

Sustainable Redevelopment of Real Estate Properties and its Social Impact

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Abstract

This paper focuses on the sustainable redevelopment of real estate properties. The investigation comprises case studies of eleven redevelopment projects in Hamburg and at other locations in Germany of areas which were once used for industrial, commercial, military or residential purposes. A calculation method was developed which enables the evaluation of the quality of the redevelopment measures carried out for the projects. A number of criteria were found to be decisive including the physical and geological layout of the premises, the infrastructure, the level of soil contamination and protection of the environment, the quality of land used for residential and non-residential purposes and its social impact.

A weighted scoring scheme has been developed that quantitatively expresses both the technical part of the redevelopment and the social benefit. This enables a process of mathematical exploration rather than a rough estimation of all factors involved. By taking into account all the parameters studied, a "quality factor" has been determined to assess the quality of any redevelopment. It has emerged that social benefit is a key issue in the redevelopment process and must be given a high priority. It is believed that the scoring scheme could serve as a tool for investors, planners and decision makers in companies and building authorities before, during and after the redevelopment process.

Keywords: Sustainability, Planning, Redevelopment, Social benefit

1. Introduction

In many countries, especially in the densely populated countries of Western Europe, the development potential of real estate properties is very limited. However, many cities or other urban regions possess a large number of premises which in former times were used for industrial purposes. When the industry abandoned those sites, they were no longer used. Often the location of these premises is excellent; sometimes it is in the city centre, and sometimes in its immediate vicinity. For this reason it is a necessity to study the different ways of redeveloping those properties taking into account a large spectrum of decisive economical, ecological and social aspects.

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2. Definition of redevelopment

Within the context of urban renewal, the term “redevelopment” is widely understood to mean building new parts of town by converting old, abandoned and/or contaminated industrial properties or formerly habitable lands. When focusing on buildings, the term “refurbishment” is understood to describe all efforts made to adapt a building to better and modern standards of living. In the course of this research it became apparent that environmental aspects are definitely crucial for the redevelopment of spaces. Aspects of rehabilitation and revitalisation of habitable lands must thus be an integral part of the decision making process.

Therefore, the term “redevelopment” should comprise all the above described parameters including a complex description of all the different parameters involved. It shall refer to the whole built environment, its refurbishment, damage repair, decontamination and rehabilitation.

3. Background

3.1. The need of redevelopment and its social impact

As mentioned above, the need to stop extensive land use for new building projects in large areas of Western Europe becomes increasingly important. In Germany, for example, the demand of new untouched land for settlement purposes (residential or non-residential) was at an average of 113 ha per day in the last two decades (see Figure 1).

