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CASE STUDY

Rising Cities: Continuity, Innovation and Deliberation of Vauban District of Freiburg, Germany

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Abstract – The future of the biosphere, indeed of humanity, will be determined in the cities of the 21st century. Urban centres are where the battle for sustainable development will be won or lost, and we find today an increasing number of cities and towns as hubs of innovation signalling the potential victory. Freiburg in Germany is one of them. As a national exemplar of sustainable urban planning, ideas developed in Freiburg have been used in countries around the world. This article will evaluate most specifically one of its districts, Quartier Vauban, developed using low carbon technologies for absolute energy efficiency, self-build and co-housing approaches, a state-of-the art mobility system, and placing the needs of its citizens at the forefront of its planning activities. This article aims to investigate how sustainable development, despite its many interpretations, can be implemented in practice, at district level in a European context.

Keywords – sustainable urban planning, sustainable development models, renewable energy, low carbon technologies, Freiburg, Melbourne principles for sustainable cities, passive houses, Vauban Development Plan, ecological footprint, ecosystems, biodiversity, empowerment, networks;

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Introduction

The future of the biosphere, indeed of humanity, will be determined in the cities of the 21st century. In 2007, for the first time in history, the global urban population exceeded the global rural population (UN Habitat, 2010). The world population has remained predominantly urban ever since. Cities cover a mere 3% of the planet surface (Columbia University, 2005) but account for 60 - 80% of global energy consumption, 75% of carbon emissions (UNEP, 2012) and more than 75% of the world's natural resources (Girardet, 2008). With the world now more than half urban and given the ecological consequences of the high-consumption urban centres (Sutto & Plunz 1991), there simply cannot be a sustainable world without sustainable cities.

Urban centres are where the battle for sustainable development will be won or lost, and we find today an increasing number of cities and towns as hubs of innovation signalling the potential victory. Freiburg in Germany is one of them. As a national exemplar of sustainable urban planning, ideas developed in Freiburg have been used in countries around the world. This article will evaluate most specifically one of its districts,

Quartier Vauban, developed using low carbon technologies for absolute energy efficiency, self-build and co-housing approaches, a state-of-the art mobility system, and placing the needs of its citizens at the forefront of its planning activities.

This article is structured in four sections. First, the principles associated with the sustainable development concept are summarised and the challenges for applying the concept in 'sustainable urbanism' are reviewed. The second section introduces the conceptual framework through which Quartier Vauban in Freiburg will be tested and evaluated. Next, the case study will be presented, capturing and introducing lessons learned. In the concluding section the implications of the findings will be presented, and recommendations will be made.

Defining Sustainable Development (SD)

The concept of sustainable development has evolved over time, and many different interpretations and definitions currently exist. Just over 40 years ago, the realisation that we are on a collision course with a growing global economy on a planet with limited resources was brought to the world's attention at the

Conference on Development and Environment in Stockholm. The Stockholm Declaration contained 26 principles on development and the environment and marked the establishment of the United Nations Environment Programme (UNEP).

In the same year the influential book *The Limits to Growth* was launched, stating that the growth of the world economy was heavily burdensome and threatening the planet and the future of growth itself. The computerised model suggested that once we combine a growth paradigm with finite resources, we can expect overshoot as a response, followed by a decline. As explained by Meadows et al (1972, p.150) “there may be much disagreement with the statement that population and capital growth must stop soon. But virtually no one will argue that material growth on this planet can go on forever”.

The next milestone in the emergence of the sustainability concept was introduced by the *Our Common Future*, known as the Brundtland Commission report in 1987, which defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Commission, 1987). The report was the outcome of 900 days of international discussions by government representatives, scientists, research institutes, industrialists, NGOs and civil society. The Commission focused its attention on the areas of population, food security, the loss of species and genetic resources, energy, industry and human settlements, realising that all of these are connected and cannot be treated in isolation from one another.

The Brundtland Commission's mandate was to:

1. re-examine the critical issues of environment and development and to formulate innovative, concrete and realistic action proposals to deal with them;
2. strengthen international cooperation on environment and development and assess and propose new forms of cooperation that can break loose from existing patterns and influence policies and events in the direction of needed change;
3. raise the level of understanding and commitment to action on the part of individuals, voluntary organisations, businesses, institutes and governments.

Figure 1. Mandate of the Brundtland Commission

The sustainable development concept presented in the report included the notion of intra-generational and inter-generational responsibility and defined the inter-

dependence between ecological integrity, economic security and social equity as a guiding principle. The intergovernmental Brundtland Report laid the ground for the United Nations Conference on Environment and Development (UNCED), known as Rio 92, which produced a number of international instruments that still provide a framework for sustainable development, influencing innumerable international conventions, policies and programmes to this day.

Since Rio 92 the competing notions of strong and weak sustainability have dominated the governmental, non-governmental and theoretical sustainable development debate. While strong sustainability argues human activities should occur within the ecological boundaries of the planet; weak sustainability claims that with time humanity may replace the natural capital we depend on, with manufactured capital.

UNCED International Instruments:

- **Agenda 21** – a voluntary action plan for governmental and intergovernmental organisations regarding sustainable development at international, national, regional and local levels
- **Rio Declaration on Environment and Development** – with its 27 principles to guide sustainable development
- **Rio Conventions** – three signed legally binding Conventions
 - United Nations Framework Convention on Climate Change (UNFCCC)
 - Convention on Biological Diversity (CBD)

Figure 2. Rio 92 Legal Legacy

Over the last two decades policy makers, researchers and scientists, businesses and practitioners have been grappling with the key question on how to make the world prosperous, fair, and also environmentally sustainable, so that our population and our economy don’t overrun the physical bounds of the planet.

For some, the sustainability concept fails to offer guidance on how to arbitrate between the conflicting drivers of economic growth, planetary boundaries and social justice.

Despite its ambiguity, an agreement to launch a set of universal Sustainable Development Goals (SDGs) emerged from the 2012 United Nations (UN) Conference on Sustainable Development (Rio+20). There followed a three-year process involving UN Member States, 83 national surveys engaging over 7 million people, and

thousands of actors from the international community. The goals have thus been heavily negotiated and have a broad legitimacy amongst all parties. They form the basis of an aspirational world transformation: the 2030 Agenda for Sustainable Development (UN, 2015).

This article aims to investigate how sustainable development, despite its many interpretations, can be implemented in practice, at district level in a European context.

