideas or the uniformity of policies across borders, sectors, areas and practices (Kerr et al., 1960). It is within this context that environmental innovations, in terms of agendas, instruments, international policy and regulatory competitions, are resulting in environmental policy change and convergence (Busch and Jörgens, 2005; Holzinger et al., 2008). Convergence therefore occurs when in response to these imperatives, societies grow alike to develop similarities that "… shape social structures, political processes and public policies in the same mould" (Bennet, 1991, p.216), culminating in common conditions or outcomes.

Though widely used in many areas of political science and public policy, as a concept, convergence comes with methodological and conceptual normative assumptions (Bennet, 1991) and theoretical under-specifications (Plümper and Schneider, 2009), leading to differences in the way in which it is understood and used, some of which are more sophisticated than others (Pollitt, 2002). In more simplistic terms, for example, convergence can be used to describe similarities in policies and approaches, and divergence can be used to discuss differences (Bennet, 1991; Pollitt, 2002). According to Inkeles (1998), convergence can also be understood as a process of "becoming", thus of moving from different positions towards a common point, emphasising therefore a transition between positions over time (Bennet, 1991). In relation to the aim of this paper, this could mean on the one hand, using convergence to represent the extent to which "going green" or "going smart" directions or paths are moving towards the common aims of sustainable development and aligning themselves to the expectations underpinning sustainable development; with similarities between

the two paths emerging throughout this process. Following Bennet (1991, p.218), these similarities could be expressed in terms (a) of *goals*, thus of a coming together of going green and going smart intents to deal with common problems; (b) of *content*, as formally manifested in policy; (c) of *instruments*, for instance smart and eco-innovations; (d) of the *outcomes or impacts* of going green or going smart, whether positive/negative or effective/ineffective; and of (e) *style*, for example, in terms of how these ideas are formulated and agreed upon. On the other hand, economic and technological imperatives, including dominant environmental ones such as those related to climate risk, could prompt the two paths of going green and going smart to diverge from each other and maintain their distinct conceptual perspectives. This could lead to moves towards a more specific destination, for instance one that is characterised by narratives of efficiency or of "business as usual plus" approaches. Alternatively, following Radaelli (2005), this divergence could simply contribute to the diffusion of certain elements of sustainable development underpinning going green and going smart ideas, without necessarily converging towards the common aims of sustainable development. This is based on the assumption that contextual contingencies, or cultural, political or environmental characteristics, can influence societies' development paths and how they respond to growth, and other imperatives (Kalogeraki, 2009).

3. Methodology

Drawing on academic and policy literatures, the paper explores the extent to which going green and going smart are converging towards the common aims of sustainable development. This is done by loosely following Bennet's (1991) five manifestations of convergence introduced in the previous section: goals, content, instruments, outcomes or impacts, and style. While cognisant that convergence studies would normally require longitudinal research and are mostly conducted within the tradition of comparative case-studies (e.g. between policy sectors or countries), in this paper specific cases are not examined. Rather, the ideologies, narratives and traits emerging from the discussions of the literatures presented in the previous sections on going green and going smart are used as a basis to explore convergence in terms of Bennet's five meanings.

Bennet's (1991) five manifestations of convergence were also used as key words to structure the academic literature search and review findings. Other key words that guided the literature review were variations of the terms "green" and "smart", with these variations referring to the context of application of the terms within the wider subject areas of planning and policy-making, and urban studies. These include, for example, green or smart development, economy, growth, cities, societies, technologies and solutions, which represent a selection of sustainable development-related concepts that have evolved over time, and have been found in both, the going green and going smart literatures (see Box 1). A number of academic databases were used to support the literature review, mainly Web of Knowledge, Science Direct, Scopus and Google Scholar. As studies published in academic journals and books often contain references to, or analyses of, policies and practice-based case-studies, a snowballing approach was applied to inform the search of the policy literature.