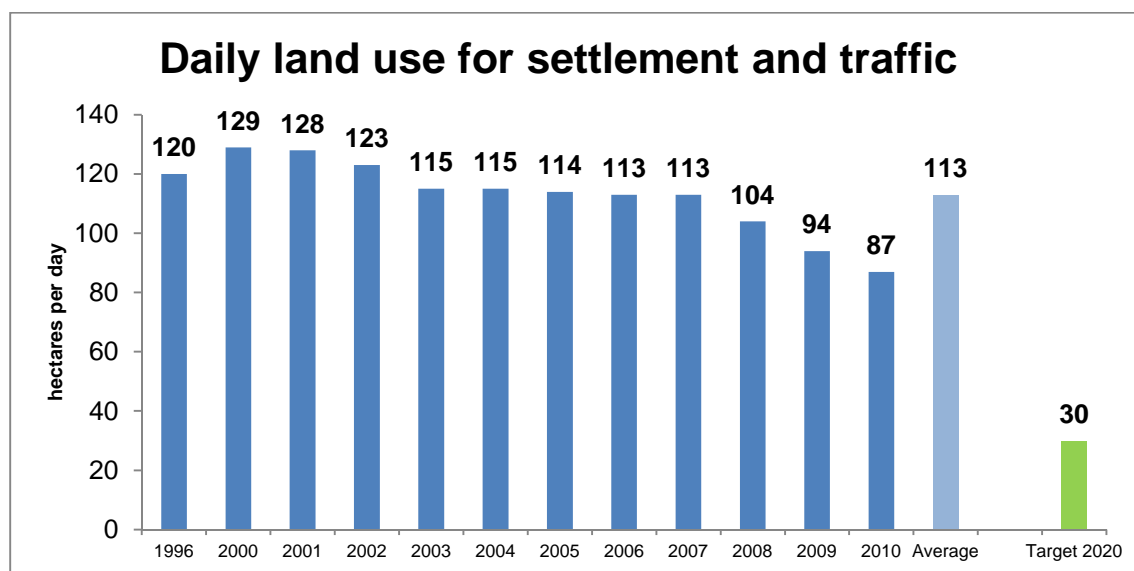


Figure 1: Land used for settlement and traffic in Germany from 1996 to 2010 in ha per day (Federal Bureau of Statistics, 2012, [Lt. 1])

Although a decline in land use since 2007 can be noticed, there is a political goal to reduce the demand of land use to 30 ha per day by 2020. This very ambitious target requires a wide range of different measures, such as the redevelopment of premises.

In many European cities, like for example in the city-state of Hamburg, the contamination of land formerly used for industrial purposes must be given special attention. According to a report by J. Hilbers at a conference on contamination in the City of Hamburg in 2010 [Lit. 5], more than 6,000 premises are registered as contaminated, are deemed to be contaminated, or are being monitored for contamination. In response to this large number of contaminated areas, which roughly cover 20% of the usable land of Hamburg, the regional government has recently launched a programme entitled “Special Investment Programme Hamburg 2010” (Lit. [4]) which aims to revitalise and redevelop those areas by giving financial incentives, reducing legal obstacles, facilitating building permits and providing technical assistance.

3.2. Advantages and risks of redevelopment

The redevelopment of real estate properties offers numerous advantages, such as:

- Integrating unused premises into the urban context of the city.
- Reducing land use in the outskirts of the city.
- Avoiding urban sprawl.
- Remediating and reducing the extent of contaminated soil.
- Contributing to forming habitable city centres rather than growing suburbs.
- Enhancing the quality of social life in the city.

However, such urban planning processes carry the following risks that must be taken into account:

- Increased land prices due to decontamination costs and/or the refurbishment of damaged buildings.
- Time schedules for erecting buildings on such premises exceed those for developing new projects on “clean soil” in the outskirts.
- Sometimes there are legal obstacles to acquiring property rights due to difficult circumstances and/or pending legal cases.

Consequently, the redevelopment process of real estate areas demands a thorough approach considering all aspects involved in the planning and execution process. Every investor or decision maker must take into account all relevant aspects to provide a reliable basis for proposed investments or other decisions. In this respect, any tool will be welcome to assist making the complexity of the parameters outlined above more transparent.

4. Investigation

4.1 Research methodology

The research methodology applied in this investigation included the following steps:

- Selecting seven appropriate real estate properties which in the last decade have been subject to a redevelopment process,

- analysing the redevelopment measures implemented in the projects,
- listing of seven main criteria to assess the redevelopment projects; the criteria were used to analyse all redevelopment measures implemented,
- developing a concept to assess the degree to which the redevelopment measures analysed in the individual projects satisfy the main criteria,
- expressing the results of the assessment in a mathematical form by applying a "weighted quality factor" for all projects analysed.
- developing an interpretation scheme to classify the success or quality of each redevelopment measure implemented based on an average quality factor; thus, each redevelopment project could subsequently be assessed on a mathematical basis.

The steps are explained in detail below.

