# Towards more sustainable neighbourhoods: are good practices reproducible and extensible?

## A review of a few existing "sustainable neighbourhoods"

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*ABSTRACT: Several urban neighbourhoods built or retrofitted from the 1990s have become renowned for their sustainability and are often presented as good practices, as far as sustainable development and low energy architecture are concerned. Although these "sustainable neighbourhoods" receive a great deal of media coverage, they seem to stay "single" experiments and are rarely repeated in other territories or at larger scales. This paper first discusses the European context, which fostered the development of these pilot experiments. It then proposes a rereading of eight famous sustainable neighbourhoods in an analytic way that is more than descriptive to highlight good practices to repeat and weaknesses to avoid and question the reproducibility of these experiments. The settings grid, which describes the achievement conditions and some common characteristics of these urban projects, highlighted through this analysis, is compared with a Belgian dwelling project, and this comparison allows us to explain why it can be difficult to extend these concepts more widely. Finally, the paper proposes several guidelines to promote energy efficiency and sustainability at the urban scale in order to support the planning of more sustainable urban projects.*

*Keywords: sustainable neighbourhoods, urban sustainability, best practices*

## 1. INTRODUCTION

The world is undergoing the largest wave of urban growth in history. In 2008, for the first time, more than half of the world's population (that is to say 3.3 billion people) lived in urban areas. By 2030, this number will swell to nearly 5 billion [1]. As cities and towns are now known to be responsible for the majority of greenhouse gas emissions [2] and energy consumption, it becomes urgent to reduce their environmental impact and to identify how to improve existing and new urban neighbourhoods and how to make them more sustainable.

These causes for concern were expressed for the first time in 1987 in the famous Bruntland report [3], which introduced the concept of sustainable development. From then on, the need for more sustainable urban forms has been treated in several successive European texts and charters that recognise the role of European cities and towns in pursuing sustainability [4] and the importance of cooperation and local actions in achieving a more sustainable future [5, 6]. In this European framework, budgets were granted to demonstrate, in real conditions, how to improve the sustainability of new and existing urban districts and how to foster the transfer of knowledge and best practices in the field of urban planning, for example, through the European Urban Knowledge (EUKN) and Energy Cities Networks.

Several pilot urban neighbourhoods, often set themselves up as "sustainable", were developed or retrofitted in this context. They received significant media coverage, and they were widely praised as best practices in terms of sustainable urban planning and low energy architecture. However, these case studies are often presented in a descriptive way, and they are not analytic enough to allow one to compare these neighbourhoods, learn from them, disseminate knowledge and turn to good account these experiments. In this context, the paper proposes a rereading of 8 well-known examples of sustainable urban design in an analytic way that is more then descriptive. The approach adopted is intended to identify invariants in the diversity of practices to facilitate the comparison between case studies and to highlight achievement conditions and common characteristics that could be reproduced to improve current and future urban projects. Every urban project is, in fact, strictly linked to its context, and systematisation or simply the copy-pasting of a project from one context to another is not the aim [7].

## 2. SUSTAINABLE NEIGHBOURHOODS

### 2.1. The district scale

The sustainable neighbourhood can be considered the meeting point between the individual sustainable building and the management of a sustainable city, which are two fields in which actors have evolved independently for a long time [8]. Thus far, this intermediate scale has been mostly neglected in building energy analyses, whereas decisions made at the neighbourhood scale have huge consequences on the performances of individual buildings and the transportation habits of the inhabitants [9]. Moreover, collective infrastructure (e.g., heating networks) is often more efficient and less expensive than equipment intended for individuals [10]. The neighbourhood is more homogeneous than the city and constitutes the ideal scale at which to experiment with new technologies and methods to improve urban sustainability [11].

Finally, the urban fragment is large enough to guarantee the transversality that constitutes the core of the sustainable development and is small enough to more easily mobilise inhabitants and gain their participation in the project.