Insert Box 1 near here

Searches of the academic and policy literatures resulted in articles aimed therefore at unpacking the correlations between going green and going smart for sustainable development, for each of Bennet's five manifestations of convergence. Articles reflecting on the changing nature of sustainable development and environmental discourses, were central for the "goals" manifestations (e.g. Zaccai,

2012; Davoudi, 2014; While et al., 2010). For “content”, the review generated articles of a more practice nature (e.g. Janicke, 2008, 2012a; Martinelli and Midtun, 2010; Vanolo, 2014). For “instruments”, the reviews generated articles conceptualising peoples choices and behaviours, whether greener (e.g. Steg and Vlek, 2009) or smarter (e.g. Viitanen and Kingston, 2014), and the manifestation of “outcomes and impacts”, reviewed the prons and cons of doing so (e.g. Ahvenniemi et al., 2017). Finally, for “style”, the reviews focused particularly on planning-related sources (e.g. Rodriguez-Bolivar, 2015; Russel and Jordan, 2007; Lascoumes and Le Gales, 2007; Meijer and Rodriguez-Bolivar, 2013), as planning is considered one of the most common means for operationalising both, going green and smart agendas, through the development of strategies, visions, policies and plans.

4. Results and discussion

4.1. Goals

As previously discussed, both going green and going smart ideas or approaches can be likened to sustainable development, in that they are helping to address or identify new routes out of environment and development conflicts and a re-alignment of environmental, societal and economic objectives. These new routes have prompted a revisit of older discourses about limits, which in the case of going green, has over the years led to the strengthening of the regulatory and policy basis for environmental protection priorities (Owens and Cowell, 2009); and to (partially successful) attempts to influence consumers behaviours (Zaccai, 2012, p.86). More recently, it has resulted in the (re-) positioning of the environment as central for economic recovery and fiscal stimulus policies (Barbier, 2009), following ecological modernisation discourses (Feindt and Cowell, 2010). Whilst following the 2008 global financial crisis there are indications suggesting that the greening of the economy may have been effective (UNEP, 2011), we are also being alerted to the dangers of using “going green” approaches for re-aligning or balancing trade-offs between environmental protection and enhancement, and economic growth and development (Turpenny et al., 2009). As noted by Zaccai (2012, p.86), though “for some concerned citizens and some parts of business sectors … “green” trends have been seen as having major influence”, their impact has been limited within wider and general trends, “(…) and currently not substantially deflecting the growing curves of some of the most serious impacts” (p.87). Conniff (2012) further highlights the discomforts voiced by many, of viewing the environment as a service provider subservient to the global economy and its services as fungible, resulting in fundamental changes about how we view or position ourselves in relation to the environment; and about the extent to which we acknowledge the importance and primacy of the environment as a foundational system (Farley and Smith, 2014). Questions could also be raised about the purpose of greening or of going green, in connection with economic and technological imperatives as well as environmental innovations, influencing the policy and politics of planning for sustainable development. This point is explored further in the next section.

Triggered by growing pressures in fields such as climate risk, the revisiting of discourses about limits is also raising questions about the more “traditional” or greening approaches to solving or framing environmental problems or crises (Davoudi, 2014; Zaccai, 2012) and about the negotiability of environmental concerns in the name of carbon control and critical vulnerabilities management and energy efficiency (Preston et al., 2011; While et al., 2010). In this context, the creative compromises between economic growth and environmental protection that underpin most sustainable

development decisions and actions are put under pressure by the prescriptive nature of climate change mitigation; for example, the exclusion of agricultural land from urban development for no other reason than the preservation of land's organic carbon storage capacity (While et al., 2010). The idea of going smart resonates well with the take-up of narratives of resource and energy efficiencies, of vulnerabilities, of resilience and of carbon control management that underpin the emergence of climate change as a guiding and organising principle for planning and public policy. Climate adaptation strategies in particular are prompting cities to take action, as most impacts are likely to be local; and cities around the world are responding by climate-proofing themselves (Boer, 2009), with being rated as "smart" now an almost mandatory provision (Reckien et al., 2015). As previously discussed, narratives of resource and energy efficiency are unlikely to be effective with the wider scope of environmental concerns that are reflected in greening efforts, resulting in trade-offs between environmental objectives (for example, investments in wind energy and windfarm developments to reduce carbon emissions against land/seascape protection), or in a move away from the consideration of more "traditional" environmental concerns, such as biodiversity or water quality.

