

Procesul regenerării siturilor de tip brownfield – un obiectiv cheie în dezvoltarea urbană durabilă (2) / Brownfield regeneration process – a key objective for a sustainable urban development (2)

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Abstract. For many EU communities' brownfields emergence was, or still is, a new issue, the complexity of which has not been fully perceived, and the economic, social and environmental effects of which have not been fully understood. In some European countries brownfield reuse policies and redevelopment techniques have been successfully practiced for more than 40 years. In other countries, this is still an emerging subject. This is the reason why sharing knowledge and experience on brownfield reuse is so important in the European context. A needed industrial development on a brownfield site, despite its unavoidable negative environmental impacts, can be more sustainable than a public park on the same site, as it helps preserve alternative greenfield sites. In addition, the proposed development could generate jobs resulting in positive effects in the social and economic dimensions. Increases in local municipality income could be allocated to environmental improvements in the surrounding area. There are many examples (so called "best practices") reporting how human factor as an initiator of brownfield regeneration – e.g. making a good project proposal, gaining a local community support, acquirement of grant titles, etc. – have overcome location handicaps or modified the characteristics of suitability of area or concrete brownfield site according to specific project purposes. In this respect, it is very important to study specific local political, cultural and social structures and contexts of regeneration processes, roles of specific actors.

Key words: environment, redevelopment, sustainability, reintegration, revitalization.

1. Brownfield regeneration, a key policy objective for a sustainable space planning

The concepts of brownfield development and urban regeneration are closely correlated toward accomplishment of sustainable urban development so that both concepts have been respectively structured around environmental, social, economic and institutional issues¹. Sustainability is neither static in time nor does it imply a fixed spatial perspective. It cannot be seen as a destination but rather as a never-ending journey—at least on the timescale at which human society operates².

Thus, besides the above-mentioned dimensions of sustainability there are also different scopes of sustainability:

- Time scale: the concept of sustainability requires a balance between short term effects versus long term effects in each of the four dimensions. This includes the consideration of future needs, therefore, the concept has an inter-generational aspect. A project that may have very positive impacts in the short term may have very negative impacts in the long term, or vice versa.
- Spatial perspective: the spatial extent and scale of a project's impact need to be defined in all three spatial dimensions, as well as political, administrative or functional

¹ UN Commission on Sustainable Development 2001

² Franz, M., Pahlen, G., Nathanail, P., Okuniek, N., and Koj A. 2006

spatial units. Different levels of action are addressed, namely the local, communal, regional, national, transnational and global level. The regional perspective allows for balancing out site specific problems and potentials within a wider spatial context. This context is very important, since a project that possibly appears to be sustainable at a local level can be detrimental on a regional level. Given globalization and inter region/intercity competition, the boundary within which sustainability is to be assessed is also relevant.

- Dynamic situation: the process of moving towards sustainability will always be subject to change, namely a final state with an equal degree of sustainability in the four dimensions will never be reached. Continual change is part of humanity's history and, therefore, it must be embraced by the concept of sustainability³.

On the basis of these dimensions and scopes a definition of sustainable brownfield regeneration has been developed: "Sustainable Brownfield Regeneration is the management, rehabilitation and return to beneficial use of brownfields in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations in environmentally sensitive, economically viable, institutionally robust and socially acceptable ways within the particular regional context"⁴. Sustainable is not synonymous with 'green'. The regeneration of a brownfield site can cause negative environmental impacts and yield a sustainable outcome e.g. positive effects in the other dimension of sustainability may outweigh the negative ecological ones and the negative impacts on the site are balanced on the urban/regional scale. If this was not so, all brownfield sites would have to be left untouched⁵.

A needed industrial development on a brownfield site, despite its unavoidable negative environmental impacts, can be more sustainable than a public park on the same site, as it helps preserve alternative greenfield sites. In addition, the proposed development could generate jobs resulting in positive effects in the social and economic dimensions. Increases in local municipality income could be allocated to environmental improvements in the surrounding area. This means a brownfield project that does not cause any negative environmental impacts overall does not necessarily need to be more sustainable than a "dirty" industrial development where potential wealth generating activities and development in the broader regional context are more sustainable⁶.

The role of brownfield reuse on sustainable urban regeneration could be taken into consideration in three different aspects including⁷:

- Remediation as a display of environmental issue,
- Revitalization as a display of social issue and
- Reintegration as a display of economic issue.

All countries and regions have a share of brownfield sites. This is a natural market-driven occurrence, similar for example to unemployment levels. Low levels of unemployment are

³ Franz, M., Pahlen, G., Nathanail, P., Okuniek, N., and Koj A. 2006

⁴ RESCUE 2003

⁵ Franz, M., Pahlen, G., Nathanail, P., Okuniek, N., and Koj A. 2006

⁶ Franz, M., Pahlen, G., Nathanail, P., Okuniek, N., and Koj A. 2006

⁷ Doerle 2012

normal and good for the labour market, while high levels cause problems. Something similar is applicable to brownfields⁸. Some regions have relatively few brownfields that markets can easily absorb and reuse, but other regions may be threatened by an unusually high number of brownfields, which may be superfluous to the real-estate market. Even a single brownfield site can have a detrimental effect on its surroundings, and if there are too many brownfields in a community, they can seriously compromise its development potential and its competitiveness.