### 2.2. The case studies

The paper focuses on six new and two retrofitted sustainable districts to allow a range of development situations to be explored. These case studies are chosen for one main reason: the literature available (mostly through websites and information centres) and the publicity surrounding them, which tends to highlight their exemplary nature as far as urban sustainability is concerned. These case studies were built 10 or 15 years ago, which gives us enough time to assess the mid-term effects. Due to the restricted length of the paper, only the main characteristics of the projects (context, number of dwellings and area) are summarised below. More detailed information will be included in the presentation / poster:

- [BO] BO01 in Malmo (S) is a new urban district built in the framework of the European Building Exhibition (City of Tomorrow). It comprises, in the first stage, around 600 dwellings on 9 hectares. New technologies are used to demonstrate expertise and change the reputation of the city.
- [HS] Hammarby Sjöstad in Stockholm (S) is a 200-hectare former harbour transformed into a sustainable neighbourhood (10,000 dwellings) in the outskirts of Stockholm that lacked new high-quality dwellings.
- [BZ] BedZed in Sutton (UK) is a new very low energy-consuming mixed-use community (2 ha, 82 dwellings and offices) built in the outskirts of London by a private developer and an architect involved in environmental topics.
- [KR] Kronsberg in Hanover (D) is a new district built for the 2000 World Exposition to promote high environmental quality and demonstrate new technologies. It comprises about 6,000 dwellings as well as shops and offices on 150 hectares.
- [FR] Vauban in Fribourg (D) is one of the most famous sustainable districts. It comprises, in the first stage, around 5,000 inhabitants and 600 jobs (38 hectares). The project aims to build a city district in a co-operative, participatory way and in line with ecological, social, economical and cultural requirements.
- [EL] Eva-Lanxmeer in Culemborg (NL) is a new green neighbourhood initiated by a foundation active in environment. It comprises around 250 houses (14 ha). Its main originality is to promote the constant involvement of the inhabitants.
- [VS] Vesterbo is a retrofitted neighbourhood in Copenhagen (DK). Environmental techniques are particularly advanced in the Hedebygade urban fragment (280 dwellings) that was very dense and socially disadvantaged.
- [AU] Augustenborg in Malmo (S) is a retrofitted social district (1,800 dwellings) built in the 1950s and mainly inhabited by disadvantaged sections of the population. The main aim is to promote a better quality of life to the inhabitants without increasing the rent.

In the rest of the paper, these neighbourhoods will be identified by the two capital letters in square brackets to facilitate readability.

## 3. ANALYSIS AND MAIN RESULTS

The analysis focuses on production processes more than on detailed facts and figures to identify the main barriers to expansion and to highlight characteristics and conditions that could foster and generalise the development of more sustainable projects. This analysis is organised around five main topics: the urban context and favourable conditions, the objectives in terms of sustainability, the achievement conditions, the financial arrangement and commercialisation and, finally, the environmental performance, its evaluation and its monitoring.

### 3.1. The context and the favourable conditions

Cities that developed “sustainable districts” were not necessarily very active in pursuing environmental policies before the beginning of the project, even if some of them were already involved in European networks or were implementing Local Agenda 21, as Fribourg, Copenhagen and Malmo did. The sustainable neighbourhood is thus not the operational implementation of former and ancient policies; instead, it is often used as a starting point to initiate, develop and communicate new sustainable local policies.

Several districts were initiated and developed in the scope of a worldwide event ([BO], [HS], [KR], [VS]). This showcase is mobilised to foster the adherence of private developers, future inhabitants and especially financiers and to widely demonstrate national or regional expertise.

The sustainable neighbourhood is mobilised to promote a region but also to change the image of a city, or at least a part of it. That is the reason why several projects were developed on former Brownfield (former army barracks in [FR], harbour Brownfield in [BO] and [HS], colliery in [BZ], [VS] and [AU] suffered from a bad reputation). The neighbourhood is thus expected to become a driving force in the city’s overall development as a sustainable city and in thwarting urban sprawl. The high quality of the dwellings and public spaces is presented as a breaking point with the past.

However, the sites on which these sustainable neighbourhoods are developed, even Brownfield, present strong potentialities: the level of accessibility is good or has been improved before the building of the district, particularly due to tramway routes ([FR], [HS], [AU]). Neighbouring districts are used to supply services, jobs or shops. Even if the mix of functions is often emphasised, activities located in the new or retrofitted districts are only dedicated to their inhabitants (local meeting centres, laundry, etc.).

