

Defining the spatial characteristics of Brownfields in the context of India

1st Rina Salvi
MIT School of Architecture
MIT-ADT University
Pune, India
reenasalvi@gmail.com

2nd Dr. Neeti Trivedi
MIT School of Architecture,
MIT-ADT University,
Pune, India
neeti.trivedi@mituniversity.edu.in

Abstract— The term brownfield comprises of a whole range of diverse spatial patterns and distribution of spaces within the city limits. This paper deliberates the need for a clear definition of the term 'brownfield' from planning and development point of view. The paper reviews the existing use of the term 'brownfield' and the several characteristics used to define the term from across the world. It reviews well-composed, established, and recognized definitions for the purpose of proposing a definition that would be applicable in the context of India, as there is no approved or an official explanation in India that classifies different types of brownfields. The classification that would emerge from the study would aim to create a non-exhaustive reference list, outlining the need for intervention in redeveloping the brownfield sites due their strategic location within the core urban areas. Hence proposing a definition that is precise to the Indian context would help in optimizing the potential development of these sites. The definition then would be subsequently used for policy recommendations and by various stakeholder groups that are involved in the revitalization of the brownfield sites.

Keywords—Brownfields formatting, spatial planning, redevelopment/regeneration, stakeholder

I. INTRODUCTION

Deindustrialization, suburbanisation, change in land use over time and change in demographic shift or economic base has resulted in environmental degradation of city core areas [1]. urban areas, even though degraded, underutilized or vacant, needs to be regenerated and are still considered as an important asset and are referred to as brownfields. Brownfields are sites that are vacant, derelict or underutilized parcels of land that had some previous use like industries or any other use that are no longer existing or are declining [2]. These brownfields are often located along desirable waterfront lands, old industrial zones, inactive landfill sites, abandoned quarries in city limits or previously used and now abandoned derelict sites in city cores.

In recent years the approach towards brownfields have changed significantly. Previously, only highly contaminated sites were taken up for clean-up, which resulted in neglect of a lot of smaller parcels in the city areas. Hence even the communities and neighbourhoods around these sites suffer from the urban blight. Several literature studies have revealed that the brownfield site problems are not just physical such as vacant, derelict, abandoned buildings but they also have

economic and social importance to an extent. So, the urban regeneration should be a sustainable one and should develop and improve the surrounding city fabric, improve the local character while also realising economic, social and physical growth.

Hence while taking any decisions regarding urban regeneration of brownfields, it needs to involve different stakeholders in their decision making. The stakeholder's response to the proposed regeneration would be influenced by their former experience and understanding [3].

Today the policies and programs related to brownfields have shifted its focus from industrial clean-up to reuse or regeneration of such sites at local level. But these approaches clearly lack defined guidelines for evaluating, reusing and designing these local level brownfield sites and does not have any strategies on engaging local community in these projects. But the question that arises is; Can one involve the local community more in the process? Various researchers including Comp and Arbogast have stressed about the need to reinforce the above aspects while dealing with brownfield sites. "Degraded environments are cultural artifacts as much as they are problems for science, and we must address these problems with the full range of the arts and humanities, as well as the sciences, if we are to be effective [4]. Arbogast further discusses that "what is needed is the willingness to experiment and see what the world of design and planning has to offer the world of earth science and vice versa ... landscape architects have the methods and tools to create a dialogue between science, [post-industrial areas], and society" [5]. Based on these opinions, another key question that surfaces are how critical is the appearance of these potentially contaminated sites and how crucial is the role of design in redeveloping these brownfield sites? These interactions in redeveloping these sites are reflections of actions between the various stakeholders or actors that would be potentially involved in the process. This hypothesis requires recognizing the different characteristics of brownfield sites which would then be followed back with investigating the relevant decision-making approaches. Hence, it is important to define the term brownfield clearly in laws and policies which warrants that everyone respects the same tenet making the development and management easy.