For many EU communities' brownfields emergence was, or still is, a new issue, the complexity of which has not been fully perceived, and the economic, social and environmental effects of which have not been fully understood. In some European countries brownfield reuse policies and redevelopment techniques have been successfully practiced for more than 40 years. In other countries, this is still an emerging subject. This is the reason why sharing knowledge and experience on brownfield reuse is so important in the European context.

For the same reason, brownfields have been a concern of European policies since the late 1980s. Initially brownfields were mainly located in regions of traditional industries and mineral extraction locations where crisis, production losses and population changes created hundreds of hectares of sites previously urbanized, but now underused or vacant. These sites were often in areas of low market demand and most of them were perceived to have development risks, which deterred private investors⁹.

On top of that, brownfields, particularly in old industrial regions, are often economically marginally viable (B sites) or even non-viable sites (C sites)¹⁰, as they are not competitive compared with greenfield sites without public intervention. The alternatives are long-term 'hardcore' sites with the ongoing socioeconomic impact on the surrounding communities. However, the State can bring about a better competitive position for brownfields by implementing a wide variety of financial, fiscal, legal, regulatory and policy incentives. Brownfield redevelopment often requires these incentives as the reluctance to redevelop brownfield sites is frequently associated with the uncertainty regarding the risks they pose—including wrong location, legacy of redundant infrastructure, decontamination costs, high rehabilitation costs, and reduced real estate value¹¹. For the cities and their governments tasked with being custodians of the public good, the regeneration of such sites and their surrounding neighborhoods presents a giant challenge. Success and failure on these sites will leave a deep and long-lasting impact on the city.

The use of incentives, so-called indirection regulation, instead of direct regulation (command and control) is quite new. According to Turner, "until recently, environmental policy in most countries was dominated by direct regulatory measures, that is, legal instruments by which governing institutions, at all levels of government, impose obligations or constraints on the actions and behavior of private firms and consumers, in order to protect the

⁸ Bergatt Jackson, J., Vojvodíková, B. 2013

⁹ Bergatt Jackson, J., Vojvodíková, B. 2013

¹⁰ Ferber, U. 1997

¹¹ Thornton, G., Franz, M., Edwards, D., Pahlen G., Nathanail, P. 2007

environment”¹². This has changed during the last 20 years: the bandwidth of forms of regulations has become wider¹³. This development can be observed in the policies for brownfield redevelopment. This includes non-fiscal instruments such as instruments including information disclosure schemes, planning policies, Environmental Impact Assessment requirements, project life cycle assessment and related extended producer responsibility procedures¹⁴.

The fact that brownfield regeneration slows down the consumption of greenfields means it is often regarded as sustainable and thus as worthy of public funding. Urban development depends on the policy cycle, which includes identifying a problem, formulating and implementing a programme, examining the intended and unintended effects of implementation and continuing with/modifying or abandoning the programme. The development and use of incentives involves a dynamic process; the target group, users and context of the incentives evolve in the run up implementation even if the legal instruments do not change¹⁵.

The European RTD project RESCUE (Regeneration of European Sites in Cities and Urban Environments) defined sustainable brownfield regeneration as: ‘...the management, rehabilitation and return to beneficial use of brownfields in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation in environmentally sensitive, economically viable, institutionally robust and socially acceptable ways within the particular regional context’¹⁶. This still very broad definition was further developed by RESCUE into its own sustainability criteria. The aim is to find out whether the incentives are sustainable. The Brundtland Report released by the World Commission on Environment and Development defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”¹⁷. This definition underlines the two key concepts of sustainable development, namely:

- the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs¹⁸.

The Brundtland Commission insists upon the environment being something beyond physicality, going beyond that traditional school of thought to include social and political atmospheres and circumstances. It also insists that development is not just about how poor countries can ameliorate their situation, but what the entire world, including developed countries, can do to ameliorate our common situation.

¹² Shafer, C.S., Lee, B. and Turner, S. 2000

¹³ Mayntz, R. 1997

¹⁴ OECD 1997; Turner 2000

¹⁵ Majone, G., Wildvsky, A. 1984

¹⁶ RESCUE, 2003

¹⁷ WCED 1987

¹⁸ WCED 1987

In other words, when enacting new incentives, the competent public authority has to consider the needs of the present and the future when using methods to redevelop brownfields. Governmental and private sector pronouncements of a connection between brownfields and sustainability are not hard to find, but the questions is if all of the incentives to promote brownfield regeneration are really sustainable and which brownfields programs will really lead to sustainable cities. As Eisen already stated, "any argument that all brownfields redevelopment is inherently sustainable is unjustified"¹⁹.

Approximately fifteen years after, the author of the Brundtland Report, Dr. Gro Harlem Brundtland stated in an interview that her definition of sustainability would not change²⁰ and pointed out two issues which are now better understood: one is the nature of the pillars and dimensions of sustainability, and the other is their integration²¹. She also underlined the need to integrate economy, society and the environment, the traditional pillars of any sustainable development.