Three Core Dimensions of Sustainability

Although definitions vary, sustainable development tends to embrace the ‘triple bottom line’ approach, which combines economic development, environmental sustainability and social inclusion as its three core elements. As the concept of sustainable development has evolved over time, these three aspects have been represented in a variety of ways, including such graphics as pillars, overlapping circles and nested circles.

As discussed below, each model portrays different interpretations of sustainable development, and over time the conceptualisation and policy-making implications of these different visualisations generated substantial discussion and debate.

The Three Pillars Model

The traditional definition of sustainable development is based on the ‘three pillars’ model (Figure 3).

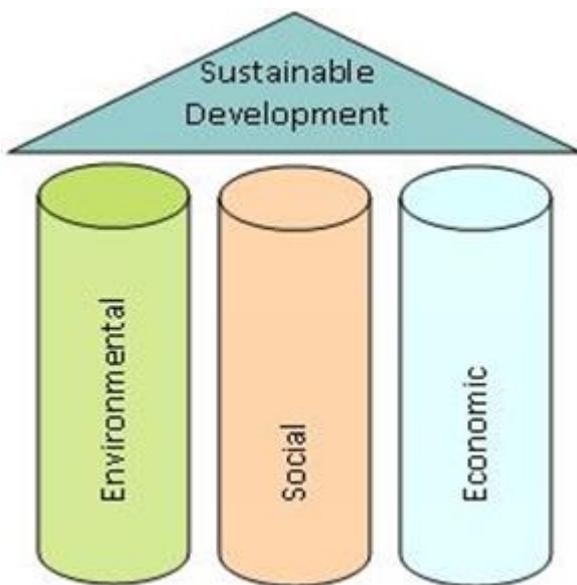


Figure 3. The three pillars model of sustainable development

This model has long been the subject of debate and criticism for two primary reasons. First, because it portrays society, the economy and the environment as

being independent of one another, failing to acknowledge their inter-linkages and perpetuating a siloed approach to the three factors. Second, because the model represents the three pillars as of equal importance. Adams (2006) argues this implies that trade-offs or compromises between the pillars can always be made, for example substituting human-made capital with natural capital. Most recently Anderson (2011) stated that the sustainable development community has lived with the three pillars image for too long and suggests it is time to move on to a more realistic and inspiring view.

In an international context it has now become more acceptable to refer to the three aspects of sustainable development as ‘dimensions’, a view that reflects their interdependency.

Overlapping Circles Model

Unlike the ‘pillars’ model, this depiction acknowledges the intersection of the social, economic and environmental dimensions (Figure 4). The sizes of the three circles are sometimes adapted to depict the realities of the present day, with the economy given greatest prominence and the environment given the least. Although there are interlocking regions, the format of this model still suggests that the three dimensions can exist independently from each other. For example, the blue region representing the economy implies it can exist outside of society and the environment.

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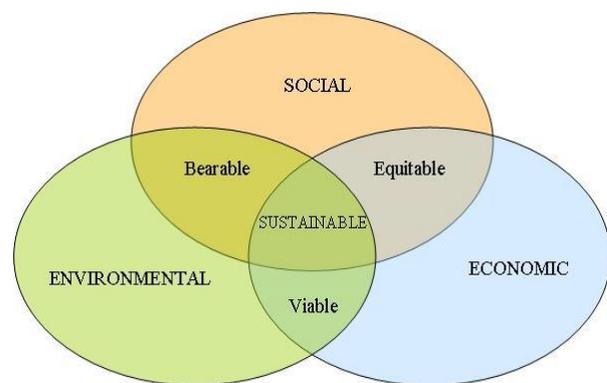


Figure 4. Overlapping circles representation of sustainable development

Nested Circle Model

The nested circle model (Figure 5) sees the three dimensions not as independent from each other, but rather as part of a system, in which all dimensions contribute to the same goal. The economy exists within a society and both are supported by the environment, which supplies natural resources and ecosystem services.

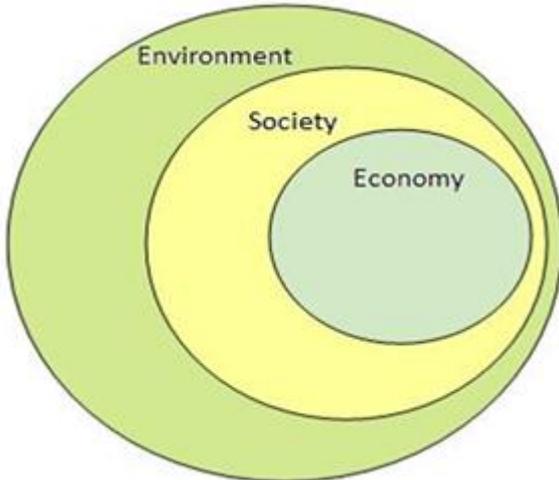


Figure 5. The Nested Circle Model

This emphasises that both economy and society are constrained by and need to fit within environmental limits. This interdependence means that sustainable development derives from a holistic approach.

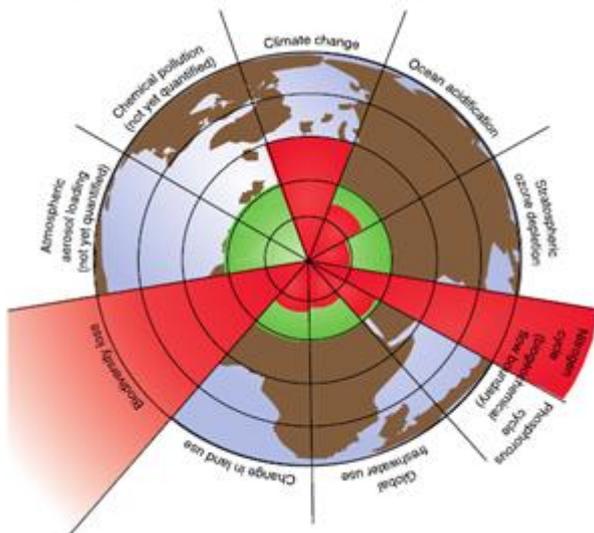


Figure 6. The nine planetary boundaries

Planetary Boundaries

The limits of the global environment have been described through various concepts since the Rio Earth Summit. For instance, ‘carrying capacity’ is defined by Giampietro et al (1992) as the limit to the number of humans the earth can support in the long-term without damage to the environment. Other concepts include ‘tipping points’, ‘footprints’ and ‘sustainable

consumption and production’ (SCP) articulated in the Johannesburg Plan of Implementation 2012, as overarching objectives of, and essential requirements for sustainable development, for which developed countries in particular should provide leadership.

