Built Environment and Landscape Design as Tools for Resilient Cities

This paper explores project frameworks and design methods in order to reveal innovative ways and processes for creating more resilient cities and regions. Looking at three models for sustainable cities, the paper examines the role that a holistic approach to landscape and the built environment can play in transforming cities for the future. Considering major environmental, economic and social challenges and extracting key quality elements from pioneer development schemes, the aim is to identify methods and policies that have a significant impact on urban transformation, landscape quality and sustainability. Starting with the model of design quality in project delivery, and looking at a transformation model, the paper discusses best practices for the development of concept and implementation before it considers the model of pan-European collaboration. An investigation of climate adaptation issues through the ‘Room for the River’, a national programme in the Netherlands, demonstrates the significance of landscape design, low carbon and spatial quality as vital aspects of the built environment. The West Midlands National Park (WMNP UK), a major infrastructure proposal, demonstrates how a broader vision can be the vehicle to help drive environmental, social and economic transformation in a region, whilst SATURN, an EIT Climate-KIC project, reveals the first stages of a pan-European city collaboration with the aim of reintegrating the natural assets within the climate change impact strategies of the participating cities, and exchanging knowledge between European regions. This paper suggests that landscape design and the built environment are important drivers towards a successful low carbon transition, and they can simultaneously enhance social and landscape identity and boost the economy of a region.

Keywords: climate crisis, landscape design, strategic design, policy, multidisciplinarity

Introduction

This paper explores three large-scale models that have demonstrated ways in which principles leading to low carbon and resilient cities have been embedded. The scale of climate change and its impact on our cities and regions is now widely recognizable, however it is only recently that it has been termed as ‘climate emergency’. The ‘resilient city’ is a broad but often controversial term, since resilience can be interpreted in so many ways. In the larger spatial context, it is often challenging to identify the true environmental or most sustainable steps that will support carbon neutral communities.

Built environment or landscape design are not new concepts, however the concepts of a carbon neutral development, or sustainable cities through innovative design are fast developing and becoming adopted. The use of multidisciplinary teams and collaborative projects with the aim to enhance
resilience, re-imagine landscape identity and boost social and economic benefits seems to be a beneficial option to future-proof our cities. This paper agrees with Nijhuis and Jauslin (2015), that “urbanisation, ecological crisis and climate change are several of the contemporary challenges of our society, which are demanding a fundamental review of the planning and design of our landscapes, in particular in relation to environmental issues and sustainability”. It is important that built environment and landscape infrastructure are integrated in order to allow, as Nijhuis and Jauslin (2015) suggest, for “design principles to gain operative force in territorial transformation processes”. The review proposed by Nijhuis’s research aligns with the focus of this paper, that is to demonstrate how innovative planning and design models can aim to address climate extremes, and propose new ways of creating low carbon cities reinforced by the introduction of policy and decision-making methods throughout their processes. Landscape infrastructure and urban developments are the vehicles to re-establish the role of design as a means of integrating environmental principles in strategic schemes. It is through the models presented here that such established concepts are dealt with differently, facilitating transformation and innovative ideas.

This research introduces three models that have dealt with environmental challenges from different angles. The model used in the Room for the River project, located in the Netherlands demonstrates how design quality is integrated in the delivery of a large strategy and the reasons why such elements are significant for the social and economic success of a climate related development. The exploration of a transformation model using the West Midland National Park proposal (UK), demonstrates ways in which a broader vision allows the creation of a holistic approach across the whole region and how this has impacted in the decision making of the area. The third model focuses on re-integrating natural assets within a range of European participating cities and it also demonstrates the significance of pan-European collaboration with the aim of achieving truly sustainable cities. This paper suggests that all three models are based on the principles of design and the built environment; however they have facilitated different ways of planning that has led to effective decision making and sustainable strategies.

