# Integration of Sustainability Issues into the Regeneration of Urban Wasteland: From Theoretical Framework to Operational Monitoring Tool

Laprise, Martine[1], Lufkin, Sophie[1], Rey, Emmanuel[1]

[1]Laboratory of Architecture and Sustainable Technologies (LAST), Ecole Polytechnique de Lausanne (EPFL), Lausanne, Suisse.

***Abstract:*** *Regeneration of urban wastelands can contribute to revitalize and densify some portions of post-industrial European cities. A growing number of urban wasteland regenerations is now promoted by diverse territorial measures. However, it must be recognized that they mostly focus on "green constructions", leaving aside holistic aspects of the concept of sustainability.*

*Indeed, due to the inherent complexity of these projects, achieving the objectives of sustainable development is not spontaneous. It depends upon a proactive search for global quality, integrated into the project dynamics, and a continuous assessment of sustainability tailored to these sites.*

*In reaction, this paper presents how a strategic integration of sustainability issues into urban wasteland regeneration projects can answer these targets. Preliminary research led to the creation of a theoretical framework, validated by a test application. Consequently, steps to transform this framework into an operational monitoring tool are presented. The resulting tool aims to concretely facilitate the regeneration of urban wastelands into truly sustainable neighborhoods.*

***Urban strategy, wasteland regeneration, sustainable neighborhood, sustainability assessment, indicator system, monitoring tool.***

## Introduction

As part of the polycentric and compact city model [1,2], the regeneration of urban wastelands is identified as a strategy to counterbalance the negative effects of urban sprawl. Indeed, it contributes to the densification and revitalization of the existing built fabric [3]. In this sense, several national European governments have developed policies and incentives to foster these projects [4,5]. Although increasing the number of wasteland regenerations is generally seen as a sustainable land take solution, these projects are not in themselves inherently sustainable [6]. Their revitalization and their densification is a "necessary but not sufficient condition" to encompass the environmental, economic and social dimensions of sustainability [7,8]. In addition, these projects must aim for a sound management of the process, in a holistic vision of sustainability. This fourth dimension facilitates a linkage between other dimensions and complements them [9].

With a land management perspective, recent tools propose *ex ante* approaches to wasteland regeneration in order to compare and prioritize sites for development or assess their potential [10,11]. Other studies have developed methods to assess the sustainability of urban wasteland

regeneration projects but are still limited to check-list, procedural framework or single evaluation [12–14]. In all cases, these methods are dissociated from the complete project dynamics they cannot be applied on a regular basis or address all the phases of a project. Consequently, they cannot be qualified as operational monitoring tools.

In order to fill this gap, a tool is required for structured and continuous follow-up of these projects by integrating a search for global quality adapted to the regeneration of urban wasteland. In this respect, preliminary work as led to the creation of the SIPRIUS indicator system, a first theoretical framework for the integration of sustainability into the regeneration of urban wasteland [15]. Using this theoretical basis, a research project is currently conducted at EPFL [16] in order to transpose this framework into a digital monitoring tool for integrating sustainability issues into the project dynamics. This paper describes the main features of SIPRIUS and a test-application performed on a project in Neuchâtel, Switzerland. It also presents a milestone of this research in progress: the identification of an adaptable digital monitoring tool entitled OKpilot. The methodological steps to transpose the theoretical framework into the operational monitoring tool are then exposed.

**Integration of sustainability issues**

In general, urban wastelands are large scale areas cut off from their surroundings, occupied by different buildings of uneven quality and marked by a strong – often negative – identity (real or perceived contamination, sense of insecurity, economic and social stigma, cultural symbols, etc.). In addition, the complex process of an urban wasteland regeneration project is also singular: multiple stakeholders, important risks, long duration, evolution of conditions, overlapping of development phases, etc. This complexity makes the correlation between the regeneration of urban wastelands and sustainable development not automatically valid. Yet, without considerations of the holistic concept of sustainability, regeneration projects that appear successful in the short term might be the blighted areas of tomorrow [17]. Therefore, an operational assessment that contributes to the integration of sustainability issues seems necessary. To fulfill its role, operational assessment is understood as a “tailor made tool” adapted to the complexity of this type of projects. This is the only way to provide key stakeholders with an accurate overview of the situation [9]. The purpose is not to deliver turnkey solutions, but rather a decision-making tool to assist them in making informed choices. Therefore, requirements for an integrated operational assessment are the following:

1. Search for a global quality: The assessment covers sustainable development principles in a broad and holistic way, i.e. environmental, sociocultural and economic aspects are evaluate in addition to a sound project management. For exemple, the latter includes citizen participation, transparency of information and collaboration between stakeholders.

