

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)**ScienceDirect**

Procedia Engineering 145 (2016) 1534 – 1540

---

**Procedia  
Engineering**

---

[www.elsevier.com/locate/procedia](http://www.elsevier.com/locate/procedia)

International Conference on Sustainable Design, Engineering and Construction

## Public-private partnership in residential brownfield redevelopment: case studies of Pittsburgh

Xiaodan Li<sup>a</sup>, Hao Yang<sup>a\*</sup>, Wenjing Li<sup>a</sup>, Zhiting Chen<sup>a</sup><sup>a</sup>China University of Mining and Technology, Beijing, Ding No.11 Xueyuan Road, Haidian District, Beijing 100083, China

---

### Abstract

In discussions on brownfields there is a general consensus among researchers that brownfield sites have the potential to be reused as green spaces, art parks, commerce centers, recreational areas and residential lots. From the various kinds of brownfield redevelopment (BR) activities, residential brownfield redevelopment (RBR) is growing quickly within the US. RBR is considered to match city smart growth goals, and it is more cost-effective for economic development than other brownfield reuse activities. The paper addresses the opportunities and challenges in restructuring RBR's ecological environment and economical benefits. To reduce or eliminate obstacles we observe a collaborative model through public-private partnership (PPP) utilized in RBR: PPP creates an institutional framework in which the public sectors provide strategic profits to the private sectors, while the private entities implement and develop the public sector's plan. In order to explore specific and significant factors affecting brownfield redevelopment in housing context, we review literature on PPP in brownfield redevelopment and discuss the compositions and characteristics of both public and private sectors in RBR. From this analysis we point out that there are three key elements for the success of RBR: (1) consensus between public and private sectors, (2) the type of landowner and (3) participation of academic institutions. To clarify the argument, two RBR projects named Summerset at Frick Park and Hazelwood (LTV), both in Pittsburgh, Pennsylvania, were selected as case studies in our analysis. Through the comparison of successful and unsuccessful cases, our statement is future concluded: consensus, public owned properties and involvement of academic institutions contributed notably in PPP and RBR. Additionally, the successful case in restructuring ecological environment and promoting sustainable development also provides a paradigm for other cities that are withstanding similar RB or RBR issues.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of ICSDEC 2016

---

\* Corresponding author. Tel.: +86-010-6233-9229; fax: +86-010-6233-9229.  
E-mail address: yanghao328@126.com

*Keywords:* Public-private partnership (PPP); brownfield redevelopment (BR); residential brownfield redevelopment (RBR); Pittsburgh; sustainable development; smart growth

## 1. Introduction

In discussions on brownfields there is a general consensus among researchers that brownfield sites have the potential to be reused as green spaces [1,2,3], art parks [4], commerce centers [5], recreational areas and residential lots [6]. Several brownfields can be found in inner cities, and they typically encompass common features that are necessary for land redevelopment, such as high population density [5], convenient transportation services [7], basic infrastructures and walkable neighborhood. Geographical advantages [9], as well as the implementation of environmental policies and funds [8] by the federal and state governments, encourage the redevelopment of brownfields. For instance, the federal environmental law entitled Comprehensive Response, Compensation, and Liability Act (CERCLA, issued in 1980) promote the cleanup of contamination sites and provide financial backing for brownfield redevelopment (BR). Federal institutions, such as the United States Environmental Protection Agency (U.S. EPA), are also responsible for implementing specific federal policies and cooperating with local authorities.

From the various kinds of brownfield redevelopment (BR) activities, residential brownfield redevelopment (RBR) is growing quickly within the US. RBR is considered to match city smart growth goals, and it is more cost-effective for economic development than other brownfield reuse activities. RBRs are considered catalysts for sustainable development [10], because they often exist in central cities and have the potential to stimulate local market after revitalization. Moreover, housing redevelopment activities meet the goals of infill inner cities and smart growth strategies, because they can provide more homes for individuals and reduce the distance from home to work. A survey on costs and risks in brownfield redevelopment indicated that some developers and stakeholders evaluated RBR more cost-effective for investors' activities than other brownfield reuse [11].