Within the European area, the issue of brownfield reuse was initially approached as a problem of contamination and industrial development. Only at the beginning of the millennium it has started to be perceived mainly as a question of project management, development and planning, which may influence entire communities²². But around 2007, the brownfield issue was put into the land use context, and since 2010 it has always been included in the scope of land-use management. It is gradually being realized that more complex and integrated solutions are needed to steer and encourage brownfield reuse. Today, brownfields are still a problem in most European countries and regions. As an indicator of the on-going regeneration of the European economy, the rate of brownfields remains still on a high level and the current economic and financial crisis has led to important new questions, including the emergence of new brownfields from the commerce, housing and tourist sectors²³. The financial crisis has fundamentally changed the environment for private and public strategies for redevelopment, and brownfield reuse is very sensitive to the real-estate market situation.

The importance of sustainable use (which already encourages urbanized land recycling and brownfield reuse) also needs to be understood by the public. Public in the EU has to be made aware of how expensive and damaging unsustainable practices are, and of what risks and social costs they represent. For an implementation of sustainable land use practices (such as urban land recycling and brownfield reuse) at local and regional levels, an honest, continuous and long-lasting political support is needed. However, to achieve a full change in political and public perception for making more sustainable land use choices (to promote brownfield reuse and urbanized land recycling), a lot of advocacy and awareness would be required. Simultaneously, at many national levels, a final tuning of gaps in individual member states legal frameworks and policies would be necessary²⁴.

¹⁹ Eisen, J. 1999

²⁰ Bugge, H. C., Watters, L. 2003

²¹ Petrisor, A.-I. 2014

²² Bergatt Jackson, J., Vojvodíková, B. 2013

²³ Bartke, S. 2013

²⁴ Bergatt Jackson, J., Vojvodíková, B. 2013

Such policies should also consider some land conversions compensation measures, which would help finance brownfield reuse in locations where their development is possible; or consider financing brownfield naturalization in locations where brownfields are superfluous to market needs. Soil use and urban land recycling are also critically important for creating sustainable and smarter cities where citizens enjoy shorter journeys to work and a high-quality life, and participate in cultural, leisure and retail activities. In Europe, polycentric urban patterns of high-quality environment could quickly erode, if gaps between cities were simply filled in with sprawling developments. Reuse of brownfields and urbanized land recycling also offer some hope for containing the carbon footprint of our urbanized communities.

1.1. Factors affecting the brownfield redevelopment process

Besides the temporal (historical) factors affecting the formation and evolution of brownfields in different European countries, it is argued that also internal geographical factors affect the actual situation and patterns of redevelopment. Oliver²⁵ made a comparative study that identified significant regional trends amongst European definitions or respectively concepts of brownfields which reflected the national policy strategies regarding land regeneration and development. The authors documented how two (not indisputable) indicators – population density and economic competitiveness – at a country level determine the perception of what brownfields and derived regeneration priorities are – from pure contamination problem focus to development potential gaining understanding.

Research studies focusing on the identification of success factors of brownfields regeneration usually link their theoretical approach to a sustainability concept²⁶, where economic, social and environmental dimensions ought to be balanced. As Pediaditi²⁷ stress, while a successfully regenerated urban brownfield is perceived as the indicator of urban sustainability that prevents urban sprawl and avoids developments on greenfields, failures are more visible reminders of unsustainability²⁸. Thus, the successful brownfield regeneration projects have to meet not only economic criteria, but environmental and social criteria as well. In this vein, Chrysochoou²⁹ uses three groups of factors for the assessment and prioritization of brownfields: i) socio-economic variables, ii) environmental variables, and iii) smart-growth variables.

Another approach is documented in the brownfields assessment methodology developed by Doetsch³⁰ for the German Federal Ministry of Environment. Their assessment and prioritization model is based on scoring 26 parameters (factors) grouped into three main dimensions according to different stakeholders' perspectives: i) potential of brownfields from the point of view of municipalities, ii) potential from the point of view of investors, iii)

²⁵ Oliver, L., Ferber, U., Grimski, D., Millar, K., and Nathanail, P. 2005

²⁶ Meadows, D.H., Randers, J., Meadows, D.L. 2004

²⁷ Pediaditi, K., Doick, K.J., Moffat, A. 2010

²⁸ Dixon, T. 2007

²⁹ Chrysochoou, M., Browna, K., Dahala, G., Granda-Carvajalb, K., Segersonb, K., Garricka, N., Bagtzogloua, A. 2012

³⁰ Doestch, O 1997

potential from the point of view of public interest. In a similar way, Cheng³¹ divide factors into groups related to (i) owner's compliance, (ii) marketability, (iii) community benefits, and (iv) political concerns.

Besides the relevance of the stakeholders' concerns and the three sustainability pillars, we need to consider as well the importance of a spatial dimension (respectively the geographical context) of the brownfield regeneration problems. The spatial dimension has two important functions: (1) balances at different territorial levels cohesion and polycentricity, and (2) results into local "sustainable communities"; at the same time, it is related to "urban regeneration"³². Brownfields do not exist on their own, independently, or in a vacuum – but they are placed and rooted in a certain geographical space which is hierarchically and functionally structured and also determined by individual sociological contexts; therefore, every brownfield site is a unique individual. The geographic environment and driving forces acting within have caused the formation of brownfields, but at the same time the actual existence of brownfields affect the environment on the rebound.

