Smart and Sustainable Cities: What Is Smart?—What Is Sustainable?

Pierre Laconte

Abstract **"Smart cities"** are cities using information and modern communications technology to connect activities hitherto unconnected. This became a buzzword supported by a variety of interests including, among others, the producers of knowledge-based consulting services making use of "big-data" collections. Four examples of smart cities applications are presented. **"Sustainable cities"** are those that meet the needs of their present citizens without compromising the ability of future generations to meet their own needs, reconciling the environmental, social and economic "pillars" of long- term durability. Sustainability applies at the levels of individual buildings, neighborhoods, entire cities, their peripheries and their regions. Benchmarking aims at systematically comparing sustainability in space and time, at each of these geographic levels. Focus is put on assessment criteria reflecting political orientations. Three pioneering examples are presented.

Keywords Smart · Big data · Energy · Transnational · Assessment
Global · Local · Sustainable

1 "Smart Cities"

1.1 "Smart Technology" for "Smart Cities"

"Smart city" services vary according to the actors involved and their aims, interests and objectives, including:

- applications of big data, optimizing the use of urban technology and urban networks,
- integrating planning and transportation,

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- saving natural resources and fossil energy,
- optimizing the use of energy distribution networks,
- optimizing consumer behavior in line with the objectives of the actors ("human engineering").

Suppliers of smart technology for cities include, *inter alia*, IBM, Siemens, Microsoft, Cisco, Deutsche Telecom and Panasonic (Libbe 2016).

1.2 Four Examples of "Smart City" Applications

1.2.1 Using Mobile Phones for Banking

M-Pesa (M for mobile, Pesa for money, in Swahili) is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone in Kenya and Tanzania. It has since expanded to Afghanistan, South Africa, India and, more recently, to Romania and Albania.

The service enables users to deposit money in an account stored on their own cell phones, to send balances using PIN-secured SMS text messages to other users, including sellers of goods and services, and to redeem deposits for regular currency.

The service has been lauded for giving millions of people access to the formal financial system and for reducing urban crime in a largely cash-based society.

However, such services also allow the buyers of the big-data flows involved to know about many aspects of the consumers' behavior, e.g., transport operators wanting to optimize bus-route networks or locate new bridges, as in Abidjan (Blondel 2013).

Orwell's "Big Brother" is not far away (Jaivin 2014), see Fig. 1.

1.2.2 Enhancing Education and Participation

"Medellin Ciudad Inteligente" emphasizes popular IT education, including a network of large and small libraries, even in metro stations, in addition to an iconic main library, see Fig. 2.

It is part of the successful metamorphosis of the Colombian "capital of crime" into a "normal" city, with the help of the active participation of its citizens (Lee Kuan Yew World City Prize 2016 Laureate).

1.2.3 Taking Advantage of Big-Data Exchange Platforms Between Users

Multinational service providers to cities and citizens are involved in platforms, ranging from health-data exchanges down to information on work opportunities and