A paper by Rockström et al (2006) proposed a new approach to sustainability by identifying nine ‘planetary boundaries’, which humanity should aim to operate safely within. The nine planetary boundaries include global biogeochemical cycles (nitrogen, phosphorus, carbon and water); the major physical circulation systems of the planet (the climate, stratosphere and ocean systems); marine and terrestrial biodiversity; and anthropogenic forcing (aerosol loading and chemical pollution).

Rockström et al (2006 p.4) affirm “anthropogenic pressures on the earth system have reached a scale where abrupt global environmental change can no longer be excluded”.

According to this model we have already overstepped three of the nine planetary boundaries with the grave risk of transgressing several others. A key message of sustainable development is that the intensity of economic activity combined with technologies that are disruptive to the planet’s own natural processes are threatening some of the planet’s fundamental dynamics such as the climate system, the water cycle, the nitrogen cycle and the ocean chemistry.

Safe and Just Space for Humanity

Taking this concept further, a discussion paper from Raworth (2012) sets out a visual framework for sustainable development that combines Rockström’s concept of planetary boundaries – which only addressed the environmental dimension of sustainability – with the idea of boundaries for human welfare. Raworth’s extension of the planetary boundary concept has become known as the ‘Oxfam doughnut’, “with an explicit focus on the social justice requirements underpinning sustainability” (Dearing et al, 2014, p.227).

Figure 7 illustrates the ‘Oxfam doughnut’ concept of a closed system, bounded by a social and human rights ‘foundation’, below which human welfare reduces, and an environmental ‘ceiling’, beyond which environmental degradation occurs. In between these two regions is a socially just space, with an inclusive and sustainable development that is environmentally safe. In direct contrast to environmental ceilings, social foundations are not defined by social dynamics but by nationally or internationally agreed minimum standards for human outcomes (Raworth, 2012, cited in Dearing et al, 2014).

Urban Sustainability

Over the last decades the concepts of sustainability and sustainable development have influenced the field of urban studies generating a comprehensive body of

knowledge, which in turn has informed a range of initiatives at different scales such as urban villages, millennium communities, resilient cities, eco-neighbourhoods, transition towns, ecovillages, urban ecology and eco-cities.

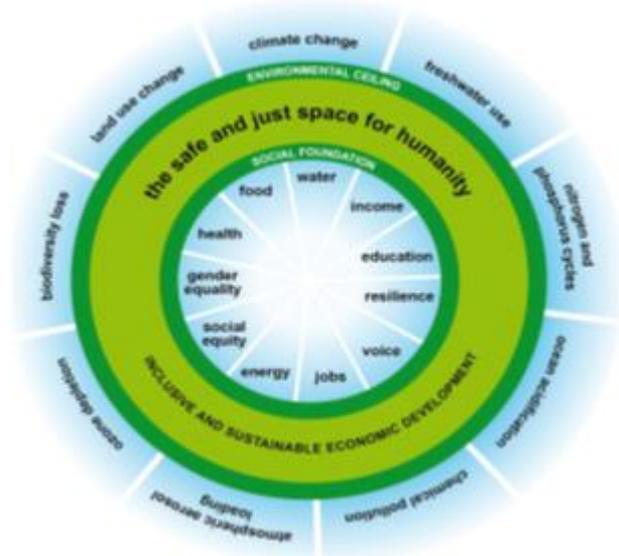


Figure 7. Safe and just operating space for humanity

For some the ‘urban sustainability’ concept lacks a coherent vision and metrics, even being considered an oxymoron and a contradiction in terms (Rees, 1997). Turcu (2012) states it has been reasoned that urban areas rely on too many resources crossing their boundaries to be sustainable and will always be net consumers of resources, drawing them from the world around them. Girardet (2012, p.17) argues “cities cannot exist indefinitely by consuming non-renewable resources from ever more distant hinterlands, and using the biosphere, the oceans and the atmosphere as a sink for their wastes”.

Despite criticism Alberti (1996) states that developing new signals of urban performance is a crucial step in helping cities to maintain the earth’s capital in the long term. Meanwhile, UNEP (2002) affirms that sustainable urban development is not a choice but a necessity if cities are to meet the needs of their citizens and become the home of humanity’s future.

Towards a Conceptual Framework

Several authors acknowledge that the multitude of sustainability indicator systems in use today is a direct reflection of the broad range of definitions and multiple interpretations of the sustainable development concept. The World Bank defines indicators as performance measures that aggregate information into a usable form, highlighting however, the unresolved issues of fluctuation, inter-temporal variations and uncertainty (IIED, 1996).

Bell and Morse (2008, p.XVII) question whether “in trying to measure sustainability, surely the civic, academic and developmental communities were engaging in a futile exercise of measuring the immeasurable”.

Despite of the debate on the immeasurability of sustainability, a range of approaches has been pursued to measure ‘urban sustainability’, notably the ecological footprint method (Rees, 1992; Rees & Wackernagel, 1996) described as a data-driven metric that tracks a city’s demand for natural capital, and compares this demand with the amount of natural capital actually available, providing information on the ‘resource metabolism’ of the city.

Other influential methods include Urban Sustainability Reporting developed by Maclaren (1996) and the Raster Model (Spiekermann & Wegener, 2003), which identifies 35 indicators derived from a state-of-the-art urban land use and transport model. Mega & Pedersen (1998) argue that indicators offer a powerful way of addressing change and are therefore critical to those cities wishing not only to adapt to, but to initiate the desired transformation towards sustainable systems. Turcu (2012) describes how indicators have captured the imagination of both scholars and politicians, in an attempt to encapsulate the real meaning of urban sustainability.

Turcu (2012) affirms that independently of the parameters to be measured, the development of sustainability indicators rests on a challenging choice between two ‘methodological paradigms’:

- expert-led approaches, also called ‘top-down’ or government models which are based on formal hierarchies
- citizen-led approaches, also known as community-led, governance or ‘bottom-up’ models, which draw on a ‘participatory philosophy’.