II. UNDERSTANDING BROWNFIELDS

Brownfield sites are underutilized areas that falls within the city limits. It is important to identify and tag these sites and to do so it requires a proper understanding about the attributes and characteristics of the site. Some of the common characteristics of brownfield sites are:[6]

- Previous industrial sites
- Presently abandoned and not in use
- Urban location
- Real or perceived environmental contamination
- Completely unaddressed
- Planned redevelopment
- Fractional or complete redevelopment

Land parcels thus identified and tagged can be deliberated for the redevelopment by adopting suitable redevelopment approaches.

III. DEFINITION

To redevelop the brownfield sites, one needs to comprehend the definition of the term and have a good understanding on the characteristics of such land parcels. Various key components were identified by Alker et al. (2000) among the definitions of brownfields from governments and institutions like; derelict, vacant, previously developed and contaminated.

The Table 1 below summarizes the common components that have been considered in several institutions.

Institution	Components				
	Previously developed	Urban	Derelict	Contaminated	Require intervention
CABARNET (EUROPE) [Millar et al., 2005]	*	*	*	∇	*
USEPA [The small Business Liability relief and Brownfields Revitalization act (section 211 (a) (39)(A)]	*	–	*	*	*
*England NLUD [DCLG 2007]	*	∇	∇	–	∇
NRTEE Canada) [NRTEE,2003]	*	–	*	*	*
ALKER et al. (2000)	*	∇	*	∇	∇

Table 1. Common elements in Brownfield definitions.

∇ Non-essential component in the definition

* Essential component in the definition

– No mention of the Component

The objective of policies regarding to brownfield redevelopment in different countries are directly affected by the way these sites originated. Hence, it's very important to review the definitions of brownfields in different countries and the possible implications due to the differences [7],[8], [9], [1].

Based on the table above, the definition of brownfields basically has two facets to it; one where the definition

considers contamination as essential component and the other definition looks at it as a non-essential component.

Countries like United States, Canada and several European countries associate brownfield sites with contamination. The term “brownfield” was first coined in United States in 1992 [10]. The most frequently cited brownfield definition was termed by the Environmental Protection Agency (U.S. EPA) in 1997, as "Brownfields are abandoned, wasted, or under-utilized industrial and commercial amenities where because of possible contamination redevelopment is challenging"[10]. In 2000, a multi-disciplinary perspective recommended a definition which states that a brownfield site is “any land or properties which had a previous use and is either abandoned or is not fully in use presently and may be derelict or contaminated” [11]. The term “brownfields” characterises land and properties that have been changed artificially, but are not presently used to their optimized potential. Agrarian land is not considered as brownfields [11]. In other words, brownfields can be termed as unemployed, non-agricultural land resources [12]. Although there are many definitions and interpretations for brownfields, the most well-known definition is the one suggested by the work group called CABERNET. They stated that: "brownfields are sites that have been affected by the former uses of the site and surrounding land, are derelict and underused, may have real or perceived contamination problems, are mainly developed in urban areas, and require intervention to bring them back to beneficial use [13]. In Canada “brownfields” is defined as “an abandoned, vacant, derelict or underutilised commercial or industrial property where past actions have resulted in actual or perceived contamination and where there is an active potential for redevelopment (NRTEE 2003)”. Several European countries like Bulgaria, Denmark, Italy, Poland, Romania and Spain also define brownfield as land or properties affected by contamination [8].

The definitions of brownfields vary from one country to another [14] for example; the United States looks at brownfields sites that are particularly industrial and commercial sites that may have potential contamination. Whereas UK and some western European countries associate brownfields with dereliction and includes even the abandoned housing sites and derelict land without any concerns about possible contamination [15]

Hence there is a clear disparity in the way brownfield sites are perceived in different parts of the world. European countries stress on the vacant land status that is easily available for development while the U.S. emphasize on the potentially contaminated land that would need protection form environmental hazards [8, 11].