4.2 Description of the projects analysed

In this research a total of eleven real estate properties were explored which were subject to redevelopment measures carried out in the last decade. The locations were once used for industrial, commercial, military and residential purposes. In almost all cases, they were abandoned by their previous users and had partly been derelict for years. The inspection and evaluation of the individual projects was carried out on site by the author, with the exception of projects No. 2 (Lit. [6]), 4 (Lit. [4]) and 11 (Lit. [4]) which are based on a literature review.

The redevelopment processes carried out comprised one or more of the following measures:

- Disposal of contaminated soil.
- Enclosure of contaminated soil with sealing walls.
- Sealing of ground area with concrete or bitumen.
- Demolition or structural redevelopment of existing building fabric or reconstruction.

New utilisation of real estate properties after the implementation of redevelopment measures depends on their prior use, the degree of possible contamination, local planning regulations and the financial possibilities of the investor. Table 1 lists all redevelopment projects studied and their use before and after the implementation of redevelopment measures.

Table 1: Description of the projects investigated and their use before and after the implementation of redevelopment measures

Name of project	Use before redevelopment	Use after redevelopment	Contamination before /after redevelopment/ implemented measures

1	Hamburg Moorfleet, 8.5 ha	Industrial, manufacture of plant protection products	Industrial, new buildings include barracks and containers for logistics companies	Yes / yes/ containment by sealing walls
2	Frau Sophienhütte Süd, Langelshiem, 3.1 ha	Industrial, lead and zinc works, contaminated with heavy metals	Industrial, installation of power plant	Yes/no partial soil exchange, partial containment by sealing walls
3	Schlieffen barracks, Lüneburg ca. 75 ha	Military, contaminated with armament, oils	Commercial and residential	Yes/no partial soil exchange
4	Channel Hamburg, 3.0 ha	Industrial, harbour facilities	Residential, channel tower 75 m high	No/no
5	Bogenallee Hamburg, 955 m ²	Residential, masonry building, 1524 m ² of living space	Residential, refurbished building	No/no
6	Schmalenbroek, Hamburg, 7 360 m ²	Residential, 4-storey masonry building	Residential, refurbished building	No/no
7	Speicherstadt, Hamburg, 1 600 m ²	Commercial, 120-year-old masonry building	Commercial, refurbished building	No/no
8	Bleiweißfabrik, Ingelheim (Rhein), 4 ha	Industrial, manufacture of white lead, contaminated with lead-containing compounds	Commercial, warehouses	Yes/yes, partial soil exchange, partial sealing of surface with concrete
9	Messerschmidt airplane facilities Regensburg, 1.3 ha	Commercial, assembly hangar for airplanes	Commercial and residential, shopping centre, retail	Yes/no, soil exchange
10	One family house, Rosengarten (Hamburg) 4 620 m ²	Residential, one family house	Residential, one family house	Yes/yes, contamination by gas emission from soil not eliminated
11	Water City Povel, Nordhorn, 18 ha	Industrial, textile factory	Residential, 500 residential units	Yes/no, partial soil exchange, partial cleaning of soil using biological methods

4.3 Detailed description of two case studies

Problems naturally arise during the redevelopment process. To gain an impression of these, two of the eleven projects listed above were selected and presented in detail below.

4.3.1 Industrial site in Hamburg Moorfleet

Situated in the south-east of the city of Hamburg covering an area of 85,000 m², Moorfleet had been the production site of a pharmaceutical company for more than 60 years and was abandoned in 1984. The company produced pesticides which were found to be highly toxic liquids and were constantly injected into subsoil layers thus contaminating not only the site itself but also neighbouring premises due to subsurface currents. After many years of political and legal turmoil, the site was successfully redeveloped by enclosing the whole area with sealing walls, installing an extensive system of monitoring wells and draining surface water as shown in Figure 3 and according to a report by Lilienweiss (Lit. [6]).