4.2. Content

Since the Brundtland Report, sustainable development as a concept and discourse has continued to evolve and be influential, though not radically transformative (Hopwood et al., 2005). The dominance of ecological modernisation perspectives or of the views of "modernisation losers" (Janicke, 2008), means that possible government and governance responses or approaches are bound by the "status quo", where business as usual models prevail. In this scenario, the onus of change is limited to the choices that people are willing to make to sustain their modern lifestyles, representing the "plus" effect described by Farley and Smith (2014). The emphasis or better responsibility for intervention has somewhat shifted from government to multi-level and multi-actor engagements of civil society, working in both formal and informal networks and coalitions, along with the state and industries to achieve a common goal (Martinelli and Midtun, 2010). In this context, individuals or more in general people are looked at as consumers, who are responsible for the environmental problems that occur as a result of their lifestyle choices and behaviours (Maniates, 2001); and who have the capacity to improve or address these problems by making greener and more techno-efficient choices (Moloney and Strengers, 2014), without having to change or renounce their modern lifestyles.

Going-green and going-smart approaches are also having to adapt to the changing contexts of sustainable development. In the case of going green, in simple and broad terms, this has resulted in a shift from environmental integration-led institutional, policy and practice-based greening efforts to the development of environmental- or eco-innovations and growth of the environmental sector, first as a provider of technological solutions for environmental protection, and then, of energy efficient technologies and material saving processes and products (Janicke, 2008). Particularly within the context of climate-friendly technologies, this shift is in turn leading to high levels of competitiveness among a growing number of industrialised and emerging countries, resulting in intensive innovations (Janicke, 2012a). The dynamic interactions and positive correlations between greening policies and technical innovations is setting the basis for a new kind of approach to going green, that does not stem from responses to climate change or wider environmental impacts, but from economic advantages (Hekkert et al., 2007; Janicke, 2012a). Examples of this approach can be found in

national level policies in South Korea, Germany and China (Janicke, 2012b); and in several institutions, such as the OECD (2011) with its "Green Growth Strategy"; UNEP (2011) with its "Green Economy Report", and in the EU's "Europe 2020" strategy (2010). However, for some this new approach to going green is, in essence, a re-interpretation of sustainable development in terms of climate change partly influenced and informed by international pressures for change, which require governments worldwide to re-define their political interests, re-orient civic values, and re-shape business strategies and technological change (Martinelli and Midttun, 2012, p.3).

The idea of going smart has also evolved. Initially referred to as pragmatic attempts to improve the operating of urban infrastructures and services through technology innovations, it has transformed into a more dynamic and powerful understanding which produces the "responsibilisation of the city" and the co-production of "smart citizens" who are actively invested and morally obliged to adapt to and live in smart cities (Vanolo, 2014), on the basis of environmental protection concerns, technological upgrading and quality of life (ibid., p.893). However, when examining the introduction of smart city visions in Italy, Vanolo goes as far as saying that the moral obligation to contribute to smart city projects and initiatives can be considered a form of "social control" by "government at a distance" that can be both intrusive and manipulative, in the way that people can be coerced into making greener choices (p.893-894). For example, city councils allowing electric vehicles to park for free in urban areas or to pay lower annual road taxes can be presumed to push consumers into buying electric vehicles (Bjerkan et al., 2016). Financial incentives and taxation facilitated by smart meters are increasingly being implemented to "force" a change in consumption patterns, optimise natural resource use and reduce emissions (e.g. Gans et al., 2013; Harutyunyan, 2014; Sovacool et al., 2017), albeit often with a financial rather than a sustainability motive (Bresnihan, 2016). Further, according to some, by becoming consumers of technologies, citizen participation is often restricted to defining smart cities in terms of citizens' digital consumer experience of urban systems and infrastructures. This results in a lack of consideration for parts of a city and of its population, making any outcome of a digital participatory process less effective in terms of mitigating future social and climate risks (Sovacool et al., 2017; Viitanen and Kingston, 2014).