**The Key Concepts**

Until recently the disciplines of landscape architecture, engineering, built environment and others have generally been treated as individual and separate disciplines, with no necessary connection or interrelationship within strategic projects. Nijhuis and Jauslin (2015) promoting the pioneer ideas of Shannon and Smets, and Belanger, argue however that “infrastructures no longer belong to the realm of single disciplines […] but to a crosscutting field that involves multiple disciplines in which the role of designers is essential”. Infrastructure has gradually become accepted as something that applies to more than one discipline and there is increasing recognition that each profession has
something to offer in this collaborative era. However, there is still much more to do when it comes to climate resilience and including the way in which infrastructure and the built environment can be part of a broader landscape approach that creates a vision for the whole city or region. Valdés et al. (2013) argue that “a resilient built environment is of paramount importance in achieving resilient cities”, since built environment is the glue between infrastructure, everyday life and human beings. Any disturbance to the built environment changes the social and economic characteristics, and it can therefore significantly impact on human society. But what about destruction of the natural environment? We surely can admit, especially in a post-COVID19 situation, that disturbances to the environment also significantly affect our health and wellbeing, communities, businesses and economies; and therefore the concepts of sustainability and resilience are of absolute importance. Vale (2014) notes that “uneven resilience threatens the ability of cities as a whole to function economically, socially and politically”. The way in which our cities and regions are organized necessarily means that some parts are more resilient than others, and this reflects on underlying socio-economic disparities, topography and income amongst other factors. We could, therefore, argue that achieving a fully resilient city is a major and challenging task that requires a common framework between the different disciplines, and behavioural change in residents, professionals and politicians. It is based on this reasoning that Vale (2014) suggests that “resilience is, simultaneously, a theory about how systems can behave across scales, a practice or proactive approach to planning system that applies across social spaces”.

Valdés et al. (2013) argue that the concept of resilience is now widely adopted across academic and policy disciplines, and is often used in relation to natural disasters; but the methodology required to create a resilient city and how landscape design blends with infrastructure is only now beginning to be unpacked. As Vale (2014) suggests, there are multiple economic and social disparities within a city and, therefore, “it is almost always over-simplistic to describe an entire city as resilient”. Even though environmental challenges are experienced differently within an urban environment, there are signs that landscape design is able to create holistic visions (Sijmons et al., 2017) for the current and future urban and rural infrastructure that can respond to these challenges and support better integrated environmental designs on a strategic scale in the future. The collaboration of the built environment and landscape design disciplines does not eliminate the various disparities of a major city, but can build pathways that will allow these inequalities to be revealed, understood and addressed in the transition to a sustainable future.

Infrastructural Design and the Landscape as Environmental Assets

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impacts of 1.5°C global warming, mentioned by the latest Intergovernmental Panel and Climate Change report, are likely to replace land use change as the major driver of ecosystem change in the coming years (IPCC, 2018). Guerreiro et al. (2018) state that since over 75% of the population of the EU currently live in urban areas, and as a result of the agglomeration of people, wider services and infrastructure, cities are particularly vulnerable to environmental phenomena. Examining the impact of the climate crisis at a global scale often puts an artificial distance between the phenomena themselves and their immediate effects on our cities, communities and economies. However, it is important to acknowledge that the pressure put on our cities requires significant effort from everyone, and that local and national governments develop and apply coherent adaptation as well as mitigation plans.

In evaluating what the built environment and landscape design disciplines can do to address some of these challenges we should recall Gossop’s explanation that “the world’s ability to absorb carbon is being steadily reduced through massive tree felling and other land use changes” (Gossop, 2011) and consider how strategic plans can review and change our current practices. Over recent years local governments and national policy have begun to adapt to the climate challenges, and there are cases where policy reports urge actors “to maintain and improve the natural environment” as Hardman et al. (2018) explain regarding the National Planning Policy Framework (NPPF) and the Natural Environment White Paper (NEWP). However, there is still no coherent process as to how infrastructural design can improve environmental challenges in cities and, furthermore, how through built environment and design approaches our cities can become more resilient and sustainable future conurbations.