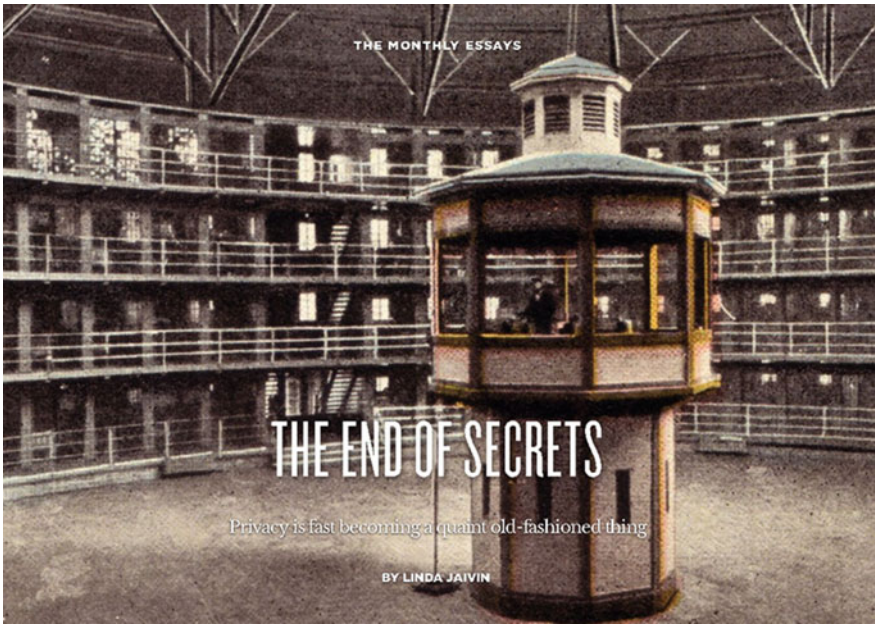

Fig. 1 A postcard showing the interior of Stateville correctional centre, Illinois, modelled on Bentham's panopticon (cover of Linda Jaivin's essay on privacy: "The End of Secrets", published in The Monthly, June 2014)

Fig. 2 España Library of Medellin. A strong statement in favor of "knowledge city". © Municipality of Medellin

personal transport. They enjoy access to international funding by the European Union (EU) and public and private financial institutions, based on long-term monopolistic profit perspectives and low levels of regulation. “Uber” taxis are an emblematic example of such a capitalistic platform, which has generated the term “Uberisation”.

Smart platforms, however, can very well be owned by independent cooperatives such as the initial platform “Blablacar”, that links long-distance travelers. A challenge to smart (and sustainable) cities is the ownership of the data exchange platforms, including the ownership of their algorithms.

1.2.4 Smart Vehicles and Cities

Autonomous vehicles (AV), or zero-occupancy-vehicles, have been often described as a “liberation from the driving chores”. However, according to the International Association of Public Transport (UITP 2017), they will also result in users acquiring greater tolerance for long-distance commuting, and in fleets of unstaffed vehicles looking for customers. They will therefore increase sprawl and urban congestion, instead of reducing it, unless they are used as short-distance links to public transport, avoiding the costly use of land for “park-and-ride” facilities (e.g., Keolis’ automated vans in Lyon in 2017, see Fig. 3).

Fig. 3 Automated vans operated by Keolis in Lyons starting in 2017 (UITP 2017)

2 "Sustainable Cities"

2.1 Definitions

2.1.1 The Space/Time Dimension

Sustainable cities are, in accordance with the Brundtland Report (WCED 1987), those that meet the needs of their present citizens without compromising the ability of future generations to meet their own needs. This requires reconciliation of the environmental, social and economic 'pillars' of sustainability.

The Brundtland sustainability definition was further elaborated by the planning-related "Sustainable Development Goals", adopted by the UN General Assembly (2016).

Assessment of best practices requires a clear spatial view of each of the geographic levels of observation, considering the likely policy conflicts between global and local concerns. Global concerns focus on global warming and climate threats at the planetary level, while local concerns focus on the needs and aspirations of citizens "here and now".

Assessment of best practices also requires putting them in a time perspective. The time perspective includes the will by political decision makers to pay for immediate investments, which will benefit only to voters not yet born. A case in point is N. Stern's plea for a lower discount rate in favor of "sustainability" investments, i.e., investments helping to reduce global warming (Stern 2006) and the debate around his views (Weitzman 2007).

Benchmarking aims at assessing the performance and the practice of sustainable development.

2.1.2 The Resource Dimension: The Case for Circularity

According to the traditional linear metabolism, cities consume resources and create waste, pollution and CO_2, plus other greenhouse-gas emissions (GHG) at a high rate.

In contrast to this linear metabolism the concept of circular economy, "Cradle to Cradle" (C2C) instead of "Cradle to Grave", has been pioneered by Mc Donaugh and Braungart (2013).

2.2 Evaluation Tools for the Sustainable City

2.2.1 Is the Reduction of CO_2 and Other GHG Emissions a Correct Indicator of Urban Sustainability?

A survey of accounting methods for GHG-emissions methods has been done in a (too) little-known comparative study by Bader N. and Bleidschwitz R., at the

College of Europe in 2009 (Bader and Bleidschwitz 2009). Unlike the measurement of GNP, for which there is a generally agreed method, there is no such agreement about the GHGs.