4.3. Instruments

To a certain extent, going green and going smart approaches come together to find ways or better solutions for "sustaining" modern lifestyles through innovations, process changes and technological and scientific advancements. This is based on the recognition that as a social construct defined by human potentials, cultural connotations and economic forces, the environment cannot be tackled in isolation from people's everyday lives. People are to be viewed as solutions and are instrumental for change to take place (DuNann Winter and Koger, 2004; Vlek and Steg, 2007). This means acknowledging that many environmental problems can be managed by changing people's behaviour (Steg and Vlek, 2009), for instance, towards greener and/or smarter choices. It also means considering peoples' capacities for change, in terms of differentiated levels of education, wealth, power and access to resources; and identities, in terms of lifestyle and life experiences, beliefs and perceptions, to establish our ethical position in relation to the way we use the environment and the extent to which we are willing to foster, and accept social change, including changes to our everyday life. In essence, the confidence in human ingenuity and technological developments reflected in the Bruntland Report itself is still very much central to the amelioration of peoples' lives, whether done

to promote more efficient/smarter choices and behaviours, or whether to promote more radical changes.

With the support of European funding and investments of large companies, “smart cities” are enthusiastically being marketed as “good cities”, with smart technologies portrayed as instrumental for developing a vision for the cities of tomorrow that is far removed from economic crises, and that can manage both, climate and financial risks (Vanolo, 2014). Equally, discussions about growth and about how to deal with pressing financial problems in the face of climate change, are leading to a reframing of greening ideas and of the concept of green growth, no longer restricted to the environmental sector alone, but to the entire economy and production system, including green, low-carbon and resource-saving processes, products and innovations (Janicke, 2012a). Following the 2008 global financial crisis and the increasing political buy-in to climate change policies, the characterisation of climate change as a “market failure” and investments in the climate-friendly low carbon green economy, are helping to promote a view of sustainable development that could be achieved by promoting smarter, cleaner and low carbon choices, as reflected in the Stern report (Hinton and Redclift, 2009); and by investing in and adopting radical innovations, as a way of pursuing the goals of ecological modernisation and securing both, environmental sustainability and economic growth (Murphy and Gouldson, 2000; Viitanen and Kingston, 2014). However, such unreserved faith in human ingenuity and technological developments for visioning sustainable future urban developments, whether driven by going green or going smart narratives, does come with risks (Vanolo, 2014; Viitanen and Kingston, 2014), as subsequently explored.

4.4. Outcomes or impacts

Arguably, both green and smart approaches are contributing to better quality lifestyles, improved services and more navigable and climate-proof urban environments. However, the way in which they deliver these improvements, or exert positive impacts in our living environments, often differs and results in diverging and disconnected interventions with regards to sustainable development (Ahvenniemi et al., 2017). In essence, green initiatives can be seen as strategic in nature, devising measures as part of planning and/or policy that lead to positive physical environment outcomes. Environmental protection and resource conservation are at the heart of green initiatives, entailing planning alternatives and actions that, for example, promote use of renewable energy sources, increase ecosystem services within urban systems or implement soft measures to ameliorate climate risks (e.g. flooding) and reduce emissions (e.g. walkable cities) (e.g. Leyden, 2003). Smart systems can help tackle these issues in a similar way but rather with a human and technological focus, using a deploy-and-monitor approach whereby smart devices are implemented to increase the knowledge base by monitoring social behaviour and system performance, and subsequently encouraging users to adapt and adopt new behaviours (e.g. energy usage, mobility choices or access to services) promoting smart communities and smart governance (Ahvenniemi et al., 2017).

As previously observed, smart devices are becoming instrumental to the management of urban systems. Yet, the technological foundation of smart interventions can have adverse outcomes for the environment as a result of an unsustainable use of natural resources. Increasing the efficiency through technology may be seen as improving system performance (e.g. reducing time and resources needed to provide a given service and thus promoting socio-economic sustainability), yet this does not necessarily reduce the environmental impact of such technology (Williams, 2011). To a

certain extent, negative impacts are unavoidable in smart initiatives, associated with the life cycle of smart devices, i.e. their manufacture, usage and disposal, entailing significant environmental effects/issues in relation to: a) exploitation of resources such as metal mining in developing countries (Castro and Sanchéz, 2003; Hilson, 2002) and associated exposure to contaminants hazardous for the environment, wildlife and human health (Oguchi et al., 2013; UNEP, 2009); b) energy usage, e.g. from data centres used to store cloud servers and process information (Williams, 2011); and c) e-waste management (Apple, 2016; Robinson, 2009; UNEP, 2009; Williams, 2011). In this context, smart initiatives may fail to meet the fundamentals of sustainability, and an unsustainable city is not "smart" (Ahvenniemi et al., 2017).