The Melbourne Principles for Sustainable Cities were developed in Melbourne in 2002 during an international charrette convened by UNEP, with the combined participation of experts and citizens from both developing and developed countries, in an attempt to bridge the gap between bottom-up and top-down approaches.

The principles were adopted at the Local Government Session at the UN Johannesburg Summit 2002 and became part of the final communiqué known as Local Action 21 or the Johannesburg Call. Since then they have been considered a holistic and relevant platform for the definition of urban sustainability amongst countries at different stages of development.

After a comprehensive review of literature, the Melbourne Principles of Sustainable Cities have been selected as the conceptual framework to be applied to the

Quartier Vauban in order to evaluate the strategy by which sustainability has been achieved in that district.

The criteria used to critically appraise the existing urban sustainability frameworks included relevant historical context, joined-up approach, conceptual clarity, level of applicability and international perspective.

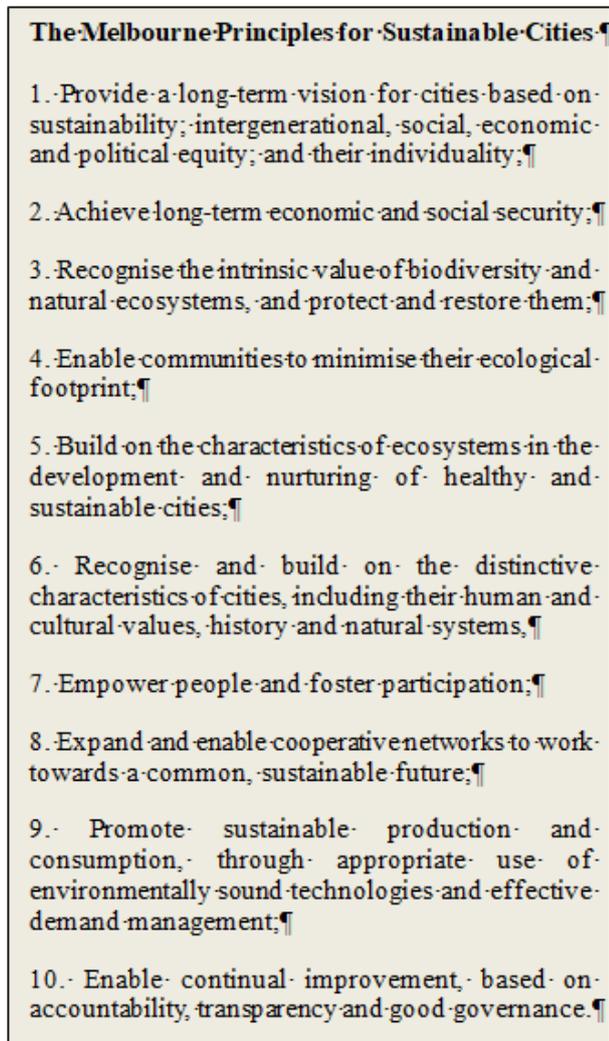


Figure 8. Melbourne Principles for Sustainable Cities

This Melbourne principles framework was selected amongst many others for the following reasons:

- The framework has a chronological and direct relation to the chain of events and debates, utilising democratic practices and springing from the Stockholm Conference that took place 46 years ago;
- The principles have been created through an engaged discussion between citizens and decision makers, both of whose participation and cooperation is essential in transforming cities to sustainability;
- The framework was validated and adopted at the Johannesburg Summit as a useful set of principles utilising participatory decision making to

be applicable in cities of both the global North and South;

- The framework utilises the nested model as the parameter for defining sustainable development;
- The framework has been recognised by ICLEI - Local Governments for Sustainability - the world's leading network of over 1,000 cities, towns and metropolises committed to building a sustainable future, as a refined structure to guide development and processes related to community sustainability.

Freiburg, the Ecological Capital of Germany

Freiburg is an old university town with a population of approximately 230,000 located in southern Germany at the foot of the Black Forest, near the Swiss and French borders. The standard of living in Freiburg is recognised as one of the highest in Germany (World Habitat Awards 2013), not only due to the natural climate and landscape advantages, but also due the active engagement of the citizens in its sustainable urban planning approach.

It is a rich city with a GDP per capita 11 per cent above the European average and has the highest concentration of sunshine in Germany with more than 1,700 hours per year (Beatley, 2012).

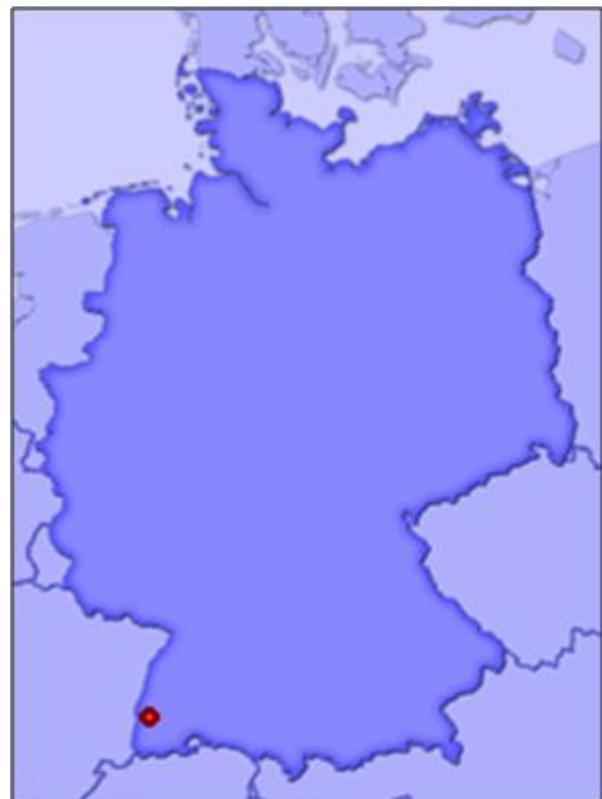


Figure 9. Freiburg's position in Germany

Freiburg developed an integrated planning approach to an environmentally sustainable pattern of city living, well before such approaches were widely recognised as necessary. According to Eberlein (2011), the history of

city planning in Freiburg is based on steadfastness and continuity. This is demonstrated by the presence of Professor Wulf Daseking, the City of Freiburg's Head of Urban Planning, and for 26 years at the leadership of the Freiburg Planning Department, in a city that has seen only four planning directors since World War II.