As Nijhuis and Jauslin (2015) explain “the idea to conceive infrastructure as landscape or landscape as infrastructure is not new. From the second half of the eighteenth century infrastructure was regarded an integral part of the landscape by landscape designers”. However, much remains to be discussed when it comes to ecology, sustainability and the urban environment. Cadenasso and Pickett (2008) state that even though there is progress maintained over the previous decade between the ideas of sustainable city design and urban ecology and that several frameworks had been developed, there was no ‘mature theory’ on what urban ecology stands for, but perhaps key principles which are beginning to emerge. Examining similar ideas and investigating the concept of city resilience, Vale (2014) argues that it is the nature of the design and planning processes developed to make our communities energy efficient, environmentally sensitive, physically and socially attractive and adaptable to climate change, that will strengthen our cities and improve the quality of life for their residents. Even though this is not an easy form of resilience, it seems to be significant amongst the few options we have to address this global crisis. Jenks and Jones (2009) also agree that “a number of urban forms may be sustainable” and many of these have been systematically tested. Although evidence as to how to develop sustainable urban forms is rather inconclusive, it is clear that there is a growing interest and engagement in support of a more collaborative approach from the professionals (designers, landscape architects, planners) and the public.
It is now apparent that we have been ignoring nature with regards to the built environment, and that this has resulted in several challenges, of increasing severity, for our communities, economies and our wellbeing. As Nijhuis et al. (2012) remark “infrastructure over the last centuries was in service of the conquest of nature, whereby the environment was denied its natural dynamism in favour of more controlled and static systems”. Therefore, it is time to use the significance of the built environment and the visioning power of landscape architecture to establish that resilient cities need to support a broader sustainable vision while building with nature and not against it. Even though we are still exploring the best possible ways in which environmental frameworks can be applied to urban areas, there is no doubt that “environmentally, less open space is likely to have adverse effects on biodiversity and the provision of environmental/ecosystem services” (Jenks and Jones, 2009) for our cities and regions.

Methodology

This paper explores innovative models that have identified principles and processes to support environmental development in urban conurbations.

Three major landscape infrastructure schemes, the Room for the River programme, the National Park for the West Midlands (WMNP) proposal and the SATURN EIT Climate-KIC project, have led to the identification of three models that deal with sustainability and landscape infrastructure. All schemes integrate the ideas of policy, environmental practice, decision making and landscape awareness, however for the purposes of this paper, the strongest points of each project are extracted. The first model, ‘Design Quality and Implementation’, is a completed scheme that reveals several methodological as well as policy delivery practices when implementing a climate adaptation scheme, and it is selected to represent the successful integration of design quality into the built environment. The ‘Transformation’ as well as the ‘Pan European’ models are ongoing cases at the time of writing and therefore this paper will report on the current findings about the way in which landscape design can form perceptions and support policy in cities and regions. The methodology behind the three presented strategic schemes includes an in-depth analysis of their structure by the lead researcher conducted at the various locations of the schemes and included several field visits, observations, interviews with experts and workshop activities with local stakeholders.

The data collected for this paper is based on visuals, stakeholder activities and observations. Maps, policy and technical documents, visual material, case study notes, drawings and images of sustainable approaches as well as outputs from the different workshops with professionals and stakeholders were collected and analysed through content analysis.
The Design Quality and Implementation Model – The Room for the River

Through a climate adaptation programme this model demonstrates the significance of landscape design, low carbon and spatial quality as ways to deliver environmentally-based infrastructure on a strategic scale. The Room for the River is a national-scale climate adaptation programme that was intended to form sustainable ways of dealing with rising sea levels in the country. Based on a newly developed design strategy, the programme ensured a high level of protection against rising water levels in 34 locations across the Netherlands while introducing design quality and landscape awareness as a major part of the environmental aspect of the scheme. The model is a good example of how quality of space and climate adaptation principles are embedded from the conceptual to the implementation stage of a strategic scheme. Using a policy and communication framework especially developed for this programme, the Room for the River has also managed to educate professionals and the public about the impact of climate crisis through landscape design and the ways in which the 34 projects have been delivered.

The successful establishment of this major infrastructure programme included two key goals: i) water safety and ii) spatial quality. By putting the environmental and design ideas at the core of the whole scheme, the Room for the River offers an innovative alternative to traditional planning and the way in which the built environment has been conceived in the past. It is important to mention that based on evidence collected by the authors, the support received by the Dutch government and the continuous involvement of the local and national authorities during the various stages of the scheme has been proven essential with regards to the delivery of environmental and landscape quality ideas (Nikologianni et al., 2019). (Nikologianni, Moore and Larkham, 2019).