4.5. Style

Different pathways for mobilising going smart and/or going green ideas are noticeable, with planning being perhaps the most common means for operationalising these ideas through the development of city-level strategies, visions, policies and plans around the globe (Rodriguez-Bolivar, 2015). Within this context, global and European initiatives have been instrumental in facilitating the "greening of public policy" (Russel and Jordan, 2007), with the consolidation of environmental assessment practices, such as Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA), helping to ensure that the environment is taken into consideration in decision-making for sustainability (Gazzola, 2011). The take-up of greening initiatives in planning is not only illustrative of the worsening of environmental conditions and of the need to reduce or avoid harmful developments, but they also reflect changes in people's attitudes, expectations and increased sensitivity to the quality of the environment (Inglehart, 1990). As a key area for government policy and intervention, planning benefits from the government(s)'s role and expectations, regulatory and institutional capacity and legitimacy to provide collective benefits and public goods such as environmental protection through greening efforts and mechanisms. However, how far these efforts go is influenced by and dependent on the level of demand and pressure for going green (based on Buttel, 2001). Following Lascoumes and Le Gales (2007), the scope and range of policy and planning instruments are indicative of underlying power structures and relations between governing institutions and societies influenced by technical and social intermediaries; and giving rise to different ways or styles for operationalising going green ideas, or for helping people make greener choices. These could include, for example, a combination of sticks (regulatory instruments), carrots (economic instruments) or sermon (informational or communicative instruments) approaches (Vedung, 1998), which can be distinguished based on the power or degree of authoritative force involved, i.e. in the decreasing level of coerciveness of regulative, economic and communicative instruments (Weber et al., 2014). These approaches go beyond the arena of government intervention or public policy, to extend to the corporate world as well, where companies can be punished for ungreen behaviours or regulated to reduce opportunities for ungreen behaviour (sticks); they can be rewarded for green achievements or for making green behaviour easier (carrots); or they can be seen to guide or encourage practices or choices that are perceived to be desirable (sermons). Whether effective or not, and regardless of the arena of application, ultimately going green approaches are limited by the very aspect that they deal with, the human character, and with a wide range of behavioural choices and alternative outcomes (Glasbergen, 1992).

Planning has also been instrumental in ushering going smart ideas around the globe, albeit in different ways, in both, developed and developing countries. New York's "Smart City, Equitable City"

strategy for technology and innovation (Smartcity, 2017), for example, illustrates how the actualisation of connected devices and the IoT can go beyond the goal of closing the digital divide, by providing every resident and business with just access to affordable, reliable, high-speed broadband services and digital facilities. According to Smartcity (2017), it is New York's commitment to achieving equality that makes its approach and efforts to going smart human-centred; and instrumental for achieving "economic growth", "justice and equity", "sustainability" and "resilience" with the support of all "kinds of New Yorkers"[1] (OneNYC, 2018). On the other hand, where a comprehensive strategy or policy for going smart is absent, to address or better react to a pressing problem such as traffic congestion, some cities have pursued smart initiatives on a project-by-project basis. Veras (2017) showcases how Nairobi and Cape Town are deploying smart city approaches, winning "Most Intelligent City in Africa" titles through thoughtful planning and cutting edge technology to attract businesses and improve the lives of its citizens. By developing a digital map of public transport routes, Nairobi, for example, has sought to create a public transit map for the city and its citizens (Williams et al., 2015). Nairobi is also seeking to develop its own Silicon Valley complete with infrastructure for tech companies in Konza City, to capitalise on rapid technological advancements (Wanyonyi, 2017). Corporatist drivers are also contributing to making the transition to smart cities more attractive. Technological giants like IBM, Nokia or Google and its parent company Alphabet, have rolled out experiments with new approaches to the planning, design, finance, construction, governance and operation of urban infrastructure and services aimed at addressing problems relating to transport, energy use and housing costs (Deakin and Al Waer, 2011; Torfing et al., 2012). Whilst there is evidence suggesting that cities have found the idea of going smart both, attractive and effective for enhancing their competitiveness (Florida, 2005; Jessop, 1997; Hollands, 2008); the availability of different and rapidly evolving technologies and business models is adding uncertainty and complexity to the process (Jordan and Huitema, 2014), and issues of access to funding are making the rollout of smart initiatives fragmented and piecemeal (Meijer and Rodríguez Bolívar 2013).