2. Adaptation to specificities: The assessment is adapted to the above-mentioned specificities of urban wasteland regeneration projects (scale of the project, various building types, etc.).

3. Inclusion of monitoring principles: The assessment is structured and continuous. It allows clear visualization of different stages of the project in order to follow and act on performance trends.

**Theoretical framework**

Building on these requirements, preliminary work has resulted in the development of a comprehensive framework entitled SIPRIUS [15]. The methodology leading to its creation is based on three successive steps.

First, the selection of criteria is divided in two categories to represent the large scale and multidimensional aspects of wastelands: 1) criteria that refer to the context, which implications go beyond the site's limits, and 2) criteria that refer to the project, which influence stays within the site's boundaries. Criteria are distributed evenly among environmental, social and economic aspects.

Second, indicators are selected to assess each criterion following fundamental rules [18]: completeness, relevance, sensitivity, objectivity, accessibility and readability. Indicators also take into account several types of buildings.

Third, in order "to measure" and give "value" to each indicator, reference values are allocated. Four reference values are available: Limit Value ($V_L$) or "veto value", Average Value ($V_A$), Target Value ($V_T$) and Best Practice Value ($V_B$). These values are achieved incrementally, that is to say by "levels of performance". Results, both qualitative and quantitative, can be measured and compared without using any numerical aggregation.

Altogether, SIPRIUS is composed of 9 criteria and 21 indicators relating to the context and 12 criteria and 21 indicators relating to the project. Concurrently with the creation of the indicator system, a conclusive test application was performed on the Ecoparc neighborhood in Neuchâtel, Switzerland. The assessment of this wasteland regeneration project has allowed to make iterative improvements and practical settings as well as to validate the adequacy and the relevance of SIPRIUS. As an exemple, Figure 1 and 2 show the results of environmental, sociocultural and economic indicators for context criteria and project criteria. These synoptic tables, based on qualitative aggregation of the results, provide a clear and synthetic view of different indicators, at different stages of the project. Comparison with the initial situations (context criteria) or with the initial objectives (project criteria) is also facilitated.

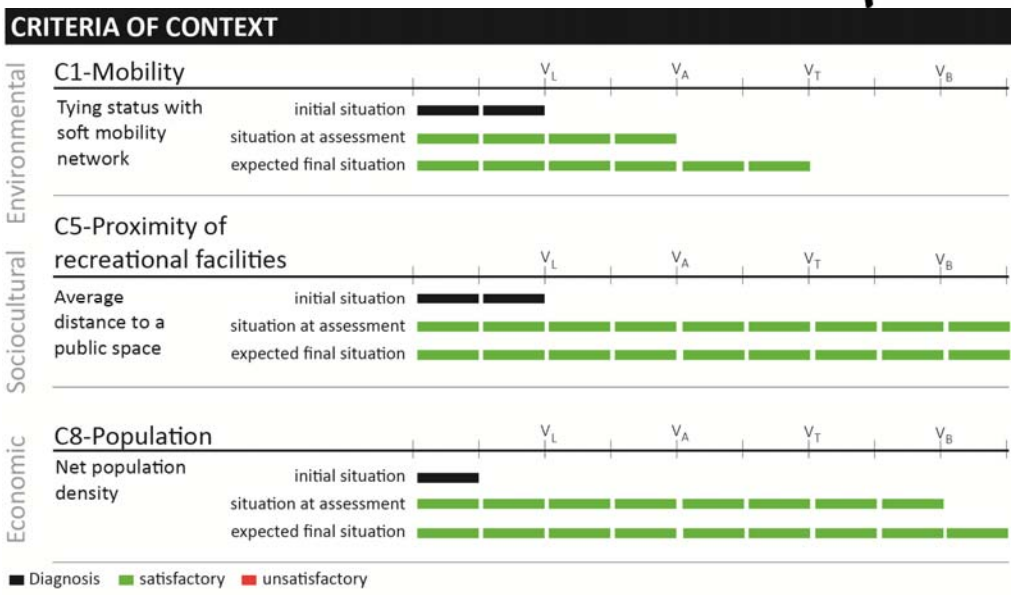


*Figure 1. Results of the SIPRIUS test application on the Ecoparc neighborhood (Neuchâtel, Switzerland). Selection of three context criteria.*