The most important point is that land property is public (except in [EL], which is a private initiative), which enables public authorities to more easily force private developers to respect their conditions as far as density, energy and environmental performances and public space are concerned. Finally, this land property policy enables a sum of money to be

available quickly when the fields are sold and to use this money to partly finance infrastructure works, including transportation and urban networks.

### 3.2. The objectives in terms of sustainability

The objectives in terms of sustainability are ambitious, especially as far as energy consumption is concerned; the sustainable neighbourhood aims to vastly reduce consumption and greenhouse gas emissions in comparison with neighbouring districts (60% in [KR] or 50% in [BZ] and [FR]), to supply the energy needs of the community using local renewable resources (up to 100% in [BO]), or to become self-sufficient in [EL], even in terms of the production of food.

There is a huge will to demonstrate new competences and to break with traditional practices. Consequently, the environmental approach is pluralistic and mainly concerns energy but also water waste (up to 12 different kinds of waste collected in [BO] or [VS]), mobility and transportation, biodiversity and materials, among others. “Low technologies” and “high technologies” are mobilised to fulfil the objectives as well as to demonstrate and test new technologies in real conditions. To systematise technical solutions for the whole project is not an aim in these sustainable neighbourhoods.

The economic and social points of view are often neglected in new developments, most likely because European and national grants were mainly oriented towards environment in the nineties [12]. Although the social dimension of a sustainable project cannot be reduced to the question of the affordability of the dwellings, a minimum percentage of social dwellings is imposed in the specifications. Renovation projects seem to pay more attention to disadvantaged population even if “gentrification” cannot be avoided.

The will to break with traditional practices is also obvious in the urban forms promoted: collective dwellings, urban linear blocks oriented toward the south or open housing blocks, high density mixed together with large green spaces, the repartition of private and public spaces, green flat roofs, the use of colour or the visibility of the water cycle, among other elements. This very specific urban form is developed to create a new offer, it is easily identifiable, and it is used as a marketing argument to facilitate its promotion and to differentiate it from more traditional urban projects. The sustainable district is thus mobilised as a marketing argument, and the environmental aspects help to produce economic value and social valorisation.

### 3.3. The achievement conditions

The break between traditional practices and the sustainable district is also carried out as far as achievement conditions are concerned. Three specific kinds of processes can be highlighted. On one hand, in a “top-down” approach, public authorities have the leadership and manage the project ([BO], [KR], [HS], [VS], [AU]). On the other hand, Fribourg and Eva-Lanxmeer have adopted a “bottom-up” approach initiated by citizens involved in the development of their own districts ([FR], [EL]). In those two cases, a group of future inhabitants develops the main lines of the project and then tries to interest public authorities and private developers to gain financial help, subsidies and building authorisations. More rarely, the sustainable neighbourhood is initiated and managed by a private developer [BZ].

The operation arrangements are more complex, and the number of actors rises in comparison with traditional urban projects. Experts and future inhabitants are often mobilised as active actors in the arrangements to gain their adherence and legitimise the project. Network developers are also involved in the early stages of the project, because numerous new technologies are used. This is also a new challenge for construction professionals, who are confronted with new constructive techniques or materials. To generate professionals and to control quality is thus crucial in guaranteeing good execution and desired performance.

Existing regulations are not adapted to these new types of developments. Several dispensations were needed to build these districts, particularly as far as the urban form is concerned. Again, the environmental exemplarity of the districts is used by the developers to gain dispensations. New tools are developed and used to accompany the developments. For example, a quality charter was developed in [BO], and developers who intervened had to respect at least 10 of the 35 environmental points proposed to guarantee urban density, architectural diversity together with high environmental quality and biodiversity. In Hanover [KR], a general plan defined the main goals chosen for the neighbourhood’s future development. On this basis, a precise tool was used to gather specific objectives and requirements applicable to private developers, land buyers and future inhabitants.