5. Discussion - going green versus going smart for sustainable development, convergence, divergence or diffusion?

For decades built environment disciplines such as planning have focused their efforts on how to plan, design and make places that are appropriate for communities, and for their ways of life. Sustainable development has extended these efforts to encompass the other side of the argument, thus to look at the extent to which these places and the ways of life of their communities are impacting the natural environment and future generations. In terms of Bennet's manifestations of convergence (1991), going smart and going green paths appear to come together to meet these efforts in terms of goals, content and instruments, albeit as presented in this paper, from different positions and reaching potentially different outcomes (see figure 1). Both ideas are motivated by the quest for a creative compromise that realigns economic growth with environmental protection, with the scope and emphasis on the environment varying significantly according to the position taken and style of delivery. Broader in the case of going green with an emphasis in public policy and planning on protecting and enhancing the environment to create and promote healthier lifestyles and more liveable urban environments; and often restricted to the consideration of green spaces and recreational parks (de Jong et al., 2015) in the case of going smart, with an emphasis on citizens to

[1] i.e. New Yorkers, civic and business leaders, elected officials and city agencies (OneNYC, 2018).

be actively invested and morally obliged (or coerced following Vanolo, 2014) to make greener (i.e. smarter and responsible) choices by adapting and living in smart cities, motivated therefore by social connectivity and financial gain. The strong environmental focus of green development alongside socio-economic considerations, therefore provide for a more enhanced approach to sustainable development, if compared to smart developments. However, it is important to acknowledge that if conceptualised in a *niche* manner or pursued through *ad hoc* and fragmented strategies, just like smart initiatives, green approaches can lead to diffusion and be limited in their reach, as they may provide a "plus" or a greenwashing effect to the status quo, rather than pursue meaningful and/or radical changes in line with the ethos and aims of sustainable development.

Within this process, economic and technological imperatives have proven to be highly influential in mobilising both ideas. The global financial crisis and the political buy-in to climate change policies and its portrayal as a market failure (Hinton and Redclift, 2009), have prompted policy-makers and the industry to have faith in human ingenuity and seek solutions in technological advancements as a way of mitigating climate and financial risks. Eco-innovations have been used to reframe greening ideas to go beyond the environmental sector to encompass the entire economy and production system, as an attempt to move away from the conventional understanding of sustainable development in terms of the three pillars; while smart initiatives and projects have been developed to ameliorate peoples' lives by making more efficient lifestyle choices easier to make and by enhancing cities' global reputation and competitiveness by using "smart" as a brand for "good". However, based on the analysis presented, rather than encouraging radical changes in the form of a redefinition of political priorities, a reorientation of societal values and a reshaping of business strategies and technological investments, the investment in technological innovations has so far failed to address the causes of environmental impacts, with a focus instead on symptoms in the name of energy and resource efficiency gains. What might be the implication of this, is that the investment and confidence in humanity's ingenuity and technological advancements, might be actually distorting the journey towards sustainable development creating diffusion rather than convergence, with societies using going green or going smart ideas in a technocratic way to pursue development paths that maintain the business as usual plus stance in response to global imperatives, and loosing site of the ambitions of sustainable development as a guiding policy discourse. Ultimately, the human-centred nature of both approaches coupled with the creativity adopted in devising ways to realign economic growth with environmental protection, means that a wide range of (individual, societal, organisational) behavioural choices are possible and development directions available. This means that moral and political imperatives are also highly important in determining whether convergence, divergence or diffusion occur, and should therefore not be discounted or overlooked.