Although many successful residential brownfield redevelopment stories took place in the US [15], there are failures and cases that are still waiting to be reused as well. It is noteworthy that RBR yet faces many challenges in restructuring its ecological environment and economical benefits. Time-consuming reclamation, high-cost cleanup, difficulties on assessment, and investment risks are factors that obstruct brownfield activities (see Table 1). Taken Summerset at Frick Park project as an example, this brownfield is located 5.9 miles away from downtown Pittsburgh. As the biggest residential project since World War II, as well as one of the first transformation projects in Pittsburgh, the revitalization spent nearly 20 years and cost more than \$250 million public and private funds. Additionally, competition from greenfields, insufficient financing and public opposition [12] also increase difficulties and challenges of RBR.

Table 1. Time and cost in turning brownfields into housing areas in Pittsburgh.

Case Name	Distance to downtown (mile)	Site area (acre)	Redevelopment time (year)	Redevelopment cost (dollar)
Summerset at Frick Park (Nine Mile Run)	5.9	238	18 (1995 to 2013)	250 million
Washington's Landing (Herr's Island)	2.5	42	8 (1989 to 1997)	44 million
Cork Factory Lofts (Armstrong Cork Factory)	2	4	12 (1996 to 2008)	78 million
Bakery Square (Reizenstein School)	17	12	- (2007 to present)	120 million

Source: Data from Western Pennsylvania Brownfields Center (2016)

To reduce or eliminate these obstacles we observe a collaborative model through public-private partnership (PPP) utilized in residential brownfield redevelopment [8]. In urban study, PPP is typically described from cooperative partnership, joint investments to integrated approach and mutually beneficial goals [8,13]. PPP creates an institutional framework in which the public sectors provide strategic profits to the private sectors, while the private

entities implement and develop the public sector's plan. One significant benefit of using PPP as an effective method is that the collaborative model can gather funds from both the two sectors and complement the limitation investment for both sectors. Particularly, PPP is necessary when the site faced weak market demand or serious environmental pollution issues [13,14] that neither public nor private sector can solve it alone. In order to explore specific and significant factors affecting brownfield redevelopment in housing context, we review literature on PPP in residential brownfield redevelopment and discuss compositions and characteristics of both public and private sectors in RBR. From this analysis we point out that there are three key elements for the success of RBR:

- Consensus between public and private sectors
- Government-owned land
- Participation of academic institutions

To clarify the argument, two RBR projects named Summerset at Frick Park and Hazelwood (LTV), both in Pittsburgh, Pennsylvania, were selected as case studies in our analysis. As the industrial core in the US in World War II, currently Pittsburgh exists a number of vacant, underused and non-vegetation brownfields. The City of Pittsburgh Department and Pittsburgh's elites have worked together to transform these areas into thriving, livable and sustainable sites since the mid-20th century and, Summerset is one of the most successful residential redevelopment cases but the Hazelwood is still vacant. Through the comparison of successful and unsuccessful cases, our statement is future supported: consensus, public owned properties and involvement of academic institutions contributed notably in RBR. Literature review, field survey and interview with practitioners and authorities are methodologies used in this paper.

#### Nomenclature

BR	Brownfield redevelopment
RBR	Residential brownfield redevelopment
PPP	Public-private partnership
NMR	Nine Mile Run-name of Pittsburgh's major city stream
URA	Urban Redevelopment Authority of Pittsburgh-name of Pittsburgh's economic department agency
CMU	Carnegie Mellon University

## 2. Public-private partnership in residential brownfield redevelopment

### 2.1. Literature review of public-private partnership

Currently public-private partnership (PPP) is a favored option in reducing or eliminating obstacles in RBR practice. PPP generally is defined as joint investments and collaborative efforts [8] between public sectors and private sectors. Recent results from B. Glumac [13] indicate that PPP is widely used because: (1) the limited public funds led public government search to cooperate with private sectors, and (2) collaboration bring more efficient and profitable for developing activities. Practically, not only governments have funding issues, private developers especially have difficulties at seeking source of funds. PPP as an effective method can gather funds from both public and private sectors and complement the limitation investment for both sectors. Furthermore, PPP engages diverse stakeholders and empower residents to reform a coordinate system [18] and obtain meaningful value for the master plan. A collaborative vision has characteristics such as taking neighborhood into account, respecting citizens and cooperating among public governments, private investors [18] and non-profit organizations [16].