The **measurement tools** differ vastly according to the institutions in charge of measuring. These currently are, among others:

- CO_2 Grobbilanz/EMSIG (Climate Alliance Austria, Energy Agency of the Regions)
- ECO_2 Region (Climate Alliance, Ecospeed)
- GRIP (Tyndall Centre, UK Environment Agency)
- Bilan Carbone (ADEME)
- CO_2 Calculator (Danish National Environmental Research Institute, Local Government Denmark, COWI)
- Project 2 Degrees (ICLEI, Clinton Climate Initiative, Microsoft).

The **measurement** covers either all of the six different Kyoto GHGs, or only some of them, i.e., mainly carbon dioxide and methane.

Different estimates of potential global warming effects are obtained depending on whether the second, third or fourth Intergovernmental Panel on Climate Change (IPCC) report is used.

The reporting standards are different.

The **scope** of measurement either only includes direct emissions or also includes indirect and life-cycle emissions, taking into account the imported and exported emissions.

The sectoral emissions definitions are highly unclear, e.g., those for transport, which does not include aviation nor shipping.

2.2.2 Measuring Fossil-Fuel Production and Consumption as an Alternative to Direct Measurement of CO_2 Emissions

Considering the very low political probability of a global agreement on the calculation of CO_2 and other GHGs, the second-best tool for assessing sustainability could be to analyze the production and use of fossil fuels as sources of energy. Fossil fuels, according to N. Stern (Stern 2006), generate some 80% of the GHG emissions. On the other hand, these emissions offer plenty of possibilities for reuse, if appropriate incentives make this attractive (Mulhall and Braungart 2016).

In any case, there is a possibility of agreement that smart and sustainable cities should be aiming at energy savings, as well as improving the quality of life of their citizens, including the quality of air, water and soils, independently from any future climate changes (Laconte and Gossop 2016).

Three pioneering approaches resulting from the author's professional experience are briefly described:

- Zurich, a high-performing member city of the International Association of Public Transport (UITP), which he managed from 1985 until 1999;

– Bilbao, also a highly successful smart and sustainable city, having devised a tool for achieving this at a minimum cost, and laureate of the Lee Kuan Yew World City Award 2012; and
– the New Louvain University town/neighborhood, of which he was one of the three planners, and which was a laureate of the International Union of Architects' Abercrombie Award.

3 Three Pioneering Approaches to Smart and Sustainable Cities or Neighborhoods

3.1 Zurich: Planning for Low-Energy Land Use and Transport as a Tool for Quality of Life (1985-)

3.1.1 Traffic Management

In Zurich, trams and buses enjoy absolute on-street priority. When approaching a traffic light, sensors (seen on the lower left in Fig. 4) ensure they have a priority green light at all time of the day. The reliability of timetables therefore makes public transport the city's fastest mode of transport. The modal split is around 80% in favor of public transport, notwithstanding the lack of underground railways, see Fig. 4.

3.1.2 Parking Management

The real political ingenuity of Zurich, however, lies in a parking policy favoring its local voters, versus commuters voting elsewhere.

Unrestricted on-street parking is exclusively reserved for Zurich-registered residents (the voters) in their neighborhoods, while cars entering the city from other neighborhoods or municipalities are limited to a maximum of 90 min' parking time (blue zone, see Fig. 5).

This measure triggered a large-scale return of inhabitants to the city, and benefitted the paid-for public car parks. It has been politically rewarding for the city fathers, while suburban rail travel has increased and improved. This system could be applied in any city where commuters largely come from other electoral districts.

Fig. 4 Effective priority for public transport and non-motorized vehicles is ensured by street-level detectors (see lower part of the picture)

3.2 Bilbao: Smart and Sustainable Urban Regeneration Through Public-Public Planning Partnerships (1989)

The prosperous, long-standing steel industry was wiped out by the 1989 crisis. Industrial land was re-used for new activities, based on services and culture, while preserving architectural heritage.

Some 40 ha of derelict industrial land along the Rià, adjacent to the city's central business district (seen on the left in Fig. 6), owned by several public bodies ranging from local to national, was unified by a public-public partnership embodied in a common redevelopment corporation—"Rià 2000".

This valuable land—situated between the two anchors and very close to the central business district—was developed by "Rià 2000", with an obligation to invest all of the proceeds in new public infrastructure along the same canal.