Insert figure 1 near here

As noted by Norman (1990) cited in Gärling (2014), encouraging people to change their behaviours towards greener options cannot be done effectively without changing, perhaps smartening, the environment in which they live in. This would entail creating a positive attitude towards change and providing the means for changing (Otto et al., 2014), with the adoption of new technologies being instrumental, if not preferable if compared to other means such as social influence (Gärling, 2014). On this basis, one could argue that going green ideas could easily entail or accommodate going smart ideas, with a number of eco-innovations and smart initiatives pointing in this direction, and possibly substantiating the confidence in human ingenuity reflected in the Bruntland Report. Carrot (economic instruments) and sermon (informational or communicative instruments) approaches

could be effective in mobilising and making green(er) behaviour easier and smart(er), particularly if supported by a legal and regulatory framework that is less restrictive in the implementation of environmental control measures (Murphy and Gouldson, 2000); and less structured, embracing therefore the human-centredness character of both going green and smart approaches and the need for creativity (e.g. New York's Smart city, Equitable city strategy). What might be less obvious is the reverse; that smart devices do not always address or lead to greener solutions but might be devised to make life easier or more cost-efficient, thus diverging from sustainable goals or diffusing their purpose(s). In some cases, maybe even restrict choice of, or access to, products and services. As noted by Vanolo (2014) and Viitanen and Kingston (2014), smart approaches are often considered the most natural solution a priori, for which seeking general consensus or exploring other possible solutions is unnecessary, because "smart is good". This in turn, is likely to restrict the creation of alternative solutions or planning approaches to present or future problems, leading to a distorted use of humanity's ingenuity in Bruntland's terms and to a divergence from the path towards sustainable development. Notwithstanding access to funding opportunities and the attractiveness and enhanced competitiveness that going smart initiatives can provide, it is important to bear in mind that the purpose of planning is to provide a forum for facilitating sustainable development (Owens and Cowell, 2011), within which "competing conceptions about the good" (O'Neil, 1998, p.18) in the public's interest (McAuslan, 1979) can be deliberated and negotiated to foster convergence. Within this context, when subscribing to smart initiatives, it therefore becomes paramount that they are conceived within the context of policy and planning exercises, rather than through a fragmented and somewhat *ad hoc* approach (Anthopolous, 2017; Kitchin et al., 2016), so that the purpose of planning and sustainable development agendas are not hijacked by other agendas, actors or narratives.

6. Conclusions

This paper aimed to reflect on the correlation between the ideas of "going green or greening" and "going smart", using convergence theory and Bennet's typology of similarities as an analytical framework. In conclusion and based on the analysis presented, greening approaches seem to better fit a narrative that looks at the reconciliation or realignment of environmental protection and economic growth in a way that fits an understanding of ecological modernisation as a policy discourse. Smart(er) approaches tend to be applied in a more technocratic way, possibly losing site of the bigger picture and of the overall destination, misinterpreting outcomes or with misleading intentions, and lacking awareness of the risks associated with being completely invested into a technology vision of the city and of the future. Achieving greater convergence between going green and going smart approaches for sustainable development is needed and could perhaps be more effective, if smart-centric approaches were subsumed in the overarching vision of environmental quality and resilience, where green approaches to urban development set the path and drive decisions towards a sustainable future, rather than risk being hijacked by other narratives or (economic, social, political or climate) imperatives/pressures. In practice, this could mean that well-established green approaches, such as existing requirements for environmental assessment and sustainability appraisal, are used to scrutinise the greening credentials of smart initiatives, for example, by identifying suitable life-cycle methodologies for assessing technology-centric planning alternatives and accounting for the end-products of those technologies used to make cities smarter. By ensuring that smart initiatives meet the fundamentals of sustainable development as a minimum, greater emphasis could instead be placed on identifying development solutions that can sustain environmental capital and address current deviations from sustainable development, facilitating in turn the convergence of going green and going smart narratives for sustainable development.

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Figure 1. Green versus smart approaches for sustainable development