IV. SCENARIO IN INDIA

Hence when one is researching on the regeneration aspects of brownfields in countries like India, where there is no clear legal and accepted definition of brownfields, one needs to frame their own definitions. India with its incremental rate of urbanization, its vast population, rich geographical diversity and different climate zones definitely requires a tactical method in redevelopment strategies. The terminology needs to be justified on the premise of the need for a robust understanding of the term brownfield from a

multidisciplinary assessment across different systems, as suggested by Alker et al. (2000). Recently there was an article in Times of India by Surojit Gupta & Sidhartha (TNN / Updated: Feb 28, 2020, 1:16 pm IST) where he has written about the Sovereign wealth funds look at infrastructure sector. The article states that the finance minister Nirmala Sitharaman in her budget speech has offered incentives for sovereign wealth funds of foreign governments in the priority sectors. The government said it will grant 100% tax exemption to their interest dividend and capital gains income on investment made in infrastructure. The government official was quoted in the newspaper that the foreign countries wanted to invest in India's infrastructure and were not just looking for greenfield projects but also at brownfield projects [16]. Rouhin Deb, an independent empirical economist and policy researcher in his article "National Infrastructure Pipeline: The great Indian dream", has also stated that Indian brownfield projects have received more interest from the foreign funding agency [17].

In KGP chronical an official news platform of IIT Kharagpur, there has been a write up on "Urbanizing the brownfields in India" by Shreyoshi Ghosh (PG Student, University of Nebraska, Lincoln; Executive Officer, IIT Kharagpur. The focus of research was "Integrating Brownfield Sites of India into the Urban Fabric". They stated that the brownfield redevelopment is relatively new within the Indian context and the planning of such redevelopment sites would require to be systematic to ensure that the subsequent projects are economic and effective. As yet as no standard definition or guideline for brownfield redevelopment is available in India, there is a need of engaging a proper planning instrument.

In another article in pioneer titled, "Making prudent use of wasteland" dated 24th April 2014, Kota Sriraj, an entrepreneur and environmental journalist with The Pioneer newspaper, New Delhi and environmental columnist with The Daily Tribune, Bahrain states that as the brownfield site management and land revitalisation assumes exciting proportions, India needs to make itself a part of the success story by taking appropriate methods by redeveloping and re-using abandoned sites [18].

There are several brownfields typologies that exist in India. They may be in the form of abandoned rail tracks or railway stations or airports, non-working industries, landfill sites, former gas stations or dry cleaners. Keeping these typologies in mind in an Indian context, one can adopt the definition that was proposed by CABARNET for the United States. The definition states that; "Brownfield are sites that have been affected by the former uses of the site and surrounding land, are derelict and underused, may have real or perceived contamination problems, are mainly developed in urban areas, and require intervention to bring them back to beneficial use".

Treating Brownfields

Hence while treating any brownfield site, it's important to engage appropriate sustainable solutions. Such solutions take into considerations all the past layers of the sites and critically examines the site condition. The process deals with a rational attitude in identifying, evaluating, implementing and treating the brownfield sites in a sustainable manner. So, the question that's needs to be asked is whether India is ready with suitable technical knowledge for scientifically redeveloping its Brownfield sites? Unfortunately, this expertise in dealing

with brownfield sites in India is not yet widely recognized. One can argue that appointing a technical team could increase in redevelopment costs, but having a strategy in place and implementing a technical approach will have its benefits both for the environment and stakeholders involved. But having a proper strategy and a scientific approach for treating brownfield sites demands site specific action mechanisms. Tata energy Research Institute (TERI) has prepared manuals for application of proper technologies with region specific conditions in order to achieve sustainable targets across India [19]. Even Global Consultants such as SGS group India has contributed towards technical and managerial solutions for redevelopment of abandoned and contaminated sites [20]. However, proficiency in scientifically treating brownfields which has a proper service chain mechanism is yet to be reinforced in India.