The huge surplus generated by the land sales was thus to be used entirely to enhance connectivity and further urban regeneration.

Transport was part of Bilbao's renewal. Partly new (with metro stations designed by Norman Foster) and partly renovated railways enhanced connectivity throughout the city and the region, and attracted energy-saving use of public transport. This extensive rail network includes metro, regional rail, tram and funicular (see Fig. 7).

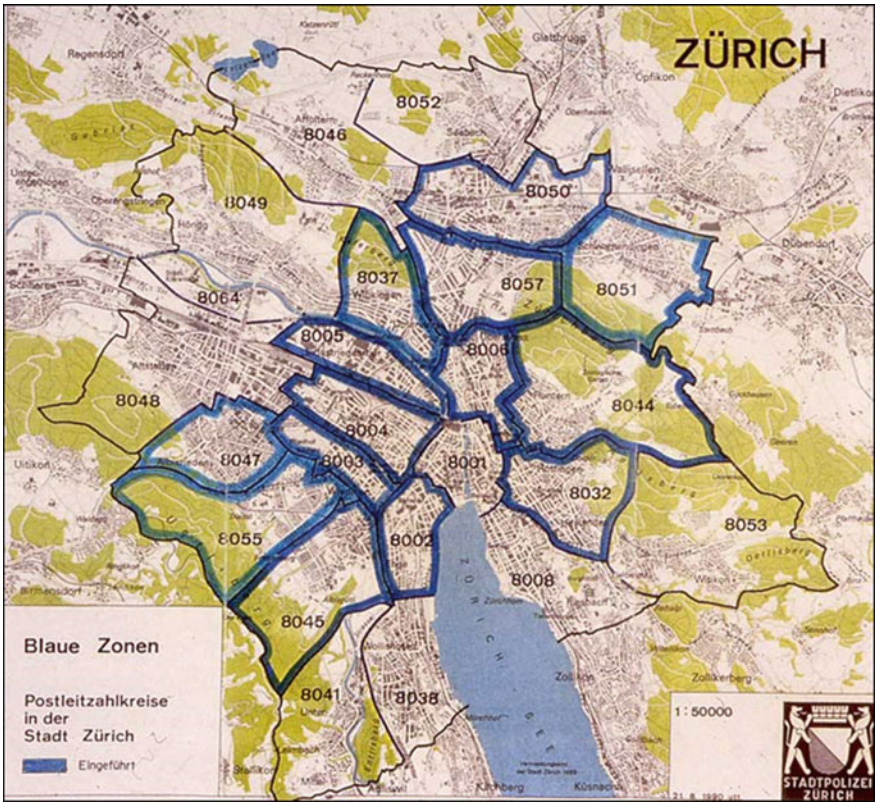

Fig. 5 Unrestricted street parking is exclusively reserved for residents of individual neighborhoods (postal districts). In the blue zone, a 90-min restriction applies to all other motorists

3.3 Louvain-la-Neuve: Planning for Low Energy and Resource Saving (1969)

3.3.1 The Case for a New University Town

Because a 1968 law required the exclusive use of the Dutch language in Flanders, the French-speaking Louvain Catholic University was forced out of the city of Louvain/Leuven. The university bought ca. 920 ha of agricultural and forest land in a rural area close to the Brussels-Namur road (N4): the central part was set aside for urban development, while forest land in the north was preserved. The overall master plan and architectural coordination was entrusted to the "Groupe Urbanisme-architecture" (Laconte 2016).

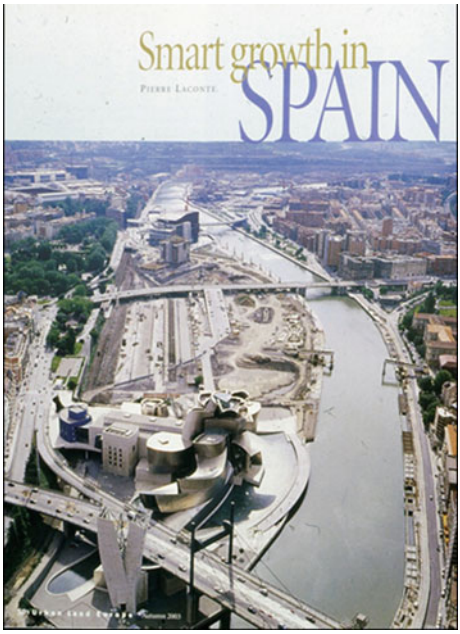

Fig. 6 The two anchors for Bilbao development, at each end of the site, were the new Guggenheim Museum and the Congress and Concert Center (Laconte 2003)