Therefore, it is necessary to perceive brownfields in their spatial context and when classifying and prioritizing them to take into account not just site-specific attributes but also contextual factors acting at a higher hierarchical level³³. It is not possible to state a priori which general factors, location factors or site-specific factors are the most important determinants. Table 1 presents a classification of such factors, where partial factors are inter-related and often significantly influence each other. This is not to be understood as a completed, but open system with other macro factors – geographical, historical, political, and economical – acting on higher hierarchical levels (e.g., actual global economic trends, political processes at European Union level). Identification and analyses of the relative importance of each of these is a task for comprehensive and interdisciplinary research.

Table 1. Summary of success factors identified by stakeholders³⁴

General factors (macro-level)	Specification
National policy (legislative, regulative and control tools).	political
Availability and quality of information (about existing sites, tools, best practices, etc.)	information
Availability of financial incentives (grants, subsidies, funds, tax allowances, etc.)	economic
Foreign direct investments	economic
Public attitudes, rate of the adoption of innovations and new developments	social/cultural
Location factors (meso-level)	Specification
General localization (location within a country, belonging to a region)	geographical
Specific locality (location within a spatial-functional structure: rural, city, inner city)	geographical

³¹ Cheng, F. 2011

³² Petrisor, A.-I. 2014

³³ Dasgupta, S., Tam, E.K.L. 2009

³⁴ Timbre survey, 2012

Concentration of other brownfields in the locality (competition of sites)	geographical
Transport links (proximity to highway, first class road, railway station)	geographical
Physical conditions of the area (terrain, subgrade properties, etc.)	physical
Landscape protection limits (proximity, heritage conservation areas, flooded areas)	environmental
Economic status of the locality (population structure, unemployment rate, entrepreneurial activity)	social/economic
Social status of the locality (social structure and cohesion of the local community)	social/cultural
Place marketing (local development strategy, land-use plan, urban study, place marketing)	social/economic
Local involvement and collaboration of stakeholders (politicians, community, NGOs)	social/cultural
Site specific factors (micro-level)	Specification
The size of the brownfield area	technical
Type of the previous use (industrial, agricultural, military, etc.)	technical
Type of the expected future use (quality, feasibility, and sustainability of the project)	technical
Extent of the built-up area and technical conditions of buildings	technical
Attractiveness of site and objects (historical, architectural, aesthetic value and image)	social/ economic
Ecological burden (extent of the contamination of soil and groundwater sources)	environmental
Infrastructure networks (functional connections to water supply, sewerage, electricity)	technical
Property relations (number and structure of property owners, availability for selling)	social/ economic
Price of the land and property	economic
Regeneration costs and return-time of investments	economic

In many cases even the good conditions for effectiveness and prosperity of a settlement (and for brownfields regeneration) may not be utilized if there were subjective problems and barriers (e.g., weak local political involvement, deficit of information, bad communication and cooperation, etc.); that is, the key actors are not able or do not want to exploit a potential. On the contrary, “soft factors” as political support or good cooperation of stakeholders can turn even insufficient conditions and low potential into positive results. There are many examples (so called “best practices”) reporting how human factor as an initiator of brownfield regeneration – e.g. making a good project proposal, gaining a local community support, acquirement of grant titles, etc. – have overcome location handicaps or modified the characteristics of suitability of area or concrete brownfield site according to specific project purposes (e.g., Brownfields Regeneration in the South Moravian Region 2010). In this respect, it is very important to study specific local political, cultural and social structures and contexts of regeneration processes, roles of specific actors.

1.1.1. Success factors and indicators

In general definition, a factor is anything that contributes to a result or a process. In the context of brownfields regeneration (hereafter Timbre context), the success factors are considered facts (conditions, circumstances, actors, agencies) that are determinants and contributors to successful regeneration of brownfields (i.e. input variables) in such a way as that they:

- are the causes of the fact that some brownfields have become objects of concerns of investors, politicians, experts or other actors;
- have been prioritized as the most critical, urgent or profitable to invest money, time and energy;
- have been regenerated and newly used, while other sites are out of attention;
- stay neglected and derelict, or the process of their regeneration has not been successfully completed.

Many success factors are more or less complex phenomena that can be expressed in general terms (e.g., spatial peripherality) as well as in number of measurable indicators (e.g., distance from the city centre, proximity to main road network, etc.). It has been suggested by previous studies^{35,36,37} that among the crucial success factors for redeveloping brownfields are decontamination and regeneration costs and acceptable return rates for investors, government incentives, focused urban development policy and political leadership, strong place branding, and local stakeholders' involvement and collaboration. It has been also demonstrated, however, that – in addition to general legislative, political and economic factors acting at national or regional scales – local geographical factors play an important role³⁸.

Brownfields do not exist by themselves, independently or in a vacuum, but they are products of the interrelationships between places and social and ecological processes³⁹. Brownfields are placed and rooted in a certain geographical space and time, which is hierarchically and functionally structured. Therefore, brownfields have to be perceived in their spatial context and we should take into account when assessing them not just their site-specific attributes (such as the level of ground contamination or property relations) but also contextual factors acting at higher hierarchical levels⁴⁰. It is not possible to say a priori which of the general factors, location factors or site specific factors are the most important ones; to identify and analyze the relative importance of each of them is a task for comprehensive research.