The turnaround time to complete a sustainable neighbourhood is comparable to standard urban projects (from 7 to 10 years between the first contacts and the completion of the project). However, due to the complexity of the operation arrangements, the high number of actors involved in the process and the innovation carried out by the project, time is used differently. Preliminary talks, dialogue and elaboration phases that intervene before the construction take more time and are crucial to guarantee the quality of the development, define new norms and standards and to perpetuate agreements in the long term. Beginning negotiations early in the process is also common in the Netherlands and the United Kingdom, whereas in France and Belgium, especially in the Walloon Region, negotiations and redirecting tend to occur later, even as late as the building stage [13]. If this specificity allows the gaining of a large consensus and guarantees the project’s higher quality before the building of the district, it can also lead to defects, especially if, as in [BO], the building phase is shortened to adhere to an overall time limit. To avoid long turnaround times, several stages (operational and financial arrangements, incidences evaluation, etc.) were conducted simultaneously in [KR]

Finally, communication is a key element in the production process of a sustainable neighbourhood.

Forums [FR], foundations [EL] or communication centres ([VS], [KR]) are opened to create a link between the different categories of actors and to build a picture or common representation of the project, which is useful in gaining the adherence of private developers and future inhabitants. Four types of communication can be highlighted: information for the public, which is legally mandatory; the consultation (citizens are consulted but public authorities have no obligation to take the results into account); the dialogue (public authorities gather the public opinion in a more participative process, improve the project and re-submit it to the public) and, finally, the co-decision or co-production in which public authorities invite the public to participate in the design of the project.

After the completion of the project, forum and information centres are created to inform citizens and future buyers, to heighten public awareness and to form the inhabitants to their future dwelling. Indeed, new technologies are used in those neighbourhoods and must be clearly explained to the inhabitants to be used correctly.

### 3.4. The financial arrangement and commercialisation

The cost of the sustainable districts is high. The question of how to finance the overinvestment is therefore crucial and must be settled in the first stages of the procedure. The return on investment is longer than usual, which is not compatible with the short-term logic of private developers. The studied projects are thus dependent upon public subsidies, which reduce the reproducibility of these experiments (up to 95% of public money in [VS], 16 millions € from the city and 32 from the state in [BO]) and question the social equity of these strategies (is it fair to concentrate so much money on limited projects?). The strategy adopted consists of first obtaining subsidies labelled as having high environmental quality. They provide an environmental identity to the project and facilitate additional financing. European funds, even if limited, are also important to legitimise the project. The final arrangements are thus extremely complex because they are based on multiple sources. This complexity has repercussions on the technologies used in the project because subsidies are often thematic and directed to solar energy, urban networks or energy savings.

Another solution to finance the overinvestment and reduce the non-commercialisation risk in the sustainable districts is to propose high-standing types of dwellings or to develop a new offer dedicated to a few privileged people (very large dwelling, numerous high-quality external spaces, high-tech equipment, etc.) that can be sold at higher prices but reduces the social balance in the district. This overinvestment also has repercussions for the environmental quality of the project. Indeed, private developers considered these new products to be risky as far as non-commercialisation is concerned. and even if the partnership and the financial intervention of public authorities reduced this risk, they insisted on reducing expected environmental performances. The maximum heat consumption proposed in [KR] was increased by 10% (55 kWh/m².year instead of 50). Several environmental targets proposed in the [BO] charter were abandoned at private developers' request.

Finally, we have identified a last type of additional cost in the sustainable district: the management costs. The numerous public spaces must be maintained, and the new technologies need more attention than traditional ones; this constitutes an additional cost. This cost may be monetised, or it may not be; for example, inhabitants may be asked to spend a few hours each month to maintain public spaces ([EL], [FR]).

### 3.5. The performances and their evaluation

Several types of quality controls were used during the building stages. In Hanover [KR], quality controls were decided, planned and formalised early in the process and set with very precise and detailed specifications. On the contrary, the quality charter used in [BO] only imposed 10 of the 35 environmental specifications but did not provide any sanctions in the case of non-adherence. In [EV], inhabitants, helped by experts, were in charge of quality control during the building phase.