The cornerstones for Freiburg's exemplary spatial and settlement development were laid out during the post-war years, just after the devastating impact of World War II which left 85% of the inner city destroyed.

Since the 1950s the Planning Department has been a key department in the municipality, combining an urban conservation approach to cultural heritage with sustainable development. Its progressive approach could be seen as early as in 1949 with the pedestrianisation of the city centre and the establishment of the tram network as the backbone of urban development.

Other characteristics of the celebrated integrated approach is the distribution of green spaces to clearly separate open zones from building zones, the tram system and the refusal to build shopping malls outside the city – all of which are still the guiding aspects of Freiburg's urban development today.

Freiburg seeks to be 'a city of short distances' with a strong orientation to walking, bicycling and public transport, car-free areas and high levels of accessibility for people of all ages. This involves three major strategies: restricting the use of cars in the city, providing effective alternative transport and regulating land-use to prevent urban sprawl. Today there are 30km of tramway networks connected to 168km of city bus routes as well as to the regional railway system. Seventy per cent of the population lives within 500m of a tram stop (ICLEI Europe).

The city has established its own Charter for Sustainable Urbanism with a set of 12 principles to guide planning and development in order to achieve a sustainable city. The charter has been widely discussed and used by planning authorities around the world, with many presentations and international congresses on the approach, as well as academic and professional visitors coming to learn directly how to establish a similar charter for their own situations and learn from its numerous good practice examples, including energy, transport, buildings and waste management.

Two-thirds of Freiburg's land area is devoted to green uses. With only 32 % used for urban development, including all transportation, forests account for 42%, while 27% of land is used for agriculture, recreation and water protection (Freiburg Environmental Policy, 2011).

The price for offering such a high quality of life is that Freiburg's population is increasing, requiring the utilisation of brown field sites for housing development.

The Vauban district has been developed under these circumstances.

Case Study: Quartier Vauban

When the French army left their military base Vauban in Freiburg in 1992, city planners and citizens identified the site as an exciting opportunity for a new district. The area of 42 ha only 3 kilometres from the town centre offered the possibility of a comprehensive approach to development with a view to address the housing shortage while integrating ecological features from the very start of the planning process. Despite developers' high interest in developing the site the City of Freiburg was able to negotiate the purchase of the land from the German Government and plans soon began to be drafted.

The vision was to build an entirely new district supplying houses for 5,500 residents, as well as kindergartens, schools and commercial outlets providing 600 jobs and a tram line running right down the middle of the settlement.

The planning of the district started in 1993 and the construction of the first phase broke ground in 1997. The first new residents had moved in by the beginning of 2000, the second wave followed in 2003 and the whole development was completed between 2006 and 2014, with some construction sites still open in 2016. The Vauban plan was developed through an alliance between the City of Freiburg, providing political support and a solid basis for the development, and the grassroots organisation Forum Vauban, representing the citizen voices.

The principle 'Planning that Learns' was embedded in the partnership, which saw each stage of planning and implementation as an opportunity to learn and refine the process.

Forum Vauban established a permanent office 'on site' with both paid staff and volunteers and as early as 1995 started to organise mobilisation campaigns, workshops and events to assist people to form co-housing groups.

The intention from the start was to develop Vauban to high environmental standards as well as ensuring that the district was built upon strong social structures. A key success factor in Freiburg's approach has been its focus on citizen participation and active democracy, enabling the engagement of a wide range of stakeholders in its radical urban planning approach (Sperling, 2008).

The project achieved remarkable results in the fields of energy-saving, traffic reduction, social integration and in the creation of a sense of sustainable neighbourhood.

Energy

All houses in Vauban have been built to meet low-energy, passive-house or even plus-energy standards.

Houses meeting the compulsory improved low energy standard were operating with 65 kWh/m²/year, compared with the average energy standard for new-build German houses of about 100 kWh/m²/year and 200 kWh/m²/year for older houses.

The ‘passive standard’ adopted heating through internal gains, passive solar gains, and heat recuperation systems meeting the standard of 15 kWh/m²/year.

The ‘surplus’ energy houses, built to a ‘passive standard’, with a supplementary energy generation plant, produce more energy in the course of a year than they consume and put the surplus into the public grid.

Vauban provided a test bed for devising and scientifically implementing ways to achieve CO₂ reductions.

There are over 90 passive houses and at least 100 units with ‘plus energy’, which is estimated to be one of the largest ‘solar districts’ in Europe.

Most recently Freiburg Climate Protection Strategy 2030 provided an updated framework for local action in key areas identified for effective GHG emissions reduction. The City’s focus is now on achieving the new target – a 40 per cent reduction by 2030 on the baseline year of 1992 – with the support of an action plan, a structure established to support the implementation process and engage its citizens.