The studies from the US, Canada and UK^{41,42} demonstrated that the primary reason why the private sector invests in some regeneration areas is the perception of achieving some target

³⁵ Bacot, H., O'Dell, C. 2006

³⁶ De Sousa, C. A. 2002

³⁷ Filip, S., Cocean, P. 2012

³⁸ Frantál, B., Kunc, J., Nováková, E., Klusáček, P., Martinát, S., Osman, R. 2013

³⁹ Bjelland, M.D. 2002

⁴⁰ Heberle, L. and Wernstedt, K. 2006

⁴¹ Adair, A., Berry, J., McGreal, S., Deddis, B. and Hirst, S. 2000

⁴² De Sousa, C. A. 2002

rates of return. Conversely, the principal reasons for non-investment include the negative image of the locality or neighboring environments, lack of capital (funding), and the perceptions of bureaucratic grant regimes⁴³. Similarly, Coffin and Shepherd⁴⁴ identified four key barriers to regeneration including legal liability, limited information, limited financial resources, and limited demand for the properties. In many cases even good conditions for prosperity of a locality and for brownfields regeneration may not be utilized if there are subjective problems and barriers, such as a weak local political involvement, deficit of information, bad communication and cooperation of stakeholders.

With respect to the existing literature discussed above – even despite of the prevailing terminological, conceptual and methodological divergences – we can argue that there is a partial consensus in two aspects regarding the success factors of brownfields regeneration: first, the multidimensionality, which means that factors form certain dimensions or groups according to the spatial level (i.e., national, local and site-specific factors) and/or according to factors' character (i.e., political, economic, environmental, social and other groups of factors). Second, the relativity, which means that different individuals or groups of stakeholders within one country or across countries may perceive and assess different factors as important or irrelevant based on their personal or collective concerns, experiences or values (i.e., intra- and inter- stakeholder group variance).

Therefore, the process of exploring and classifying success factors presupposes the following two key phases: first, the stakeholder segmentation, which means a segmentation of the general public to specific categories of stakeholders⁴⁵; second, the factors determination, which means an identification and categorization of specific factors and their measurable indicators. It is hypothesized that some factors being relevant in most geographical contexts can be identified (there are some basic factors generally agreed upon by the majority of previous studies even though sometimes different terms were used for their description).

Table 2. Examples of potential success factors and their measurable indicators⁴⁶.

Success factors	Possible indicators
Peripherality of a location	Proximity to regional city (km)
Economic potential of locality	Number of business subjects per 100 inhabitants
Ecologic burden of a site	Extent of soil contamination (Pb mg. kg.-1)
Local political involvement	Rate (%) of participation in municipal elections

One of the objectives of this paper is to survey, identify and classify the factors that are significant for a successful regeneration process. In the existing brownfield literature, the (success) factors are alternatively called criteria, parameters or variables. Many success factors are more or less complex phenomena that can be expressed in general (qualitative) terms or nominal variables (Table 2). Indicators represent simplifications and quantifications of complex factors into measurable variables. Usually one factor can be measured via more

⁴³ Adair, A., Berry, J., McGreal, S., Deddis, B. and Hirst, S. 2000

⁴⁴ Coffin, S.L., Shepherd, A. 1998

⁴⁵ Doak, J. and Dixon, T. 2005

⁴⁶ Timbre Survey, 2012

alternative or complementary indicators. The selection of specific indicators is determined mostly by the availability of data.

1.2. Environmental Benefits of Brownfield Redevelopment

As previously stated, different nations have defined the term brownfield in various ways. Some countries defined it as previously developed land, some as contaminated land and some others as contaminated previously developed land. Therefore, contamination issue is basically an important factor in explanation and development of what is presumed as brownfield land. However, it is not commonly considered as a major factor in some countries.

Assuming that brownfield lands are dealing with the presence of hazardous materials, pollutants or contaminants, cleaning-up programs will be extremely required in order to remediate the degraded sites. These contaminants mainly resulted from previous industrial uses that still remained on the site and have detrimental effects on human health and the environment. The contaminants can be due to intrinsic factor – in site contamination like soil, groundwater and surface water pollution- or extrinsic factor- resulted from off- site contamination mainly through nearby sites. Therefore, removal and remediation plans should be taken into account not only to recover existing quality of a land, but also to contribute to preserve fertile lands. In other words, by means of reusing existing developed lands we can also reduce the pressure on undeveloped land (Greenfield site) that is currently or could be used for agricultural purposes.

Therefore, apart from the significant and obvious impact of brownfield redevelopment on the revitalization of a declining site, we can also maintain the valuable and productive natural resources through remediation of contaminated lands. Meanwhile, different studies indicate that brownfields projects, in comparison to alternative greenfields projects, save between 20 percent and 40 percent of vehicle miles traveled. This translates directly to air emissions reductions⁴⁷.