Monitoring the performance of the neighbourhood during its use is also important in checking the adequacy between initial requirements and measured results. Sensors and personal meters are thus used in several neighbourhoods, which allow the household to follow, in real time, the evolution of energy and water consumption. Indicator systems are developed and used. Unfortunately, these procedures need time and money and, in many cases, the monitoring of these systems is abandoned several months or years later because of the lack of money dedicated to this task.

Moreover, even if the measured performance following the completion of the studied projects is better than standard requirements, it is not always as positive as expected because the behaviour of the occupants was not accounted for in the previous forecasts [14]. In [BZ], for example, measured consumption varies from 1 to 6 according to the household [15]. In Hammarby, the high level of the equipment (especially in the kitchen) that is furnished to the inhabitants to improve the quality of the dwellings leads to huge energy consumption, even if heating loads are reduced. Finally, new technologies are sometimes difficult to understand and difficult for inhabitants to assimilate, which can reduce the expected performance. This is especially true in retrofitted projects because inhabitants are not always looking for changes in their habits or in neighbourhoods aiming at very high quality; these projects also attract wealthier people more interested in the neighbourhood's proposed quality of life than in its sustainable aspects. On this subject, neighbourhoods promoting a "bottom-up" approach ([FR] and [EV]) present better performance because inhabitants have been involved since the beginning and have chosen this kind of neighbourhood specifically for its environmental quality.

Another trend highlighted by the experiments is that performance is difficult to maintain in the long

term. Solar panels in [AU] were removed after a few years because they were out of service. The cogeneration and water treatment devices in [BZ] were over-dimensioned and are no longer functional.

Finally, we can highlight that, even if innovation and high quality are promoted, simulation tools were not used to improve the conception of buildings or to anticipate energy requirements.

### 3.6. What is reproducible and how?

The analysis presented in the previous section allows us to highlight three kinds of reproducibility in the production process of a sustainable district.

The first type is a "step-by-step" reproducibility within a specific neighbourhood; innovations are tested in one phase and then improved and reproduced in the following phase by trial and error (e.g., the four-phase building process in [EL] or the resolution of the thermal bridges in [KR]). This learning is important in building knowledge, especially in a field experiencing much innovation.

The second type of reproducibility is the "adjustment"; the management is adapted and adjusted during the evolution of the project according to the experience gained and the external conditions.

The last type of reproducibility is "learning", and it can take three different forms: the duplication of a practice from one neighbourhood to another (the experience gained in [FR] has been used to develop a second sustainable neighbourhood in the city), the sectional diffusion of an innovation (the ENVAC sustainable waste collection system tested in [BO] and [HS] is now used in other European cities) or the duplication of a model (the BedZed model developed and tested in the United Kingdom should be implemented in emerging countries).

This analysis confirms the iterative and adaptive nature of the production processes of sustainable neighbourhoods [16] and can also be applied, at a larger scale, to every innovative process in the field of urban planning.

We can finally highlight a more particular form of diffusion of the sustainable neighbourhood. The pilot experiments are sometimes mobilised by citizens as a means of applying pressure on public authorities to better account for environmental quality and sustainable development in a particular local urban project (e.g., Rungis ZAC in Paris).

## 4. APPLICATION OF THE SETTINGS GRID

This section aims to collate the production processes of the studied neighbourhoods with the reality of a Belgian dwelling project through the settings grid highlighted from the previous analysis.

### 4.1. The case study

The case study is the Baviere housing project. It comprises about 600 new dwellings built on an urban site (4 hectares) located close to the centre of Liège (Belgium), in the Outremeuse neighbourhood. The site was former occupied by a hospital and has been a Brownfield for several decades, because even if several urban projects mainly oriented towards services were studied, opposition or financial arrangements led to the abandonment of the projects.

In 2005, the public authorities, with the agreement of the land owner (private society), decided to organise a competition to find a team able to develop a new project on the site. At the end of the process, Himmos' project was selected.