Table 1. Sustainable Energy in Quartier Vauban

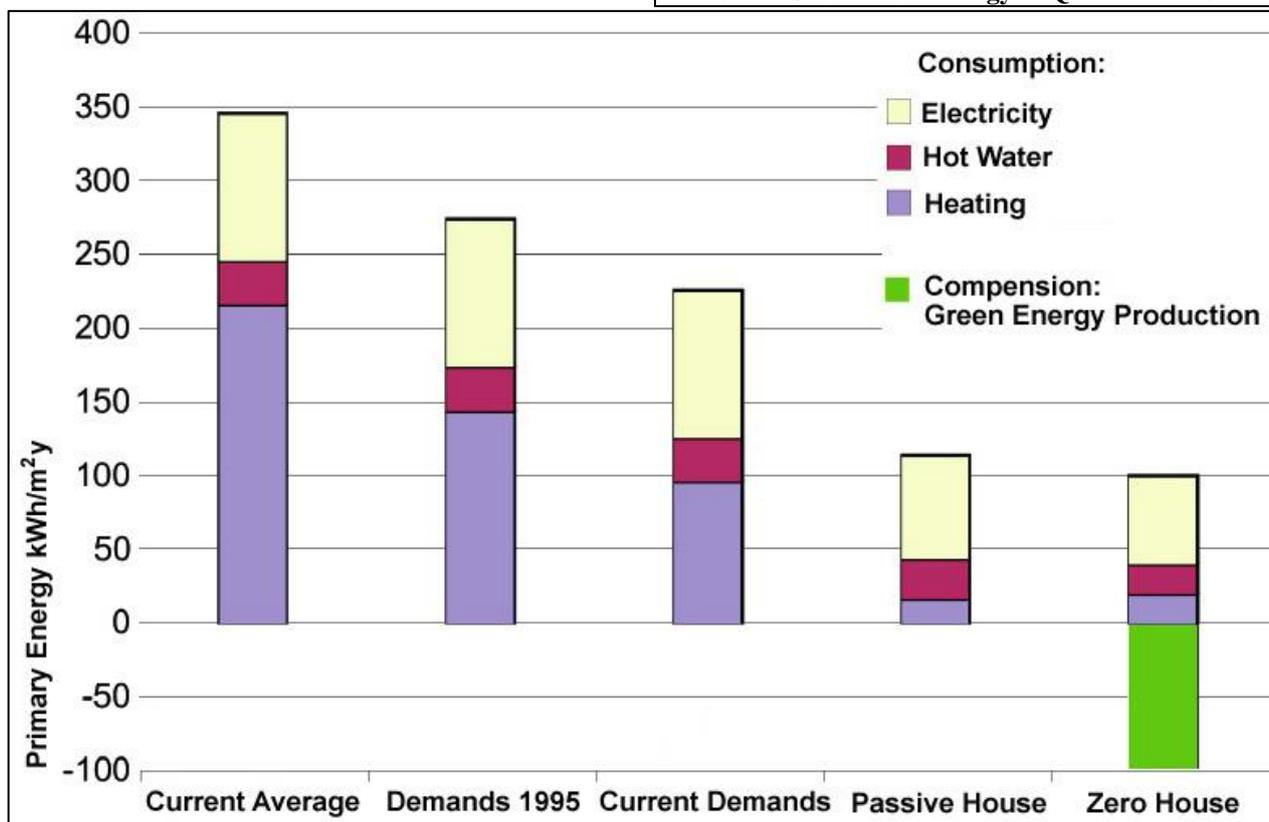


Fig 10: Primary energy savings with the energy houses by Sperling

A highly efficient co-generation plant operating with wood-chips (80%) and natural gas (20%) plus many solar installations provided the remaining heat (hot water) and 65% of the electricity in an environmentally responsible way.

The City’s 1996 climate protection act called for CO₂ emissions to be reduced by 25 percent by 2010. To achieve this reduction, the City introduced a series of measures, including the ‘low-energy standard’, by which every new property built on municipal land must consume no more than two thirds of the legally permitted energy use ceiling in Germany.

Compulsory Improved Low Energy Standard for All Units	65 kWh/m ² /year compared with the average energy standard for new-build German houses of about 100 kWh/m ² /year and 200 kWh/m ² /year for older houses
Passive Standard 4 Storey Units	15 kWh/m ² /year No regular heating systems, heating through internal gains, passive solar gains and heat recuperation system 42 units 1 st phase and 50 units 2 nd phase
Plus-energy Standard Units	At least 100 units; houses producing surplus electricity sold to the public grid. By 2000

	achieved: 450 m ² solar collectors, 1200 m ² photovoltaics
CHP Plant	Since 2002, connected to the district heating grid, running on wood-chips
Savings	Energy 28 GJ per year (CER – cumulative energy requirements-based calculation); CO ₂ 2100 Tons a Year; Mineral Resources: 1600 Tons a Year

Water and Waste Management

The Vauban master plan included extensive use of permeable ground surfaces and vegetated areas designed to attenuate and treat rainwater runoff.

Water conservation was implemented through the collection of rainwater and use indoors, green roofs, pervious pavement, unpaved tramways and drainage sloughs with rainwater infiltration covering 80% of the residential areas.

The water management plan also included an ecological sewage system which transports the sewage via vacuum pipes into a biogas plant where it ferments together with organic household waste, generating biogas which is used for cooking. Remaining waste-water (grey water) is cleaned in biofilm plants and reused for gardening and flushing toilets.

Property owners are charged a storm water fee according to the percentage of their land that is permeable.

Mobility

The mixed-use compact district is served by various modes of public transportation, car-sharing and walking and biking infrastructure. The mobility concept in Vauban was developed to reduce traffic in the neighbourhood to a minimum.

Kasioumi (2011) notes Vauban is exceptional in its mobility concept. With more than half the entire district being 'parking-free', cars are allowed to travel to and from the residences at a very slow speed and only for pickup and delivery.

Private parking spaces, which have to be purchased for approximately €18,000 per vehicle owner plus a monthly service charge, is concentrated in two collective garages on the fringe of the settlement.

Car density in the Vauban district is currently approximately 164 cars per 1000 inhabitants, considerably lower than Freiburg's average of 374 cars and the national average of approximately 566 cars per 1000 inhabitants (Schiller, 2010).

Good local public transport connections linked to the city railway, and convenient mobility services with car

sharing and bike-shops are integral elements of the traffic concept.

According to ITDP 2011 in 2002, 39 of Vauban District households have car-sharing membership, as opposed to only 0.1% in Germany, and 40% of the households do not own a car.

The mobility implementation process was intensively accompanied and supported by the Forum Vauban working group 'Traffic' which had the role of promoting the idea of living without a car of one's own, negotiating between residents and the administration, and of ensuring the necessary balance of interests.

Principles		Indicators
Reduce Car Usage		Streets and public spaces dedicated to children and social interaction No parking in front of the house or on private property for large parts of the residential areas
Speed Limit		Residential Areas 5km/h Main Roads 30km/h
Car-free Living		Creation of a legal framework: the Association for Car-free Living 140 households joined in the first development phase Nearly 40% of households are car-free
Car-sharing		Residents joining the car sharing organisation have access to the cars and receive a one-year free pass for public transportation within Freiburg and 50% reduction on every train ticket
Extension of the Tram Network		Tram conveniently crosses the district with two stops

Social Engagement

A key ingredient for the success of Vauban was public engagement under the orchestration of Forum Vauban in an attempt to introduce more radical design measures into the master-plan. Sperling (2008) affirmed that the success of the eco-district owed much to its democratic strength, direct citizen participation, dynamic planning and consensus building.

From the start Forum Vauban was tasked by the City to help coordinate groups of interested architects, residents and financiers into building cooperatives - "Baugruppen" in German - each being sold small plots of land on which to build housing consistent with the densities and

minimum energy standards set out in the masterplan and Freiburg's planning regulations.