Therefore, the remediation of brownfield sites could also significantly result in a reduction of greenhouse gas emissions, which is one of the principal issues of global warming. Global warming is a phenomenon caused by excessive use of fossil fuels mostly generated by industrial activities. Additionally, as previously mentioned, most of brownfields – but not all – are formerly utilized in industrial purposes and are mainly aimed to take some more sustainable functions afterwards – whether to reuse the abandoned buildings or to use the remained lands as greenfields or parklands. Hence, as a result of brownfield remediation we could expect greenhouse gas emissions to decline and subsequently the outcome will be the improvement of air quality.

Another environmental benefit of brownfield remediation is its significant influence on the improvement of water quality. According to the United States Environmental Protection Agency the higher-density properties generate less stormwater runoff. As briefly noted before, brownfield regeneration basically tends to reduce urban sprawl by means of

⁴⁷ Paull, E. 2008

development in densely developed areas to effectively exploit the existing infrastructures; thereby it could significantly improve the quality and quantity of local water supply. Brownfields redevelopment contributes substantially to the reduction of stormwater runoff in two different fashions:

- Protecting undeveloped and natural lands through reusing abandoned or under-utilized buildings and infrastructures.
- Maximizing pervious and vegetated areas through transforming existing hardscapes into landscapes.

Additionally, increasing the amount of vegetated areas that are pervious also results in reduction of a natural phenomenon called “heat island effect”. Heat islands are temperature differences between developed and undeveloped areas - mainly rural areas - caused by the sunlight absorption of dark colored surfaces⁴⁸. Urban heat islands can create elevated temperature up to 10 degrees in urban areas compared to their outlying rural surroundings⁴⁹. Accordingly, by means of protecting undeveloped lands as well as creating more green spaces, brownfield redevelopment can considerably reduce urban heat island effects through an integrated and comprehensive remediation plan. Consequently, as it is illustrated on Table 3 brownfields redevelopment on the environmental side saves land from the negative externalities associated with sprawl; reduces air emissions and greenhouse gases; improves water quality through reduced runoff; depletes heat island effects and generally accommodates growth in an environmentally responsible fashion⁵⁰.

1.3. Environmental Benefits of Brownfield Redevelopment

Declined and damaged urban sites can be redeveloped and redeployed for the good of whole communities. Brownfields redevelopment promotes the social responsibility of areas that are at the risk of land degradation in many ways. Revitalization of brownfields can be considered as a reinforcement of the social aspects of sustainable urban regeneration by improving the quality of life, and promoting human health and also occupant’s well-being. In addition, a successful development plan could also result in reducing urban sprawl by encouraging different communities to concentrate in a compact mass rather scatter across the metropolitan regions⁵¹.

Therefore, the pattern of a society and respectively the whole involved community members - including occupants, workers, visitors, and all relevant actors - can be profoundly changed through the redevelopment management of brownfield sites especially within metropolitan cities. Table 3 shows some important social impacts of brownfield redevelopment process on sustainable urban regeneration.

Meanwhile, the profound effects of brownfields reintegration practice on the economic growth of a declined neighborhood should be extremely taken into consideration. During the last decades, economic issues have been regarded as integral themes in the urban planning

⁴⁸ EPA, 2008

⁴⁹ EPA, 2008

⁵⁰ Paull, E. 2008

⁵¹ Mehdipour, A., Hoda Rashidi, N. 2013

procedures. By means of exploration into the history of urbanity, we can obviously realize that all the prosperous projects essentially have striven to develop long-term, positive and practical strategies to take advantage of economic opportunities. In fact, reintegration of brownfields, as degraded lands, into the economic market cycle could significantly contribute to sustainable approaches⁵².

Table 3. The major benefits of brownfield redevelopment. *Journal of Sustainable Development Studies* (Mehdipour and Hoda, 2013).

REMEDICATION	↔	REVITALIZATION	↔	REINTEGRATION
(Environmental display)		(Social display)		(Economic display)
<ul style="list-style-type: none"> - Protects biodiversity - Improves air quality - Minimizes stormwater runoff - Reduces greenhouse gas emissions - Reduces heat island effects - Lessens urban sprawl 		<ul style="list-style-type: none"> - Provides more integrated community involvement - Cuts down long-term risks to human health - Increases the quality of life - Appreciates local culture and heritage - Promotes public safety - Aesthetically creates more pleasing urban space 		<ul style="list-style-type: none"> - Increases land value - Reduces energy consumption cost - Enlarges employment and investment rate - Increases the average income - Encourages regional industries

As previously stated, brownfield redevelopment has to be considered as an opportunity rather than a problem. On the economic side, it could attract the attention of investors and developers to enroll in revitalization process of brownfields - as distressed lands - where considerable subsidy levels are required. Meanwhile, brownfield redevelopment can economically benefit both government and population interests. Governments benefit since redevelopment places property back on the tax rolls⁵³. The brownfield development also benefits population since it contributes to the generation of new job opportunities.

By this means, the average income of the area will be significantly increased which subsequently allows the provision of better amenities and services. Meanwhile, a fast and safe redevelopment process of brownfields could also profit the owners as well as companies which redevelop their degraded real estate property, since brownfields incur costs, whether for maintenance and traffic safety, connection charges, land tax and insurance payments or the obligation to prevent hazards⁵⁴.