V. ROLE OF MULTI-STAKEHOLDERS

In recent years the priority has shifted from just the clean-up of such sites to the regeneration and reuse of local brownfield sites. This shift is based on the prevalent changes in awareness of experts and researchers, who have begun to see brownfield sites as valuable prospects and resources for regenerating cities and neighbourhoods in the now densely urbanized environments in which many people now live and work. Brownfield sites are now looked at as an catalyst for ecological, cultural, and social change" [21] and not just as a landscape product.

This change in the focus of brownfield programs from highly polluted post-industrial clean-up to local brownfield reuse has led to more involved community engagement. For example, the programs are revived to include better amenity values that lead to an improved and healthier quality of life for local residents [22].

The concept of brownfield regeneration in the perspective of sustainability is proposed as: "Sustainable Brownfield Regeneration is the Management of brownfields recovery to beneficial use in a responsive way to people; considering present and future needs, environmentally sensitive, economically viable, institutionally robust and socially acceptable, within the particular regional context"(RESCUE (2005) Best Practice Manual, LQM Press, Nottingham). The hidden crucial component of this concept is the balance between the multiple stakeholders' desires, present and future generation, and diverse sustainability dimensions and the context. Increasing challenges due to urbanization calls for sustainable development and it does require more innovative and untraditional solutions like brownfields regeneration.

The concept of brownfield regeneration has evolved from a modest form of restoration or rehabilitation of a building, to a cohesive, all-inclusive, responsive sustainable urban regeneration. It is a complex process. Even the policies pertaining to brownfield regeneration seems to have a balance between removing potential contamination risks and bringing about opportunities by reuse of brownfields. Former policies and programs fixated on identifying sites, imposing fines on liable parties responsible for removing the contamination. Whereas now it encourages reuse activities that will bring economic and better community benefits.

These regeneration projects do have many challenges. There are limitations of regenerating brownfield sites: like for example clean up considerations, technical expertise and

governance, reuse goals may be unacceptable to the neighbouring people or previous residents of the site, environmental liability concerns and financial barriers. But despite these challenges, a brownfield regenerated site has significant opportunities. It has the scope of demonstrating effective regeneration of brownfield sites in the city and has the potential to impact urban communities, revitalize the neighbourhoods [23], and also make them economically viable and attractive [7].

One of the crucial dimensions of brownfield regeneration is the range of professions involved in the process. The planning process goes smoother if more stakeholders are identified and involved right from the early stage for regeneration project. Hence effective brownfield regeneration often relies on resilient management among stakeholders including local communities; local government; private parties; and non-profit organizations. Successful regeneration of brownfields can be achieved when these stakeholders work together to follow a shared regeneration goal. Hence a participatory planning process that involves a multi-disciplinary approach from various stakeholders, from the governing bodies to investors, community people, planners seem to have become more important. A stakeholders' involvement in the process of decision making and project evaluation is important while implementing land change policies where local outlooks are taken into consideration.

In brownfields, the multi stakeholders involved are the property-owners, financier, developers. These stakeholders are interested in regenerating the brownfields because of the financial benefits involved [24,25]. According to De Sousa (2006) [26], brownfield sites when developed by landowners and investors seldom taking into consideration environmental aspects. These stakeholders would always look to maximise the capitalization of these sites; transforming them, for instance, into a housing development. In most cases, it is observed that because of the real estate market the developers are the influential stakeholders in the development of urban projects [27]. Whereas, the traditional stakeholder group which consists of urban planners, communist activists, elected officials in governing body seek to augment the urban space usage to improve urban neighbourhoods that is conserving the built and landscaped heritage to stimulate economic and social development and ensure the well-being and safety of the residents to generate local dynamics around regeneration projects [28,29,30]. Academicians and community residents can play the role of influencing and attracting the private actors that is the investors, who even with their conflicting priorities can generate favourable situations for economic and urban development [31,32].

It is observed that the public or community stakeholders are not integrated in the process of project regeneration, as they are rarely included at the beginning of project planning. Academicians form an interface between stakeholders involved in project management and the community people. These academicians or experts occupy an intermedial space. They play multiple roles of being a interpreter, smuggler and media messenger [32]. According to Sardinha (2013) [33] "public promoters" can also petition and mobilize "lay experts" that is the citizens with special experience, and build on their applied knowledge that has been acquired

from their active involvement in the day-to-day life due to proximity to the brownfield sites in the neighbourhood.