More than 50 workshops were held with the potential residents and approximately 40 co-building (co-housing) projects, two housing co-operatives and a self-organised settlement initiative were founded by 2002, so far providing living space for about 1500 people.

Uptake was enthusiastic, with this model of development accounting for most of the buildings constructed in the first two phases of development, which commenced in 1998 and were completed by 2004.

With the support of Forum Vauban building consensus and leading in the social design, the residents established cooperative shops, small private enterprises, a farmers' market and a self-initiated neighbourhood-centre.

Comparing and Contrasting Melbourne Principles with Vauban Practices

Principle 1

Provide a long-term vision for cities based on sustainability; intergenerational, social, economic and political equity; and their individuality.

This principle proposes that a long-term vision is the starting point for catalysing positive change, leading to sustainability. One of the Transition Towns principles states that despite the state of the planet, if we are unable to imagine the future we want, we will not be able to create it (Hopkins, 2008).

Since the end of WWII, Freiburg has been providing a distinctive long-term vision for its spatial planning, incorporating awareness of the past and looking way into the future. Quartier Vauban reflected and advanced Freiburg's long-term vision, expressed in the shared aspirations of the residents for their district to be designed and implemented to higher ecological specifications, through a participatory process.

A strong vision can be used as a framework for strategic and operational decision-making. Vision evolves as new challenges emerge, inviting new solutions for arising problems. A question remains - how often is Vauban's vision revisited? Addressing this question will prevent Vauban from getting trapped in its own success story and its brave utopian vision of clean living, while continuing to develop meaningful cross-sectorial solutions.

Principle 2

Achieve long-term economic and social security.

The concept of self-build housing or 'Baugruppe' was adopted from the very beginning and incorporated into the master plan for the area. Freiburg Municipality gave preference to groups of citizens over commercial developers at the site and also fixed the land prices so

that commercial developers could not enter into a bidding war with self-build groups.

The self-build element of the Vauban initiative has jump-started the localisation of the economy and actively supported local businesses in the area through the use of local builders, suppliers and architects. The master plan provided commercial space in the districts for 600 jobs.

More research needs to be undertaken to measure the economic progress of the district. Through the lens of the SD nested model, this principle should make the economic and social security contingent upon environmental security. The full support to this principle means Vauban should continue to encourage and support community members creating businesses that enhance the local economy; do not generate pollution; and do not exploit human and/or natural resources.

Principle 3

Recognise the intrinsic value of biodiversity and natural ecosystems and protect and restore them.

It is through citizens' first-hand experience of nature that the importance of healthy habitats and ecosystems is valued and appreciated.

Vauban was built upon a brown field of former barracks with the aim to safeguard, interconnect and restore the remaining green spaces of the area. The new residential area integrated 60-year-old trees, bringing mature life into the young district. Public green spaces were developed together with local residents during several meetings and workshops. Despite being a very condensed settlement, its design demonstrates a recognition of the intrinsic values of ecosystems.

Principle 4

Enable communities to minimise their ecological footprint.

The ecological footprint of a city is a measure of the 'load' on nature imposed by meeting the needs of its population. It represents the land area necessary to sustain current levels of resource consumption and waste discharged by that population. Reducing the ecological footprint of a city is a positive contribution to sustainable development.

According to WWF (2015) Freiburg is widely considered the single best city example of sustainable urban development. However Mayer (2015) states Freiburg's ecological footprint is easily overlooked. Many goods and resources consumed in Freiburg are produced in countries far away from the green city. So these goods don't actually pollute the city area but they do pollute the environment in those countries producing them. An objective evaluation should not omit this pollution when calculating Freiburg's ecological footprint.

In terms of Vauban the settlement has a compact, mixed-use urban form that uses land efficiently and protects the natural environment and biodiversity. The footprint of Vauban could provide an interesting research project that should also consider the consumption patterns of its residents.

Principle 5

Build on the characteristics of ecosystems in the development and nurturing of healthy and sustainable cities.

Cities can become more sustainable by modelling urban processes on ecological principles of the form and function by which natural ecosystems operate.

Key characteristics of ecosystems include diversity, adaptiveness, interconnectedness, resilience, regenerative capacity and symbiosis. These characteristics can be incorporated in the spatial planning strategies of cities to make them more productive and regenerative.

The landscape architect Tillman Lyle proposed that in the design of human ecosystems we have to be particularly careful to mimic a number of characteristics that support the dynamic stability of the natural ecosystem to which our human designs have to adapt, and which we are, at the same time, adapting for human participation.

David Orr suggests “resilience implies small, locally adaptable, resource conserving, culturally suitable, and technologically elegant solutions whose failure does not jeopardize much else” (Orr, 1992, p.34).

Vauban has scored high on its natural design approaches, demonstrating a closed-loop approach in both its energy and water processes, where heat and power are generated locally, waste is minimised and energy and material use become jointly optimised (Van der Ryn & Cowan, 1996).

Principle 6

Recognise and build on the distinctive characteristics of cities, including their human and cultural values, history and natural systems.

Freiburg has preserved its distinctive profile of cultural, historic and natural characteristics while making bold steps towards a resilient future. From a market town to a medieval minster and Renaissance university town, to its post-modern ecological disposition, it is apparent that the historical path that the city has trodden has been both acceptable to its people and compatible with their values, traditions, institutions and ecological realities.

According to Spielberg (2008) the dominating class of Vauban residents can be described as intellectuals coming from a post-materialistic milieu. Following the tradition of the nuclear protesters of the 70s and 80s, Vauban residents are considered ‘eco-pioneers’.

Research in news articles reveal that there is a fragile balance between the pioneers and ‘ordinary citizens’, possibly inhibiting the cultural diversity needed for diverse human systems to evolve. (Guardian). The majority of Vauban residents are young middle class people with children. More efforts should be made to increase the mix of social groups and ages.

New districts also need to preserve their history. What happened in the area before? What signs of its history can still be found? What is ‘the district story’? The answers to these questions are also important to create an identity for the new community.

Principle 7

Empower people and foster participation.

Major driving forces for the development of Vauban have been the ideas, the creativity and commitment of the people involved and the common goal to create a sustainable, flourishing neighbourhood. From the start it was clear that it was not possible to solve all problems within one project, however there was an openness to dialogue towards a consensual vision.

The official Vauban website states that direct citizen participation was much stronger than expected, with residents really identifying with ‘their’ district.