Achieving a consensus among the government, developer and resident can foster understanding for further redevelopment activities. Appropriation of social resources such as public funds and community support are considered attractive factors to private developers [20]. Based on consensus between public and private sectors, PPP can provide a flexible system to revitalize contamination sites and maintain mutual interests for both sectors [19]. An unfunded program or contentious project is typically listed as unconsidered property. Moreover, the landowners

of brownfield sites typically play a leading role in redevelopment and city-assisted site or government-owned land mostly has higher priority in revitalization. Landowners such as private foundations may face difficulties because RBR means additional costs, that made RBR is less competitive than developing greenfields [21]. On the contrary, public owners have the capacity to obtain public funds and grants, as well as apply tax incentives for RBR, that propel residential brownfield activities notably. We also observe that there is an evolution in PPP that non-profit organizations and community-based groupings as private sectors participate in residential brownfield redevelopment (RBR) activities [16]. Universities can provide high technology, research, advanced services and ethics for ecological reclamation [22], that make extraordinary contributions for RBR.

## 2.2. Public and private sector's compositions in RBR

PPP establishes a framework that complex interactions between a number of public and private, political and professional interest groups take place [6]. To make sense PPP's effect in RBR, it is useful to identify both sectors' roles and responsibilities in RBR. It is evaluative because it shows structural basis for understanding PPP in RBR.

Federal agencies and local authorities are common compositions within public sectors. Typically, elected officials are responsible for the preparatory process of RBR [17], such as site cleanup, environmental assessment, seeking public funds, developing master plan and constructing infrastructure. Public agency's behavior significantly influences the redevelopment outcome. For instance, the Urban Redevelopment Authority of Pittsburgh (URA, established in 1946) is a local official agency working closely with the mayor's office. The URA provides a flexible business environment for Pittsburgh and helps revitalize Pittsburgh brownfield. Since established, the URA acquired four large scale brownfield sites, as well as several smaller scale sites, and implemented environmental assessment and clean-up, which ensured the redevelopment results of efficient and high-profile.

Developers are one of the most significant compositions in private sectors. Typically after clean-up and installing basic infrastructures by public agencies, the private sectors are responsible for further market development. Public sectors play a crucial stabilizing role in redeveloping the contamination site, while private investments focus on maximize market profit. Economic gain is an attractive goal for developers, and consensus between public agencies and developers can reduce developers' concern on potential risks. Non-profit organizations and social-based groupings are currently significant compositions in RBR activities as well. Reuse brownfield is a complex ecological engineering issue and it needs integrate various kinds of scientific technologies from ecological initiatives and aesthetic design, to theoretical research and practical work. Universities are precisely the considering candidate for the collaborative activities. Moreover, academic institution's efforts on brownfield can even transform public's former master plan [22].

## 3. Case studies

The case studies of Summerset at Frick Park and Hazelwood help understanding that consensus, public-owned site and academic institution's participation are significant factors in public and private efforts, and they can result in efficient, profitable and expeditious residential brownfield redevelopment (RBR).

### 3.1. Summerset at Frick Park

Summerset is the biggest residential project since World War II, as well as one of the first transformation projects, that converted industrial discarded site into housing project in Pittsburgh, PA. The project is established on top of a large slag heap, and it involved the restoration of piled up slag and polluted Nine Mile Run (NMR) stream. It also involved the development of local real estate, which planned the site as a green residential community. The Summerset planning is awarded the ALSA Merit Award in 2015, as well as the 2015 Act 2 Award from PA brownfields Conference. Much of the literature on Summerset focuses on ecological reclamation efforts at NMR [22, 23], however there are few studies on the key elements for the success of residential brownfield redevelopment (RBR).

Summerset is not a slightly polluted site, practically the site had been covered by a 120-foot-tall toxic slag heap for 50 years and over 20 million tons of slag were dumped into this area. This 238-acre site sat underused from the

time the Duquesne Slag Company stopped its industrial activity in 1972 [25] until the Urban Redevelopment Authority of Pittsburgh (URA) purchased the land for \$3.8 million in 1995. The URA put the concept of developing a housing project in the released master plan in 1996. From the master plan, the URA agreed to clean the site and carried out activities from acquisition brownfield, clean-up the site, construction the roads, utilities and parks, to partition and market the property to make the residential redevelopment project possible [26]. Sewage treatment, water purification and land reclamation were given top priority in environmental governance. Practically, the URA provided \$10 million management grant to ensure successful restoration. By 2013, Summerset has totally cost \$250 million public investment in preparatory activities (see Table.2) [26].

Table 2. Public financing in Summerset.