The community people that is the local residents and citizens want to live a good quality of life and want their urban environment to improve [34]. These local community stakeholders can help in expressing and consolidating resident outlooks through different engagements and proposals to encourage regeneration approaches and local development. Engaging local community in the development of regeneration projects is an important aspect for the sustainability of a project, as they can bring their own experience of the neighbourhood land characteristics. This helps in addressing the needs and wants of the local residents while creating the conditions for the development project [35].

These contributions of multiple stakeholders help to strengthen the regeneration development process and to the execution of effective urban strategies to have better quality of life while also improving the economic and environmental situations of the neighbourhood. The purpose of the stakeholder groups is to provide a stimulus to the urban regeneration projects.

Degen and Garcia noted that elected political representatives often overlook the influence of historical and geographical characteristics of different neighbourhoods and tend to duplicate one neighbourhoods' mode of urban regeneration to the others [36]. However, this might give outcomes that may not turn out the way it was anticipated due to different characteristics of different neighbourhoods.

VI. CONCLUSION

The concept of urban regeneration of brownfields in a sustainable manner is crucial and globally the potential of regenerating them has been recognized. Brownfield's regeneration, with proper planned intervention and involvement of all the concerned stakeholders, could lead to an inclusive solution having social, economic and environmental benefits. Including brownfields in development plans could be a tactical solution, as these sites have land values which can interest different stakeholders like investors, developers due to their strategic locations. Finally, brownfield regeneration needs to be under the gambit of urban planning body in India to enable urban planners or designers to incorporate them in the planning process. It could be done under diverse disciplines and scales depending upon the typology and characteristic of brownfield site. India needs to incorporate the terminology of brownfield in its policies, legislation and urban planning laws. The definition of brownfield needs to be outlined in an Indian context to clearly state what is meant by underdeveloped, derelict, vacant, abandoned and so on. Even the classification needs to be stated according to the conditions of an Indian context. All possible stakeholders need to be involved in the regeneration process at each stage of the project process, specifying the type of involvement from each player so their objectives and constraints could be identified. There is no tool that would guarantee the success of the regeneration project. A mix of tools is required that is contextual to each brownfield site that consider the strategic vision and goals of the city. These will always be a need to experiment and implement these regeneration approaches towards brownfields. They bring

about environmental and economic development, engage with the community around and eventually transform these brownfield sites so they become assets to the city.