This case study has been chosen because it presents several common characteristics with the studied neighbourhoods: a programme mainly oriented towards housing, high-quality public spaces and a few services, a clear dedication to sustainable development (as written in the specifications edited by the public authorities), a desire to create a new reputation, achievement in several stages, a call for investors and planners, an urban form promoted in the winning project and a pluri-disciplinary team, among others. Finally, even if the project has been delayed indefinitely since the last economic crisis in 2009, large urban projects are fairly rare in the Walloon region.

Information about this project was gathered through interviews with the main actors of the project (public local and regional authorities, neighbours, architects, etc.) and the analysis of legal texts (specifications, legal notices, etc.).

### 4.2. The comparison

The comparison between the sustainable districts and the Baviere project allows us to highlight points of convergence and divergence.

Convergence mainly deals with two themes: the characteristics of the site on which the district is planned (good accessibility, Brownfield to redevelop, etc.) and the urban form promoted (in rupture with traditional urban forms met in Liège). The private developer, who was already active in the Netherlands and in Flanders, used this new urban form to construct a new high quality picture to facilitate the project's commercialisation. Together with the public authorities' attention to sustainable development and the project proposed by the architects (energy consumptions in the project are, for example, lower than the legal requirements), conditions were gathered to produce a new district more aware of environmental quality than traditional urban projects, even if developing a sustainable neighbourhood was not an aim.

Unfortunately, points of divergence explain why it was not the case. The project is currently stopped because of the last economic crisis. However, if financial sources had been more diversified or if subsidies had been gained, the financial arrangements would have been more robust and would perhaps have weathered the crisis. Moreover, information and communication about the project, even if it were somewhat more pronounced than the legal requirements in the Walloon region of Belgium, did not lead to a large public consensus around the project, nor did it stabilise the process. Finally, existing regulations are not adapted to new technologies; for example, using rain water in the toilets requires a dispensatory, the resale of the energy produced in the district is not already a common practice, and a fixed number of parking

places must be planned when a new development is built, which is not necessarily compatible with mobility aims.

## 5. MAIN RECOMMANDATIONS

The following main recommendations are highlighted from the previous analyses and could help to build more sustainable urban projects:

- Information, formation and public awareness are crucial to mobilise citizens to promote sustainable development and to gain their adherence to this aim.
- Social quality and economical viability are also part of sustainability and must not be neglected.
- The overinvestment linked to more sustainable project is a reality but must not be reported to the final buyer thought the high quality of the dwellings.
- Thinking in terms of global costs is useful because the reduction in charges quickly compensates for the overinvestment. Public-private partnerships can also help to better split the risk. Green loan, third investors, etc., exist and should be investigated
- The legal framework and requirements need to be adapted to new technologies and goals. A more proactive attitude must be adopted by the public as far as sustainable development is concerned. Public authorities must take leadership in urban projects (namely, through land ownership) and impose more strict requirements on private developers by putting them on concurrence to improve the quality and environmental performance of a project.
- Environmental requirements should be added to the specifications, which must specify clear objectives and expected consumptions.
- Controls are necessary to ensure that initial requirements are respected. It is better to initiate quality upstream and to control it downstream.

## 6. CONCLUSIONS

In conclusion, our study of the main characteristics and conditions that allowed the achievement of several sustainable neighbourhoods in Europe and the confrontation with a Belgian housing project has highlighted the demonstration nature of these projects. It has emphasised fundamental qualities to promote more sustainable urban districts and faults to avoid (social aspects, high prices, etc.).

Reproducing exiting “pilot” experiments is difficult because of the exceptional conditions that were gathered (especially as far as the financial arrangements are concerned). However, these experiments are useful because they have proved that it is technically possible to retrofit and build more sustainable urban projects. The challenge is now go out the exception logic carried out by these experiments and to put the knowledge gained to good use for our current and future urban projects.

Urban sustainability must become the rule and not the exception and must be reached at more affordable prices because technical solutions exist and have proven their appeal. However, the most crucial goal seems to simultaneously heighten public awareness of the importance of our lifestyles and behaviours. It is only by combining innovation, technology, good governance and citizens’ sensible behaviour that it will be possible to draw a more sustainable future and to provide an appropriate response to the global challenge of climate change.

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