3.3.2 Planning for Land Saving and Uncertainty

Being left with only the annual resources allocated to all Belgian universities, a pedestrian-focused option was chosen. A linear pedestrian spine starting from the only existing road allowed the university to save land and advance investment in transport and parking infrastructure, see Fig. 8.

The main pedestrian street was implemented from the first phase, starting at the existing road east of the site in 1972, later being extended to the railway station opened in 1975, at the center of the city, and towards the western part of the site. Car access to buildings and parking is placed outside the spine, with some underpasses enhancing access, see Fig. 9.

The center of the first phase was the Science Library, an iconic concrete building seen as the cathedral of a university town, with its plaza (parvis) above an automobile underpass. For some 45 years, it has been a social gathering place surrounded by university buildings, shops and restaurants (arch. A. Jacqmain), see Fig. 10.

The National Belgian Railways agreed to build a subterranean railway link to the existing express-rail line between Brussels and Namur. All streets are pedestrianized and combine university buildings, housing, retail and cultural services. Land remains the property of the university and is leased to investors. All motorized transport is located underground, see Fig. 11.

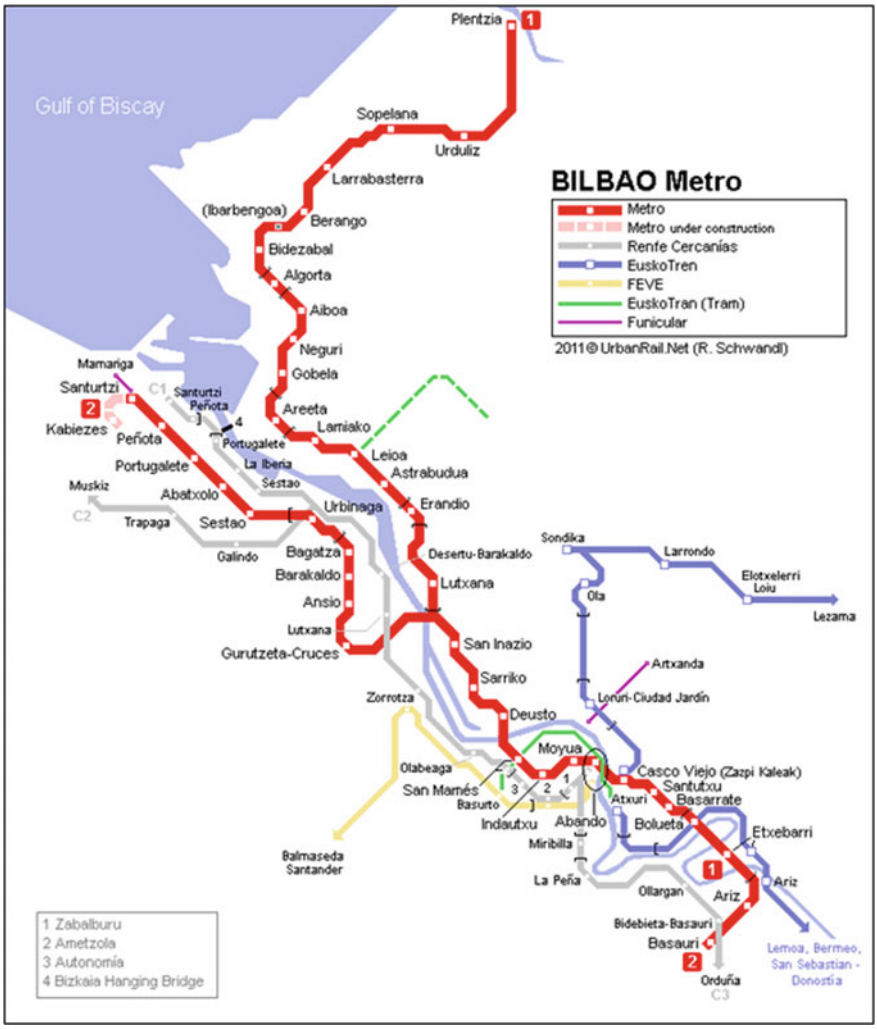

Fig. 7 Bilbao transport network

The space above the slab is built up with multifunctional, high density-low rise buildings. The shopping mall adjacent to the railway station (8 million visitors/year in 2015) and the private Hergé museum (arch. de Portzamparc, Paris), also near the station, are part of the high density-low rise development, see Fig. 12.