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REFERENCES

- [1] Adams, D., De Sousa, C., & Tiesdell, S. (2010) Brownfield Development: A Comparison of North American and British Approaches. *Urban Studies* 47(1): pp.75-104.
- [2] Dixon, T. (2007). The property development industry and sustainable urban brownfield regeneration in England: an analysis of case studies in Thames Gateway and Greater Manchester. *Urban Studies*, 44(12), 2379-2400.
- [3] Pahlen, Gernot and S. Glöckner. "Sustainable Regeneration Of European Brownfield Sites." (2004).
- [4] Comp, T. A. (2007). Science, art an environmental reclamation: Three projects and a few thoughts. In A. Berger (Ed.), *Designing the reclaimed landscape* (pp. 63-76). London: Routledge.
- [5] Arbogast, B. (2007). Interrogating a landscape design agenda in the scientifically based mining world. *Designing the Reclaimed Landscape*, 52.
- [6] Walkowiak, E., & Frazier, D. (2000) Brownfield Redevelopment as a Catalyst for Creating Sustainable Cities. In C. A. Brebbia, A. Ferrante, M. Rodriguez, & B. Terra, *Sustainable City: Urban Regeneration and Sustainability* (Vol. 9, pp.113-122). Rio Janeiro: WIT Press.
- [7] Grimski, D., & Ferber, U. (2001) Urban Brownfield in Europe. *Land Contamination & Reclamation* 9(1): pp.143-148.
- [8] Oliver, L., Ferber, U., Grimski, D., Millar, K., & Nathanail, P. (2005). The scale and nature of European brownfields. In CABERNET 2005-International Conference on Managing Urban Land LQM Ltd, Nottingham, UK, Belfast, Northern Ireland, UK.
- [9] Ganser, R., & Williams, K. (2007) Brownfield Development: Are We Using the Right Targets? Evidence from England and Germany. *European Planning Studies* 15(5): pp.603-622.
- [10] US EPA. 2003a. Brownfields definition U.S. EPA Brownfields Homepage. Available: <http://epa.gov/brownfields/index.html>.
- [11] Alker, S., Joy, V., Roberts, P., & Smith, N. (2000). The definition of brownfield. *Journal of Environmental Planning and Management*, 43(1), 49-69.
- [12] Myers, D., & Wyatt, P. (2004). Rethinking urban capacity: identifying and appraising vacant buildings. *Building Research & Information*, 32(4), 285-292.
- [13] Ferber, U., Grimski, D., Millar, K., & Nathanail, P. (2006). Sustainable brownfield regeneration: CABERNET network report. University of Nottingham: L & Quality Management Group.
- [14] Fakultet u Podgorici, A., Perovic, S., & Folić, N. K. Brownfield regeneration—imperative for sustainable urban development.)
- [15] syms, clarke, 2011
- [16] <https://timesofindia.indiatimes.com/business/india-business/sovereign-wealth-funds-look-at-infra-sector/articleshow/74361643.cms>.
- [17] <https://www.orfonline.org/expert-speak/national-infrastructure-pipeline-the-great-indian-dream/>
- [18] <https://www.dailyponer.com/2014/columnists/making-prudent-use-of-wasteland.html>
- [19] SGS SA. (2018). environment/soil/interpretation-and-modeling/contaminated-land-studies/brownfield-analysis. [Online] Available: <https://www.sgsgroup.in/en-gb/environment/soil/interpretation-and-modeling/contaminated-landstudies/> brownfield-analysis
- [20] US EPA . (2017, August 24). laws-regulations/summary-comprehensive-environmental-response-compensation-andliability-act. [Online] Available: <https://www.epa.gov/laws-regulations/summary-comprehensive-environmental-responsecompensation-and-liability-act>.
- [21] Langhorst, Joern W. "Re-covering landscape: Derelict and abandoned sites as contest terrain." *Icon*, vol. 10, 2004, pp. 65–79, <http://www.jstor.org/stable/23787128>. Accessed 25 Apr. 2022.
- [22] Jenkins, Robin, Elizabeth Kopits, and David Simpson. *Measuring the social benefits of EPA land cleanup and reuse programs*. No. 2168-2018-8085. 2006.
- [23] Nazon, D. (2007). Brownfields Redevelopment and Competitive Advantage Theory: Urban revitalization and stakeholder engagement in south Troy, NY.
- [24] Holden, M. Sustainability indicator systems within urban governance: Usability analysis of sustainability indicator systems as boundary objects. *Ecol. Indic.* 2013, 32, 89–96.