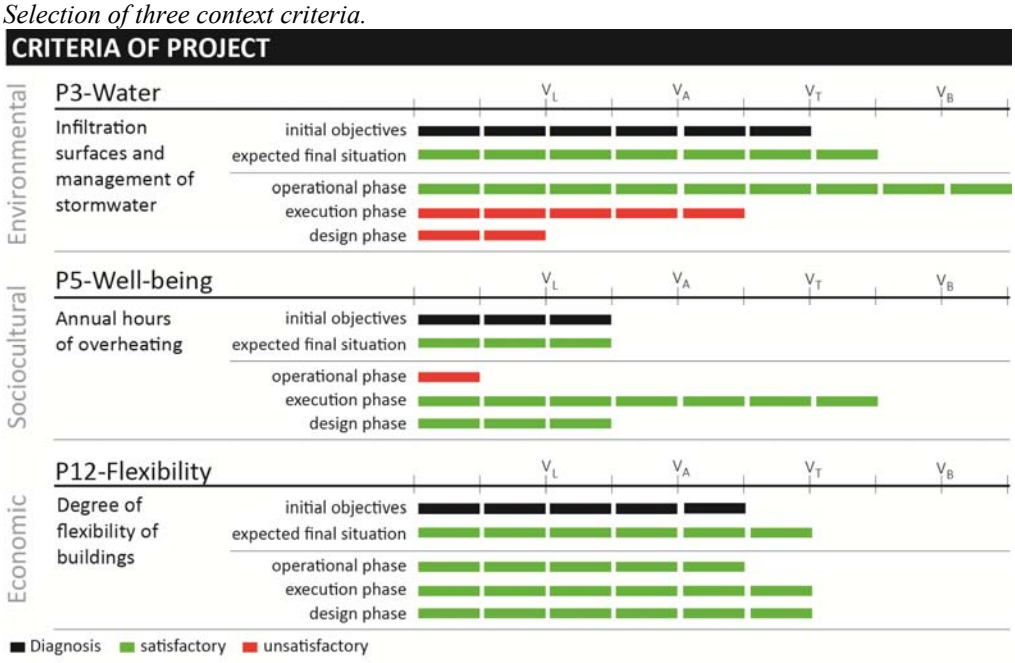


*Figure 2. Results of the SIPRIUS test application on the Ecoparc neighborhood (Neuchâtel, Switzerland). Selection of three project criteria*.

The test application has demonstrated that SIPRIUS fulfills most of the requirements for an integrated operational assessment. It covers the three primary dimensions of sustainability in a search for global quality and is adapted to the specificities of this type of projects. In addition, it sets the basis for monitoring principles with the measurement method based on reference values and the results expressed in a synoptic table.

The test application shows that SIPRIUS contributes to draw attention on sustainability issues within a project. However, the use of the framework can be cumbersome due to the large

number of indicators. It can be limited by the level of involvement and interest in the assessment of key stakeholders. In order to generalize its use, the ongoing research suggests transposing this existing theoretical framework into a digital monitoring tool that could support the management and the communication of the project's performance.

**Identification of an existing digital monitoring tool**

Digital monitoring tools are used in many diverse fields where the management of sustainability issues is needed. Even though indicators may differ, methods employed for sustainability monitoring in business, in a public services or in development projects have considerable similarities. Consequently, instead of starting from scratch, it appears relevant to use an existing monitoring tool as a basis.

For the purpose of identification of an appropriate tool, required properties are described below. In general, the tool must allow *ex ante, in itinere* and *ex post* assessments and give simultaneously overviews and precise pictures of the project performance, at different stages. More precisely, it must provide a structured database and integrate both qualitative and quantitative indicators. It must help to make iterative improvements to the project according to the results of the assessment. It has to be applicable to a variety of urban wasteland regeneration projects and extended to the general practice. Finally, simplicity of the monitoring tool is required: it must be easy to operate by a project leader as well as to make reports and to communicate the results to a majority of stakeholders from various background, from professional to citizen groups.