As shown above, brownfield naturalization and temporary use techniques are usually applied in the areas of low market demand. The temporary reuse techniques can help to raise public awareness and investors' interest. They often help to remove sites' negative image and/or gain public acceptance for their reuse and can also preserve these sites for development or remove them from the developable land market for a limited period. On the other hand, the naturalization techniques bring brownfield sites back to their natural uses and the sites stop being developable land. Such a naturalization technique can be used as a

⁵² Mehdipour, A., Hoda Rashidi, N. 2013

⁵³ Hudak, T.A. 2002

⁵⁴ Umweltbundesamt, 2005

compensation measure for the greenfield land take in areas of strong development pressures.

This, however, requires reliable and updated data on land use, at local level or at least on the NUTS4 scale. As indicated in the previous paragraphs, the actual potential for reuse of any brownfield site depends on its category ('A', 'B', 'C'), on its location, on the economic conditions and on the state of the real estate market.

The national governance levels usually provide legal frameworks and tools for regulating the urban development processes. But the real implementation of urban development on the ground is in the hands of local authorities, and within the EU there are different national approaches and local examples of how to deal with urban regeneration and development.

The levels of development power of local authorities and their legal or budgetary independence may somewhat vary among the EU states, as well as the sophistication of each national or regional regulatory system and of the urban management and development skills that individual local authorities may possess. Even the level of understanding and abilities of local development stakeholders (institutions, financing bodies, consultants, developers, etc.) could be different and, lastly, also the actual state of local markets and of local economic, demographic and social conditions that test the local government competencies in 'governance'.

But, despite all these differences, the principles of successful urban governance are usually the same. The powers of jurisdiction of the local government, its responsibilities and duties in the field of local development are generally clear. But there are many areas where the development issues overlap with the jurisdiction boundaries, stakeholders' interest varies or the solutions and the leadership of particular issues are being moved from the local government level to a different one.

Brownfields are very often an issue whose impacts or solutions are reaching above local jurisdiction. Where the 'jurisdiction status quo' and the current legal framework create barriers, more cooperative, informal or contractual ways of addressing those issues are required. That is where the governance principles come in, through "a set of decisions and processes made to reflect social expectations through the management or leadership of the government"⁵⁵. Governance processes are generally more participatory and address solutions without depending on the departmental responsibilities or other jurisdiction boundaries. Competent urban governance can have a significant influence on handling communities' urban development and regeneration.

It can be documented that the quality of local governance and of local authorities' leadership (especially where difficult circumstances are present) are in most instances the main decision forces that drive local urban regeneration. Governance success can be further enhanced by invoking a wide public interest in local regeneration processes and by abroad stakeholders' participation and involvement in local redevelopment. Urban governance skills

⁵⁵ Fasenfest, D. 2010

are usually reflected in the local ability to manage and steer local development processes, to attract and coordinate private and public interests and investments and to provide high quality public domain with ample benefits. The quality of local urban governance involvement in regeneration and development, however, depends on many factors:

- urban investments are carried out by various private or public bodies;
- financing is controlled by private institutions or public grant programs;
- technical and legal implementations are governed by the local legal framework.

But without an effective and committed local governance and a strong local leadership, the end result of brownfield reuse is usually insufficient.

1.4. The stages of the brownfield redevelopment

The three stages of the brownfield redevelopment process are pre-development, development, and management. Each stage requires specific actions, funding and/or financing. Integrating cleanup and redevelopment activities as appropriate at each stage is the key to cost-effective, sustainable brownfields redevelopment.

1.4.1. Pre-Development Phase

Pre-development activities lay the foundation for a successful brownfield redevelopment project. The developer (or local government, for a publicly funded project) conducts several analyses, assesses the feasibility of a project and decides whether the project should move forward. This is the riskiest phase for potential private developers because they are investing money upfront without a guarantee of any return. During this phase, the developer usually does the following:

- **Conducts Due Diligence.**

Due diligence involves a variety of activities in advance of purchasing a property and activities specific to the environmental components of the redevelopment., such as conducting property and environmental assessments, researching land and building titles for the property, continuing communications with key stakeholders about the planned redevelopment.

- **Conducts Various Analyses:**

- An analysis to evaluate the physical and regulatory development potential of the property;
- An initial feasibility analysis that usually consists of quick, back-of-the-envelope calculations;
- A feasibility analysis to evaluate and understand different types of project risk, including financial and environmental risk;
- A market assessment to identify reuse options.

- **Determines Any Fatal Flaws**

Once the due diligence and various analyses are complete, the developer will determine if there are any obvious fatal flaws.

- **Develops the Proforma and an Agreement for Purchase of Property**

If proceeding with the project, the developer will move forward with an in-depth financial proforma and negotiate their contract terms to purchase the site. These negotiations are a method of risk management and address key issues, such as liability,

financial risk, environmental covenants, institutional controls, and regulatory assurances. Such negotiations lead to an agreement to purchase the property from the seller (i.e., a letter of intent or Purchase and Sale Agreement).

- **Uses the Proforma to Refine Site Design and Maximize Profit.**

The proforma can be used to guide the site design process by calculating estimated costs and profit derived from different buildable square footage and site constraint inputs. A potential developer will likely explore several redevelopment concepts during this phase to ensure that the project is feasible financially and from an environmental standpoint.