Use aspects	Cost ( <i>dollar</i> )	Resource of funds
Land restoration	\$11,687,766	City Bond
-	\$3,101,828	Land Proceeds
-	\$330,000	EPA Grant
Monitor dust and airborne particulates	\$750,000	Foundations
-	\$12,500,000	State - RACP
-	\$742,080	State – Growing Greener
-	\$1,500,000	County – LCTF
-	\$8,235,000	PWSA
Total	\$38,846,674	Total

Source from the Urban Redevelopment Authority

Consensus between the URA and private developers fosters understanding and collaboration on further development. According to the URA's former vision, the developer conducted a market study and further planned the Summerset as a green residential community, which can provide 700 single and multi-family homes and more than 100-acre public space in inner city (see Figure.1). "As the site took a long time to develop, and because we had so much interest in the project, we actually sold our first phase of homes before they were built." Said Malky, the president of EQA Landmark Communities [27]. At the time of sale, the Summerset property was assessed as generating about \$2.9 million in annual property tax revenue.



Fig. 1. Summerset and TND principle. Source from <http://summersetatfrickpark.com/>

Carnegie Mellon University (CMU) participated in Summerset project and mostly focused on the wetland restoration and riparian habitat restoration of Nine Mile Run stream. There is a Creative Inquiry Studio in CUM and it is constituted by artists, lawyers, landscape architects and scientists. CMU and their staff made efforts on conservation the Nine Mile Run and at first no one else cared. Professors exhibited protective effort on Nine Mile Run, hosted brownfield tours and community dialogues, and affected a change in public government and local residents to transform the polluted NMR to a sustainable public space. CMU's ethics and effort facilitated the

Pittsburgh City Planning announced to provide a funding for CMU's restoration work in 2000, as well as the citizen attempting to concern Nine Mile Run's future.

### 3.2. Hazelwood

From 1870's to 1910, Hazelwood was an industrial and transportation hub and home of wealthiest families in Pittsburgh. But currently the 178-acre site is the last large undeveloped brownfield in inner Pittsburgh. Hazelwood is a privately financed brownfield owned by four southwest Pennsylvania foundations: Benedum Foundation, Heinz Endowments, Richard King Mellon Foundation and McCune Foundation. The community is still waiting for revitalization.

Though the URA conducted a set of brownfield projects of residential development, such as Summerset, Washington's Landing, and South Side Works, but it passed the Hazelwood. The public thought Hazelwood had a negative value. A lack of consensus on private landowners and provincial governments has resulted in Hazelwood is still an unconsidered land for redevelopment. No reclamation or habitat took place. There are only two buses passing here and no redevelopment stories in this site.

## 4. Conclusion

Because of the potential benefits to residential brownfield redevelopment (RBR) in economical, ecological and community development, it is important to study public-private partnership in RBR as well as its crucial factors. Comparing the successful Summerset and unsuccessful Hazelwood cases, this paper has shown that the consensus, public-owned land and academic institution's participation are key factors in residential brownfield redevelopment (RBR). The Summerset's successful came from the URA's assistance on purchasing and cleaning up the site, the developers interest in Summerset, and the CMU's effort on restoring the Nine Mile Run's ecological environment. On the contrary, in Hazelwood's case, though its private landowner wanted to develop the site, the public redevelopment activities did not invest Hazelwood, and no academic institutions participated in Hazelwood's environmental problem. This research shows that the consensus, city-assisted land and university's assistance should be considered in achieving RBR success. Additionally, the successful case in restructuring ecological environment and promoting sustainable development also provides a paradigm for other cities that are withstanding similar RB or RBR issues.