To unpack and fully understand the impact of this model in relation to design quality and delivery, Figures 1-3 demonstrate key conceptual diagrams, a diagrammatic masterplan and one detailed visualization of the Nijmegen city project, one of the programme’s 34 locations.
Figure 1. Dyke Relocation and New River Waterflow Diagram for the City of Nijmegen. Room for the River Programme. Image Courtesy: Rijkswaterstaat, Room for the River

The initial situation with the existing dike.

The dike was moved 350 metres inland.

An ancillary channel is to be dug in order to give the river more room. This will create an elongated island.

Bridges across the ancillary channel.

The significance of this programme is in the central position of the policy and governmental support, and the continuous communication between multidisciplinary teams. The successful methodology in delivering spatial quality and hydrological efficiency at such a scale, it is a result of the integration of landscape design with the built environment. This unique model has managed to provide an environmental vision on a strategic scale (Figure 1), whilst simultaneously fully supporting the businesses and economy of the area by creating a destination for residents and visitors (Figure 2). The true impact of how quality of space can be implemented is shown on Figure 3, where, through the medium of a pedestrian and cycling bridge, the concept of climate crisis and awareness is being vividly highlighted. Using the physical barrier between one’s body and water, this design, forces one’s mind to understand what rising water level would mean and find ways to adapt in an urban environment. The point when landscape architecture creates new ways of experiencing nature and enhances learning and environmental awareness is when quality of space is successfully implemented in a city. Landscape design and infrastructure must act as enablers to ensure a better understanding of nature and how to create sustainable urban environments.

Looking beyond the initial design and the necessary engineering work for such a major infrastructure development, these visualizations demonstrate design
expertise and the full integration of environmental and landscape ideas. The diagrams enable us to unpack the initial conceptual ideas of hydrological efficiency and spatial quality, and to understand how such an area can be designed with environmental principles without losing either quality or cultural and social engagement. Since this scheme is completed and operational, it would be safe to acknowledge that the design of the Citadel Bridge (Figure 3) is a good example of how the concept can be interpreted in reality and work as an exemplar of real-life environmental awareness and education through our daily interactions or routes within a city. As it is understandable that a significant carbon footprint has been incurred in the scheme’s delivery, however, its design and implementation have been justified as being beneficial for future-proofing the region and its completion will enhance the environmental, economic and social benefits in the years to come.

Figure 2. Nijmegen Masterplan for the Room for the River Programme. Image Courtesy: Rijkswaterstaat, Room for the River
Figure 3. Citadel Bridge Designed by NEXT Architects Connecting the City of Nijmegen with the Veur-Lent island. Left: Normal Situation; Right, Flood-Resistant Design. Image Courtesy: Rijkswaterstaat, Room for the River

The Transformation Model – The West Midlands National Park (WMNP)

The second model explores the major transformation opportunities that a landscape-led and infrastructure development can bring to a region. The West Midlands National Park (WMNP) proposal developed by the CATiD research centre at Birmingham City University offers a unique approach for the area identifying resilient ways to re-discover a hidden landscape when supporting the social, historic and economic characteristics of the region\(^1\). The significance of this model is delivered from several powerful drawings and a stakeholder engagement process that has allowed policy and governmental authorities to redefine the way in which they deal with regional scale to the point that the WMNP has been recently (5\(^{th}\) June 2020) formally adopted by the West Midlands Combined Authority (WMCA) as the vehicle for a green recovery in the region in a post-COVID19 era (BCU, 2020).

The WMNP proposal is a way to see a region differently, through the lens of landscape and climate change, that allows evaluation of the current decision-making methods and aims to lead to further transformation of the region towards a carbon-neutral future. By proposing a close relationship between people and place, and building on strategic initiatives, this model envisions the creation of an iconic landscape that will enhance identity of place. With the use of powerful diagrammatic but carefully-developed drawings, the WMNP aims to reveal the significance of visual material to the way in which we understand and act upon the landscape. Through visioning workshops and stakeholder activities, this proposal has begun to demonstrate alternative ways to improve the perceptions of the area and allow local authorities and communities to imagine a different, much more positive, future, particularly in some of the most challenging parts of the region.