In Louvain-la-Neuve, all storm water is funneled to a reservoir which is treated as a lake, saving infrastructure costs and attracting residential investment, see Fig. 13.

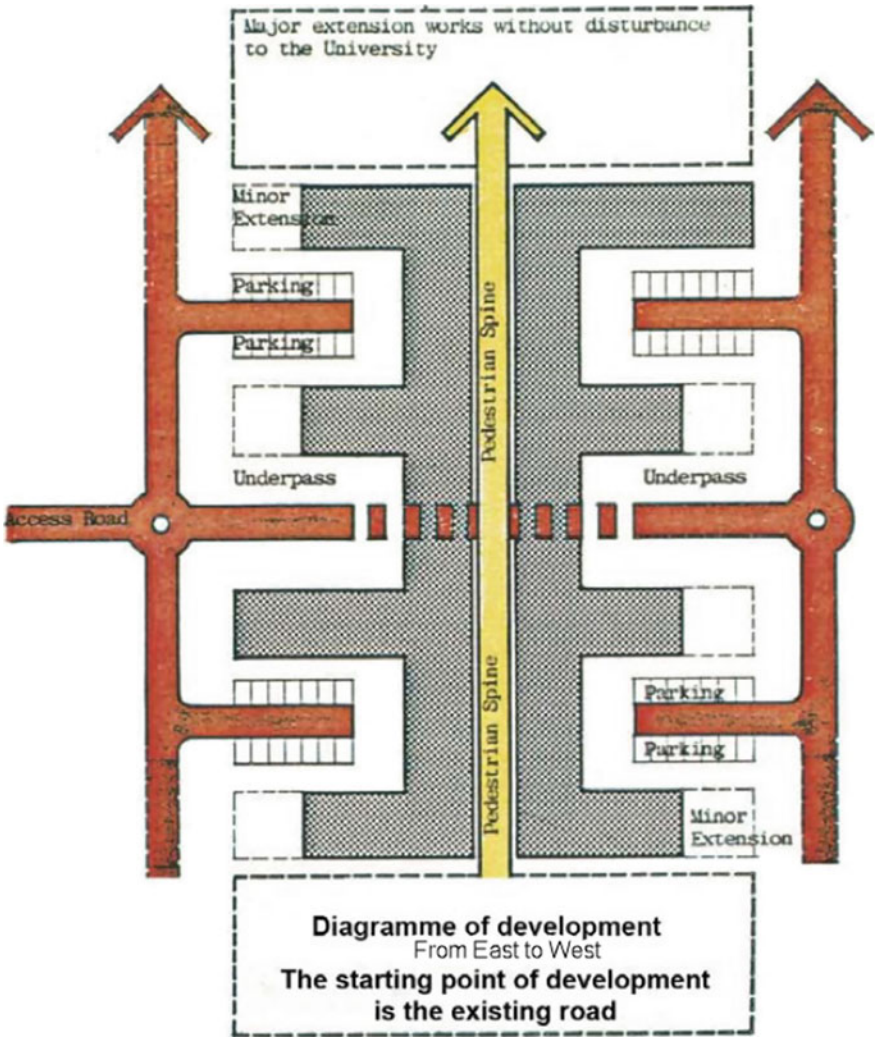

Fig. 8 A linear pedestrian central spine—in this case inspired by the University of Lancaster—allowed a step-by-step mixed urban development with automobile access to buildings and parking being placed outside the spine, with occasional underpasses