## References

- [1] De Sousa, Christopher A. Turning brownfields into green space in the City of Toronto. *Landscape and urban planning* 62, no. 4 (2003): 181-198.
- [2] Siikamäki, Juha, and Kris Wernstedt. Turning brownfields into greenspaces: Examining incentives and barriers to revitalization. *Journal of health politics, policy and law* 33, no. 3 (2008): 559-593.
- [3] Mathey, Juliane, Stefanie Rößler, Juliane Banse, Iris Lehmann, and Anne Bräuer. Brownfields as an element of green infrastructure for implementing ecosystem services into urban areas. *Journal of Urban Planning and Development* 141, no. 3 (2015): A4015001.
- [4] Byrne, Jason, Megan Kendrick, and David Sroaf. The park made of oil: Towards a historical political ecology of the Kenneth Hahn State Recreation Area. *Local Environment* 12, no. 2 (2007): 153-181.
- [5] De Sousa, Christopher A., Changshan Wu, and Lynne M. Westphal. Assessing the effect of publicly assisted brownfield redevelopment on surrounding property values. *Economic development quarterly* (2009).
- [6] Adams, David, and Craig Watkins. *Greenfields, brownfields and housing development*. John Wiley & Sons, 2008.
- [7] Chrysochoou, Maria, Kweku Brown, Geeta Dahal, Catalina Granda-Carvajal, Kathleen Segerson, Norman Garrick, and Amvrossios Bagtzoglou. A GIS and indexing scheme to screen brownfields for area-wide redevelopment planning. *Landscape and Urban Planning* 105, no. 3 (2012): 187-198.
- [8] Sagalyn, Lynne B. Public/private development: Lessons from history, research, and practice. *Journal of the American Planning Association* 73, no. 1 (2007): 7-22.
- [9] Adams, David, Christopher De Sousa, and Steven Tiesdell. Brownfield development: A comparison of North American and British approaches. *Urban Studies* 47.1 (2010): 75-104.
- [10] EPA. Equitable Redevelopment of Petroleum Brownfields for Zuni Pueblo and Other Tribal Communities. Rep. (2013):7-22. <http://www.epa.gov/smartgrowth/equitable-redevelopment-petroleum-brownfields-zuni-pueblo-and-other-tribal-communities>.

- [11] De Sousa, Christopher. Brownfield redevelopment versus greenfield development: A private sector perspective on the costs and risks associated with brownfield redevelopment in the Greater Toronto Area. *Journal of Environmental Planning and Management* 43, no. 6 (2000): 831-853.
- [12] Davis, Todd S. *Brownfields: A comprehensive guide to redeveloping contaminated property*. American Bar Association, 2002.
- [13] Glumac, B., Q. Han, W. Schaefer, and Erwin van der Krabben. Negotiation issues in forming public-private partnerships for brownfield redevelopment: Applying a game theoretical experiment. *Land Use Policy* 47 (2015): 66-77.
- [14] Howland, Marie. Private initiative and public responsibility for the redevelopment of industrial brownfields: Three Baltimore case studies. *Economic Development Quarterly* 17, no. 4 (2003): 367-381.
- [15] Wedding, G. Christopher, and Douglas Crawford-Brown. Measuring site-level success in brownfield redevelopments: A focus on sustainability and green building. *Journal of Environmental Management* 85, no. 2 (2007): 483-495.
- [16] Detrick, Sabina. The post industrial revitalization of Pittsburgh: Myths and evidence. *Community Development Journal* 34, no. 1 (1999): 4-12.
- [17] McCarthy, Linda. Off the mark? Efficiency in targeting the most marketable sites rather than equity in public assistance for brownfield redevelopment. *Economic Development Quarterly* (2009).
- [18] Schilling, Joseph, and Jonathan Logan. Greening the rust belt: A green infrastructure model for right sizing America's shrinking cities. *Journal of the American Planning Association* 74, no. 4 (2008): 451-466.
- [19] Brunner, Scott W. Sharing the Green: Reformatting Wisconsin's Forgotten Green Space Grant with a Public-Private Partnership Design. *Marq. L. Rev.* 95 (2011): 305.
- [20] Crowley, Gregory J. *The politics of place: contentious urban redevelopment in Pittsburgh*. University of Pittsburgh Pre, 2005.
- [21] De Sousa, Christopher A. Urban brownfields redevelopment in Canada: the role of local government. *The Canadian Geographer/Le Géographe canadien* 50, no. 3 (2006): 392-407.
- [22] Carney, Lora Senechal. Ecology and the Ethics and Aesthetics of Collaboration: The Case of Nine Mile Run. *RACAR: revue d'art canadienne/Canadian Art Review* (2010): 63-72.
- [23] Collins, Tim. Interventions in the rust belt: the art and ecology of post-industrial public space. *ECUMENE-LONDON-* 7, no. 4 (2000): 461-467.
- [24] 2002 National Association of Home Builders Report
- [25] Tarr, Joel A., ed. *Devastation and renewal: an environmental history of Pittsburgh and its region*. University of Pittsburgh Pre, 2004.
- [26] Xiaodan Li, Hao Yang. Turning brownfield redevelopment the case of summerset at frick park. *Advances in Mathematics and Computer Science and their Applications* (2016):78-83
- [27] [www.jameshardie.com](http://www.jameshardie.com)