Part of the WMNP process is to use design to redefine the region. Working with large-scale maps, as shown in Figure 4, the project unpacks the physical and

cultural characteristics of an area (water, history, environment, society) allowing for a visual method that helps public and private actors to realise the potential of the region. Even though the project is still in its conceptual phase, it has already begun to change perceptions in the region, enabling multidisciplinary collaboration and impacting on local and national decision making and the way in which policy is formed for our cities with regards to nature.

Figure 4. West Midlands Valleys Diagram Emphasizing the Topography and Hydrology of the Area, Made for the WMNP Proposal. Project/Image by Kathryn Moore

Exploring post-COVID19 scenarios and the way in which this pandemic has forced us to rethink and re-evaluate our response to nature in a city context, the transformation model introduced by the WMNP is an innovative approach that can be beneficial for different regions at a global scale. The accessibility and proximity on open spaces, especially if living in a densely-built-up urban environment, together with the advice to reduce long-distance travelling, has encouraged communities to get to know better their neighbourhoods in an unprecedented way. Since February/March 2020 it has been more apparent than ever that nature and green spaces play a major role in the way people can cope with stress and support their mental and physical health. The lockdown measures adopted as a response to the COVID19 crisis have increased some types of outdoor recreational activity but have also demonstrated the importance of access to green open spaces that are interwoven within the
built-up matrix” (Venter et al., 2020). Therefore, it is clear that the built environment and landscape design have a major role to play in future-proofing our cities both in a climate crisis and with a public health perspective. As Venter et al. (2020) mention, “the current pandemic reveals some important dilemmas we might face regarding green justice on the path towards urban planning for future sustainable cities” and the transition model introduced in this section responds to the needed environmental as well as social and economic transformation of the area.

Natural Assets and the Engagement of Cities – The SATURN Pan-European Model

SATURN is an EIT Climate-KIC pan-European project which deals with re-integration of natural assets and aims to support cities and regions transition to a carbon neutral future. With its focus on governance and an established collaboration between Birmingham (UK), Trento (Italy) and Gothenburg (Sweden), the project examines how landscape design and the built environment can support the movement towards urban resilience and what processes are required to do so across Europe. Although SATURN is an ongoing project, and therefore this paper only presents data from its first year of activity, it has already attracted international interest as a response to its innovative communication process between the multidisciplinary teams and its goal to create a framework on valuing the landscape through design and a stakeholder engagement process using visual tools and drawings.

The project focuses on the relationship between cities, the landscape identity, natural assets in each area, food growing methods as well as social characteristics. At the core of this model is the belief that landscape visioning and resilient city planning is not an easy ‘copy-paste’ activity, but through strong communication and collaborative working, methods, principles and frameworks are able to be developed and applied in other European and international countries. The process established by this model aims to generate holistic strategic frameworks, advise cities on landscape management, development and transformation, engage urban populations and help them understand the significance of their landscape and local farming. A crucial part of this initiative is also the re-evaluation of policy and strategic documents for the cities and the institutions involved, exploring ways in which to identify alternative methods to support the transition to sustainable communities.

Based on a three-tiered approach, the SATURN analysis includes a) an exploration of a holistic spatial approach and framework, b) the use of ecosystem services and natural capital to map and evaluate the landscape potential of an area and c) the creation of a systems approach as a way to reveal new capacity building, stakeholder engagement processes and other hidden beneficiaries between the participating cities. Using the built environment as well as design methods to demonstrate the value of the land, the SATURN model aims to build a comprehensive and flexible framework to guide cities on a more resilient path and
spread awareness of why a sustainable urban environment is essential. The goal is not only to highlight the natural assets of each area, but to build a collaborative network that will elevate the knowledge, policy documents and engagement strategies and co-create an economically sustainable, scalable and environmentally friendly process for cities and regions. Specific tools are also being developed to support decision making on local and regional levels.