- [25] Mori, K.; Christodoulou, A. Review of sustainability indices and indicators: Towards a new City Sustainability Index (CSI). *Environ. Impact Assess. Rev.* 2012, 32, 94–106
- [26] De Sousa, C.A. Urban brownfields redevelopment in Canada: The role of local government. *Can. Geogr.* 2006, 50, 392–407.
- [27] Cappai, F.; Forgues, D.; Glaus, M. Integrating An Environmental and Socio-Economic Assessment Tool for the Development of Brownfield Development Projects. Available online: <http://vdf.ch/expanding-boundaries.html> (accessed on 1 May 2019).
- [28] Thomas, M.R. A GIS-based decision support system for brownfield redevelopment. *Landsc. Urban Plan.* 2002, 58, 7–23
- [29] Cappuyns, V.; Kessen, B. Evaluation of the environmental impact of Brownfield remediation options: Comparison of two life cycle assessment-based evaluation tools. *Environ. Technol.* 2012, 33, 2447–2459. [CrossRef] [PubMed]
- [30] Beekmans, J.; Ploegmakers, H.; Martens, K.; van der Krabben, E. Countering decline of industrial sites: Do local economic development policies target the neediest places? *Urban Stud.* 2015. [CrossRef]
- [31] Chrysochoou, M.; Brown, K.; Dahal, G.; Granda-Carvajal, C.; Segerson, K.; Garrick, N.; Bagtzoglou, A. A GIS and indexing scheme to screen brownfields for area-wide redevelopment planning. *Landsc. Urban Plan.* 2012, 105, 187–198. [CrossRef]
- [32] Brill, C.W. using GIS to contrast perceived versus preferred priorities for Brownfield redevelopment in worcester, massachusetts. *URISA J.* 2009, 21, 49.
- [33] Sardinha, I.D.; Craveiro, D.; Milheiras, S. A sustainability framework for redevelopment of rural brownfields: Stakeholder participation at SÃO DOMINGOS mine, Portugal. *J. Clean. Prod.* 2013, 57, 200–208. [CrossRef]
- [34] Cappai, F.; Forgues, D.; Glaus, M. Integrating An Environmental and Socio-Economic Assessment Tool for the Development of Brownfield Development Projects. Available online: <http://vdf.ch/expanding-boundaries.html> (accessed on 1 May 2019).
- [35] Sardinha, I.D.; Craveiro, D.; Milheiras, S. A sustainability framework for redevelopment of rural brownfields: Stakeholder participation at SÃO DOMINGOS mine, Portugal. *J. Clean. Prod.* 2013, 57, 200–208. [CrossRef]
- [36] Webster, D. (2000) The Geographical Concentration of Labour-Market Disadvantage. *Oxford Review of Economic Policy* 16(1) pp.114-128.
- [37] Brown, B. B., Perkins, D. D., & Brown, G. (2004) Crime, New Housing, and Housing Incivilities in a First-Ring Suburb: Multilevel Relationships across Time. *Housing Policy Debate* 15(2): pp.301-345.
- [38] Gibson, K. J. (2007) Bleeding Albina: A History of Community Disinvestment 1940-2000. *Transforming Anthropology* 15(1): pp.3-25.
- [39] Alker, S., Joy, V., Roberts, P., & Smith, N. (2000). The definition of brownfield. *Journal of Environmental Planning and Management*, 43(1), 49-69.
- [40] Ganser, R., & Williams, K. (2007) Brownfield Development: Are We Using the Right Targets? Evidence from England and Germany. *European Planning Studies* 15(5): pp.603-622.
- [41] Millar, K., Ferber, U., Grimski, D., & Nathanail, P. (2005) CABERNET: A Vision of Economic Regeneration and Sustainable Land Use. Proceeding of CABERNET 2005 The International Conference on Managing Urban Land (pp.238-244). Nottingham: Land Quality Press.
- [42] Carnegie Mellon University. (2016). steinbrenner/brownfields. [Online] Available: <https://www.cmu.edu/steinbrenner/brownfields/Case%20Studies/pdf/washingtonslanding1herrs%20island.pdf>

- [43] Greenberg M. R., & Hollander, J. (2006). *The environmental protection agency's brownfields pilot programme*. *American journal of public health*, 96(2), 277-281
- [44] Beekmans, J.; Ploegmakers, H.; Martens, K.; van der Krabben, E. Countering decline of industrial sites: Do local economic development policies target the neediest places? *Urban Stud.* 2015. [CrossRef]
- [45] Degen, M.; Garcia, M. The Transformation of the 'Barcelona Model': An Analysis of Culture, Urban Regeneration and Governance. *Int. J. Urban Reg. Res.* 2012, 36, 1022–1038. [CrossRef]