An analysis of various digital tools allowed us to identify a web-based monitoring solution called OKpilot. It offers structured and continuous assessment throughout the project process and holds the required qualities. OKpilot is a user-friendly sustainability monitoring tool for businesses and public communities. It is a SaaS (Software as a Service) platform which ensures smooth implementation, simple maintenance and lower operating costs [19]. The technical feasibility in order to convert OKpilot toward the field of the built environment has been confirmed through a preparatory test. From this information, particular adaptations – presented in the following chapter – were identified in order to make the two systems compatible.

**From theoretical framework to operational monitoring tool**

With the objective of integrating sustainability issues into urban wasteland regeneration projects through an operational monitoring tool, the research project is organized around three major key steps:

1. Adaptation of the theoretical framework: SIPRIUS needs to be updated in order to meet the current and future challenges of sustainability in a search for global quality. These include aspects relating to a sound project management by the addition of criteria relating to the process (public consultation, transparency of information, etc.). Besides, reference values refer mostly to the Swiss context; they need to be adapted to different countries in order to match case studies (key step n.3).

2. Adaptation of the monitoring tool: This fundamental step implies particular adaptations so that OKpilot meets SIPRIUS' needs. Two of them are of strategic importance.

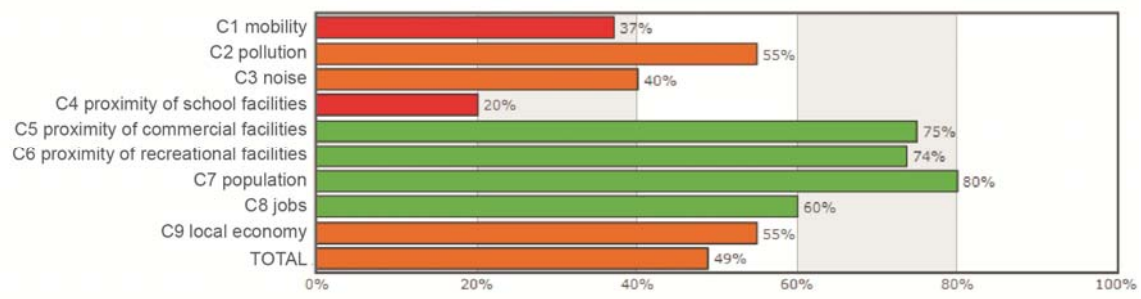


*Figure 3. OKpilot - Results are displayed in a standard histogram*

The measurement method used by OKpilot is based on relative values: the results of an assessment are expressed as a percentage. Computer programming is needed to develop and include absolute values to the measurement method. This is necessary in order to be able to compare results based on levels of performance (reference value system: Limit, Average, Target and Best Practice Value).

OKpilot displays the results of an assessment using a standard histogram with continuous bars for each criteria. (cf figure 3) In this regard, an adaptation of the graphical representation is also needed in order to include the synoptic table developed for SIPRIUS (cf figure 1 and 2). It displays incremental values which represent the level of performance for each indicator.

3. Case studies: The third key step consists of case studies selected in Belgium, France and Switzerland. Indeed, these three countries are concerned by the phenomenon of urban wastelands and direct their land use policies toward their regeneration at different levels.

Conducted in parallel to the adaptation of the SIPRIUS system, this step will contribute to feed the framework in an iterative way as well as to optimize and validate the monitoring tool by taking into consideration practical needs in relation to the integration of sustainability issues in concrete urban wasteland regeneration projects.

**Discussion**

By means of an adaptation work validated by case studies, a new operational monitoring tool with its own specificity in terms of content and its own identity in terms of presentation will be developed. This tool aims at answering the requirements of an integrated operational assessment by including a search for global quality and monitoring principles, both adapted to urban wasteland regeneration projects.

The research aims at facilitating the integration of sustainability issues in the project dynamics by providing useful bases to stakeholders; urban wasteland regeneration projects then become neighborhoods with increased sustainability. This objective is translated in an operational monitoring tool applicable to a multitude of projects of this type.

In the long-term, a fourth step will include a verification of the usability of both the tool in day to day situation and the outputs. In addition, this step – performed with the potential users – will allow validating the identification of the primary target audience of the operational monitoring tool (private property developers, public developers, local authority, professional advisors, etc). This usability phase will be included in the planning of the research underway at EPFL.