- **Prepares a Redevelopment Plan.**

If a decision is made to go forward, the developer will begin redevelopment planning for the site, based on the information gathered and the market assessment. A sustainable redevelopment plan will integrate site assets and limitations, incorporate neighborhood features, address community concerns, and satisfy market demand. A redevelopment plan generally includes:

- A Community Engagement Plan that is implemented early in the process to build public and regulatory support for the project. Creating community buy-in for the intended reuse can facilitate entitlements, reduce delays, and minimize risks.
- A Site Reuse Vision, which is a visual representation of the redevelopment plan that is used to communicate with stakeholders, regulatory officials, economic development leaders, and the real estate market.
- A Redevelopment Implementation Strategy, which is a step-by-step strategy for obtaining regulatory approvals, community support, and implementing the redevelopment plan.
- A Resource Roadmap, which identifies public incentives that may be available and needed to help finance the development, and potential funding sources for making infrastructure improvements to attract tenants and end users. This may be particularly important for developments located within a weak market.

For a publicly funded redevelopment or a public-private partnership effort, a municipality or community often will conduct planning activities to ensure that the community's site reuse goals align with local economic, infrastructure, social and environmental conditions, and help determine which reuses are feasible for the site.

- **Identifies Sources of Funding or Financing.**

- A combination of private and public sector funds may be used to pay for assessment, remediation, purchase, and redevelopment activities. For pre-development activities, several types of funds may be available:
 - Buyer or equity partner cash;
 - Local, state or federal government programs that offer tax credits, loans, incentives or abatements, bonds, subsidies or grants;
 - Local tax increment finance (TIF) or special assessment (SA) districts;
 - In-kind contributions (non-monetary contributions, such as donated design services or sweat equity of developers).

- **Acquires Environmental Insurance.**

The developer may decide to purchase an environmental insurance policy, such as Pollution Legal Liability (PLL). PLL insurance can provide coverage for pre-existing

contamination that may be unknown, onsite and offsite third-party bodily injury and property damage, and regulatory reopeners of a completed remedial action. The term of the policy and the coverage amount can vary based on the insurer and the environmental condition of the site. Insurers will generally require a comprehensive understanding of the environmental condition of a site typically developed through comprehensive site characterizations. In some cases, an approved remedial action plan may be necessary before the insurance will take effect. In the case of a property transfer, PLL insurance can provide protection to both the buyer and the seller.

1.4.2. The Development Phase

This phase includes permitting, environmental cleanup, construction, financing, and marketing activities that culminate with completion of the project and a formal opening. During the development phase, the developer usually does the following:

- Obtains Necessary Permitting and Approvals. This includes local and state land use approvals and construction permits.
- Conducts Environmental Cleanup and Completes Construction. Based on assessment activities, planned cleanup actions, and stakeholder input, developers are typically able to integrate and streamline cleanup and construction activities and ensure all issues are resolved so that the redevelopment process runs smoothly. This phase is extremely time sensitive. Any delays result in higher costs and may make the project financially unfeasible.

For activities during the development phase, several types of funds are typically used:

- Private Equity:
 - Hedge or investment funds;
 - High net-worth individuals ;
- Construction Financing
 - Private bank loans;
 - Grants ;
 - Public sector loans;
 - Public infrastructure investments.
- Permanent Financing - Mortgage (e.g., insurance companies, pension funds):
 - Tax increment financing (TIF) districts, special assessment districts;
 - Tax credits - Industrial revenue bonds.

1.4.3. The Management Phase

During the management (or operational) phase, the developer decides whether to:

- hold the property for the long-term and assume responsibility for operation and maintenance (O&M), or
- sell the property to another entity that will take over long-term responsibility for O&M

If the developer chooses to sell the property, the developer must ensure that ongoing maintenance required under the remedial action plans and any institutional controls are

transferred to the new buyer. During the management phase, three types of funding generally are available to the developer:

- Operating income (e.g., rents);
- Tax abatements;
- Workforce or economic development incentives.

2. Conclusions

“Sustainable Brownfield Regeneration is the management, rehabilitation and return to beneficial use of brownfields in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations in environmentally sensitive, economically viable, institutionally robust and socially acceptable ways within the particular regional context”⁵⁶. In the context of brownfield regeneration, short term concerns about construction methods and materials and long term issues such as land use and future land use possibilities require simultaneous evaluation for sustainability to be predicted in advance.

The definition of sustainable regeneration is not meant to imply that sustainable development should be regarded as a situation that can be achieved or a destination that can be reached at some time in the future. Rather it is a journey through the ever-competing interests of the four dimensions that seeks to optimize the impacts and benefits while preserving the freedom of action and range of options of future generations⁵⁷. The focus should not be on situations regarded as optimal from today’s perspective, but on the potential flexibility of the instruments used to approach sustainable development. Thus, the process of sustainable development requires a continuous re-evaluation in order to adapt to changing boundary conditions, priorities and evolving knowledge and technology. This requires much flexibility in the steering of the process.

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⁵⁶ RESCUE 2003

⁵⁷ Franz, M., Pahlen, G., Nathanail, P., Okuniek, N., and Koj A. 2006

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