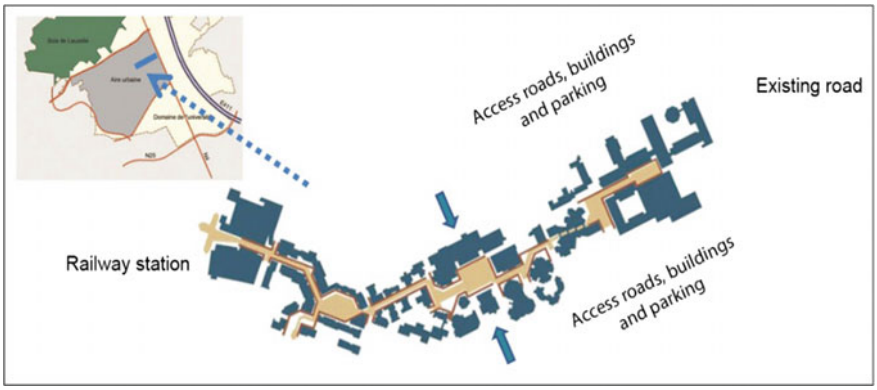

Fig. 9 Implementation of the spine on the ground—a string of public spaces for movement and leisure

Fig. 10 The science library

Fig. 11 Street-level entrance to the railway station

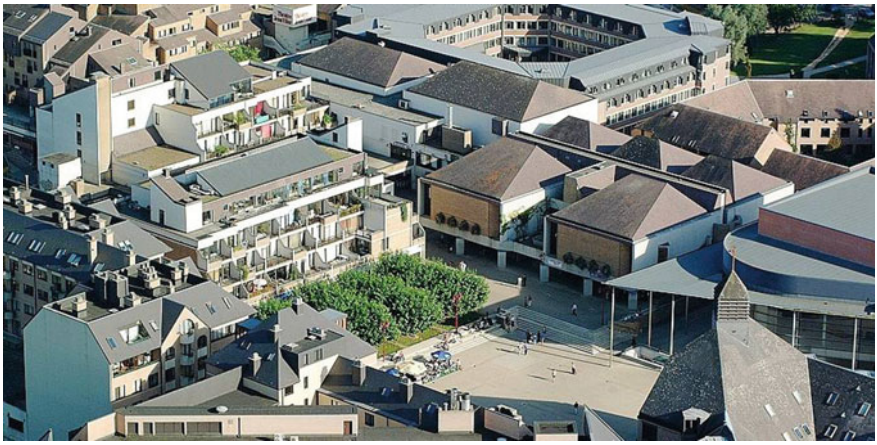

Fig. 12 Apartments, shops, lecture halls, faculty buildings and green space on top of the slab

Fig. 13 General view including the water reservoir treated as a lake

4 Conclusion

This opening keynote address has attempted to separate the concepts of "smart" and "sustainable" planning, the goal of urban planning being sustainability, with the best possible use of available resources and technology.

As to "smart cities", four examples of technology-based "smart" planning tools have been presented as illustrations, stressing in each case both their added value and their potentially negative side effects.

As to "sustainable cities", the distinction has been drawn between the global and local levels.

Global threats related to global warming and the GHG emissions, potentially affecting climate, result mainly from the use of fossil energy. The direct measurement of emissions has, however, escaped any agreement between countries and stakeholders, allowing measurement discrepancies, unreliability and room for fraud. The proposed solution to better measuring global warming threats is to analyze the production and consumption of fossil fuels and ways to reduce the gigantic subsidies they enjoy in most countries.

At the local level, quality of life and reduction of air and water pollution also relate to reducing the need for energy based on fossil fuels for transport and other urban uses, while contributing to reducing GHG emissions at the global level.

Three pioneering examples of local-level sustainable planning have been presented. Not ignoring the multiplicity of best practices, but always limited in space and time, a one-time best practice risks becoming a worst practice at a later stage, or vice versa.

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Author Biography

Pierre Laconte is President of the Foundation for the Urban Environment, which seeks to link urban planning, transportation and the environment. A past President of the International Society of City and Regional Planners, and former Secretary General of the International Association of Public Transport, he was evaluator for the European Green Capital Award in 2012 and 2013 and a member of the Lee Kuan Yew World City Awards Council. He is one of the three planners in charge of the Louvain new university town in Belgium, which received the Abercrombie Award of

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