**Conclusions**

Sustainability is not inherent to urban wasteland regeneration projects, therefore an adapted operational monitoring tool is necessary for its integration. The SIPRIUS theoretical framework sets the basis for an operational assessment. In parallel, the digital monitoring tool OKpilot is identified as suitable to SIPRIUS' needs as it offers a structured and continuous assessment of the project. Three key steps are described in order to develop the operational monitoring tool: the adaptation of the theoretical framework, the adaptation of the digital monitoring tool and the validation through case studies. The operational monitoring tool is expected to contribute to the integration of sustainability issues into the regeneration of urban wasteland and by consequence increase the sustainability of resulting neighborhoods. Further work suggests the inclusion of a usability phase. Research is now starting with the adaptation of the digital monitoring tool.

**Acknowledgement**

This research is supported by the Swiss National Science Found (SNSF), project number 100013_143376.

**References**

[1] Rogers, R., Gumuchdjian, P. (1998). *Cities for a small planet.* Icon Editions. Boulder, Colo.: Westview.
[2] Williams, K., Burton, E., Jenks, M., editors. (2000) *Achieving Sustainable Urban Form.* London: Taylor & Francis.
[3] Rey, E. (2007) Des friches urbaines aux quartiers durables. *Tracés*, 13(5)
[4] Thornton, G. et al. (2007) The challenge of sustainability: incentives for brownfield regeneration in Europe. *Environmental Science Policy* 10: 116–134.
[5] Couch, C., Leontidou, L., Petschel-Held, G., editors. (2007) *Urban Sprawl in Europe: Landscapes, Land-Use Change and Policy.* Oxford: Blackwell Publishing.
[6] Eisen, J.B., (1999) Brownfield policies for sustainable cities. *Duke Environmental Law Policy Forum*, 9:187–229.
[7] Andres, L., Bochet, B. (2010), Regenerating brownfields and promoting sustainable development in France and in Switzerland: what convergences? *Revue d'Economie Regionale & Urbaine*: 729–746.
[8] Rey, E. et al. (2013) The influence of centrality on the global energy consumption in Swiss neighborhoods. *Energy and Buildings*, 60:75–82.
[9] Sharifi, A., Murayama, A. (2013) A critical review of seven selected neighborhood sustainability assessment tools. *Environmental Impact Assessment Review*, 38:73–87.
[10] Chrysochoou, M. et al., (2012) A GIS and indexing scheme to screen brownfields for area-wide redevelopment planning. *Landscape Urban Planning*, 105:187–198.
[11] Schädler, S. et al. (2011) Designing sustainable and economically attractive brownfield revitalization options using an integrated assessment model. Journal of Environmental Management, 92:827–837.

[12] Pediaditi, K. et al. (2005) Monitoring the Sustainability of Brownfield Redevelopment Projects: The Redevelopment Assessment Framework (RAF). *Contaminated Land & Reclamation*, 13:173–183.
[13] Williams, K., Dair, C. (2007) A framework for assessing the sustainability of brownfield developments. *Journal of Environmental Planning and Management*, 50:23–40.
[14] Wedding, G.C., Crawford-Brown, D. (2007) Measuring site-level success in brownfield redevelopments: A focus on sustainability and green building. Journal of Environmental Management, 85:483–495.
[15] Rey, E. (2012) *Régénération des friches urbaines et développement durable : vers une évaluation intégrée à la dynamique du projet.* Louvain-La-Neuve: Presses Universitaires.
[16]LAST, Laprise, M. (2014) *Intégration des enjeux de la durabilité aux projets de régénération de friches urbaines: Du référentiel théorique à l'outil de monitoring opérationnel. Thesis in progress*. Ecole Polytechnique Fédérale de Lausanne.
[17] Thévoz, L., Dekkil, G. (2009) *Les dimensions sociales des projets de mutation des friches urbaines: négociation, participation et mixité sociale*. Rapport de synthèse et étude de cas.
[18] Bossel, H. (1999) *Indicators for Sustainable Development: Theory, Method, Applications.* Winnipeg, Canada: IISD International Institute for Sustainable Development.
[19] GLOBALITE Management. OKpilot - Solution 2014. http://okpilot.com/okp_fr/Solution.html