As this paper investigates how landscape design and the built environment can be the vehicles to promote and contribute to resilient cities, the issue of governance of nature and landscapes examined by SATURN is considered very significant. This pan-European model aims to change the land management approach which is currently determined by ownership and silos, and consider the natural assets of each area with a fresh approach aiming to attract business, tourism, and entrepreneurial activities while providing for the environment and the community. The existing fragmentation around the landscape, its governance and people’s engagement are believed to be leading to a singular, often only technologically focused, approach on climate change. The environmental approach of SATURN, with respect to the built environment, is not based on preservation or totally new designs, but on a restoration of the landscape value and the natural environment as ideas in order to increase the pride, the interest and awareness for our cities. Local authorities are often the first level of interaction with the public and they often have very different needs or aspirations, even within the same region. Especially in a post-COVID19 era, it is expected that “substantial changes to future design, use, and perceptions of public space” (Venter et al., 2020) are unavoidable, and this paper argues that SATURN is already working towards this direction in relation to the climate crisis and the landscape in urban and regional areas. SATURN’s aspiration is to extract best approaches from across Europe, test the methods to additional urban and rural locations and create a supportive process for local and regional authorities.

Discussion

The three-model approach presented above reveals significant ways in which innovative design and planning can address climate extremes and play a major role in a sustainable transition of our cities. The successful integration of design quality during the implementation phase of an environmentally focused scheme, such as the Nijmegen project of the Room for the River, provides justification that a strategic development should not only rely on an effective engineering approach, but a comprehensive plan that includes public engagement and education. The impact that the built environment and landscape design have in the delivery of resilient cities depends on professional expertise, the ability to exchange ideas and the need to establish a strong vision in alignment with the environmental challenges and the political situation of the area.

While embedding climate and spatial qualities is of major importance in large-scale infrastructural developments, the transition to urban resilience is still subject to other factors as demonstrated by the WMNP project. Both an in depth
understanding of an area, and a willingness to divert from the well-known methods and processes adopted for decades by public and private stakeholders, is a crucial step in the way towards sustainable cities. Decision making in the past has often been driven by specific agendas, without necessarily following the environmental or even the cultural and social needs of a city. This paper argues that landscape design can unpack this neglected information, leading to new knowledge to support environmental, economic and social transformation.

The engagement with local governance which is intertwined in the SATURN project is another significant element contributing to the sustainable framework. Even if environmental characteristics, spatial quality elements and a new decision-making process is in place, the opportunity to collaborate with local authorities and co-create tools with public and private stakeholders is crucial in order to attract the interest of other cities and regions at a global level. The scope of SATURN which is to provide solutions for the challenge of fragmented governance and neglected landscape while involving its major actors (city, public, major institutions, environmental organizations, agriculture sector, entrepreneurs) to this process is a perfect mechanism to create a positive climate for this transition.

Conclusion

The environmental challenges we face, the increase of extreme climate phenomena and the need for sustainable cities are very evident. In addition, the recent experience of living during a global pandemic has emphasized the significance of, and need for, natural environment in order to support our physical and mental health and, therefore, the access of open spaces in urban or densely populated areas is becoming non-negotiable. An environmental or sustainable approach in design, infrastructure and any kind of development is a one-way route in the response to the climate crisis and this can be achieved through collaboration, multidisciplinarity and pioneer concepts that embed environmental as well as economic benefits for our cities.

The steps revealed by the three models, in addition to the assets of policy, strategic documents, and multidisciplinary teams which were adopted by all of the examples, demonstrate that achieving the goal of resilient cities is not an easy exercise, but it is achievable. Determination, strong leadership, willingness to identify new ways of thinking and cross-silo collaboration are key steps in the way to achieve sustainable cities. The power of landscape design to reveal the value of land, our memories and sense of belonging has been identified as a significant factor in changing perceptions and creating visions. The major role played by the built environment in global policy, if used effectively, will encourage design and planning that will make our communities environmentally and energy efficient, without sacrificing their natural assets by adopting only mass produced technological tools that promise ‘resilience in a box’.
References