This can be evidenced by:

- the number of 30 co-housing groups and community building projects,
- the number of people taking part in workshops,
- the number of people committed to local initiatives (district festivals, farmers’ market, neighbourhood centre, mother’s centre, private kindergarten, community gardens, the co-operative district’s foodstore, ecumenical initiative for a church in Vauban and others).

Vauban’s project structure integrated legal, political, social and economic actors from grass-roots level up to the city administration. For Vauban to continue to maintain a high standard of social participation, attention needs to be given to empowering those whose voices who are not always heard, so that the whole settlement avoids the fundamentalism associated with the creation of an eco-enclave.

Principle 8

Expand and enable cooperative networks to work towards a common, sustainable future.

There is value in cities sharing their learning with other cities, pooling resources to develop sustainability tools, and supporting and mentoring one another through inter-city and regional networks. These networks can serve as vehicles for information exchange on lessons learned. Vauban attracts city planners, students and researchers from all over the world, who visit to learn, exchange and

be inspired and Forum Vauban frequently receives invitations to present the project at conferences and seminars, including an invitation to present at a Conference on Urban Planning and Regeneration: Key to Tackling Climate Change organised by CIFAL Scotland and Dundee City Council in 2008 at Caird Hall.

Principle 9

Promote sustainable production and consumption, through appropriate use of environmentally sound technologies and effective demand management.

Sustainable production can be supported by the adoption and use of environmentally sound technologies which can improve environmental performance significantly.

These technologies protect the environment, are less polluting, use resources in a sustainable manner, recycle more of the city’s waste and products, and handle all residual wastes in a more environmentally acceptable way than the technologies for which they are substitutes.

Vauban scores high on this principle with a 4.5 out of 5. Some of the evidence includes:

- Energy efficient houses
- Highly efficient co-generation plant operating with woodchips and connected to the district's heating grid
- Number of solar installations constantly increasing
- Ecological traffic/mobility concept
- The residential area built around conserved old trees
- Rainwater collection and permeability

Principle 10

Enable continual improvement, based on accountability, transparency and good governance.

Governance has different meanings to different people but has broadly been defined as the intersection of power, politics and institutions (Leach, Scoones, & Stirling, 2010). Valentin et al (1999) introduced governance as the fourth pillar of sustainable development.

Vauban’s governance structure integrates legal, political, social and economic participants from the grass-roots level up to the city administration with three main institutional players:

- NGO ‘Forum Vauban’ as official body of the broad citizen participation
- Project Group Vauban providing the administrative coordination of local authorities
- City Council Vauban Committee, the main platform for information exchange, discussion and decision preparation for decisions that were ultimately made by the City Council

Until 2003 most conflicts were resolved in a cooperative, participatory way. In some cases, differences of opinions

were taken to the city council to be decided by majority vote.

Initial resistance came in the early days from many of the city’s population, especially those who lived in the suburbs, who did not want to reduce their dependency on the car and wished to have out-of-town shopping facilities.

There was also strong resistance from the developers who wished to have a free hand in the development of the city. Both were overcome by having a clear strategy for the development of the district and making this clear to developers and by convincing and inspiring the people, through engagement in the discussion and decision-making process, that this was a good choice for the city.

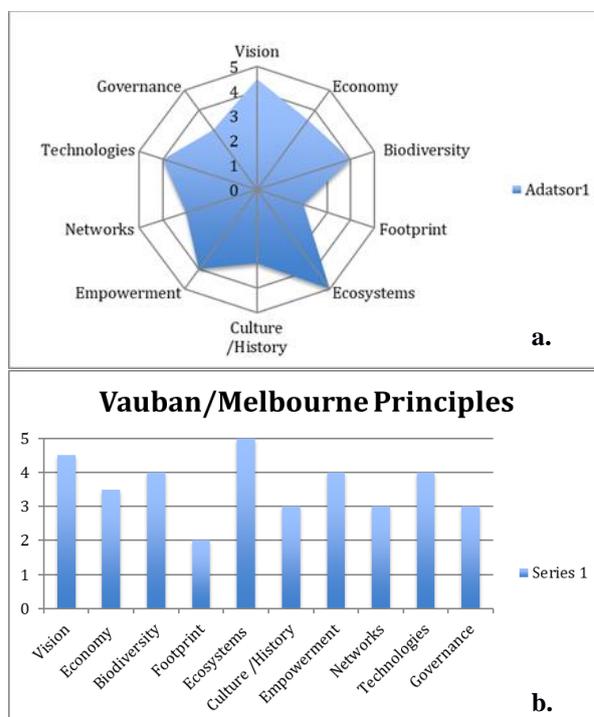


Figure 11. *a* and *b* demonstrate the numeric synthesis of the evaluation of Vauban against Melbourne Principles where 1 is low and 5 is high performance towards sustainability.

Conclusions

Sustainable cities are the key to our future - they generate their own wealth, shape local policies and are spearheading a thrilling new vision of governance for the implementation of the Agenda 2030 (UN, 2015). Pragmatic in approach, close to real people and their problems (Barber, 2013), cities also contain the seeds of their own regeneration (Jacobs, 1961). Barber (2013) argues that in this century, it will be the city, not the state that becomes the nexus of economic and political power. This article has explored the conceptual interlinkages between the three dimensions of sustainable develop-

ment in the context of Vauban district in Freiburg, known as the ecological capital of Germany. It has also investigated how, through the process of implementation of sustainable development, the nature of the interface between environmental protection, social inclusion and economic development has been constructed. Finally, it has analysed the performance of the neighbourhood against the Melbourne Principles, reaching an overall score of 3.6 points against 5, where 1 is low and 5 is high performance.

Continuity of an integrated planning approach over the last 30 years has led to the development of Freiburg as a leading exemplar of sustainable living in a compact car-lite city. The car-free, high density, energy efficient, socially engaged Vauban district is a matter of civic pride for its residents and Freiburg officials, providing a great example for planners worldwide, not only as best 'practice' for sustainability, but also as good 'process'.

In the coming years spatial planners face tough decisions about where they stand on protecting the green city, the economically growing city, and advocating social justice. On a planet with limited resources, growing population and greater social disparities, conflicts among these goals will tend to intensify. To win the sustainable development battle nothing less than a calculated revolution in the way we plan, live, do business and seek recreation is required. This is the continuous design challenge ahead of Freiburg and cities worldwide.

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