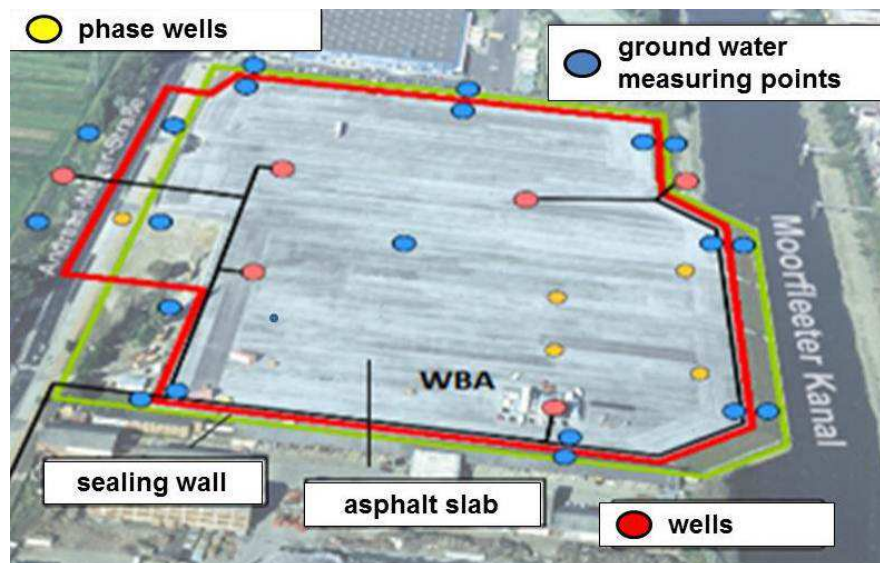


Figure 3: Redevelopment of a contaminated site in Hamburg Moorfleet

Today, there is on-going monitoring and documentation of the surface layer, the surface rainfall water and subsoil gas emissions. The whole site is reused and let to a logistics and forwarding company that does not require costly foundation structures for its administration buildings. The rental income covers all expenses for monitoring and maintenance. So from the technical, economic and ecological point of view, the redevelopment carried out in this case is considered a success. However, as will be shown later, a high weighted score was not achieved when taking into account the complexity of the parameters to be looked at in this process. Not enough attention was paid to the social benefit in particular (see Table 5).

4.3.2 Warehouse in the “Speicherstadt” Hamburg

A good example of a refurbished building is the 120-year-old warehouse in the Hamburg harbour area (see Figures 4 and 5). The warehouse is a listed building which means that it is protected as a historic building by the local building authority and its original facade must be preserved in the development process. It was formerly used for customs purposes and the investor carried out a vast modernisation programme which included complete refurbishment of the roof construction, windows, balconies, stairs, electronic and plumbing installation, heating, air conditioning and sanitary installations. Figures 4 and 5 show the facade and interior of the building after construction works. The building has gained a high degree of acceptance by commercial users due to its architectural beauty. Nowadays it is used as an

office building achieving high rental income due to its excellent location in the harbour area close to the Hamburg city centre.



Figure 4: Facade of former warehouse in the Hamburg harbour area



Figure 5: Interior of former warehouse in the Hamburg harbour area after refurbishment

4.4 Evaluation of the projects investigated

4.4.1 Selection and scoring of evaluation criteria

The main objective of the research project was to demonstrate the success of a redevelopment measure by applying verifiable criteria. A total of seven criteria were defined to assess each redevelopment project (cf. Table 2):

Table 2: Main criteria for the assessment of redevelopment projects studied

Number	Main criteria
1	Physical and geological layout of the premises
2	Infrastructure at a macro- as well as micro-scale level
3	Soil contamination and protection of the environment
4	Quality of land use for residential and non-residential purposes and its social impact
5	Legal and political framework and obstacles
6	Technical feasibility of erecting buildings
7	Market acceptance of the premises after redevelopment

These criteria were developed to reflect the sustainability, legal and technical feasibility and social needs of the users of the buildings or sites. The quality of a redevelopment project provides the basis for further investment. It is therefore crucial for each project to determine how and to what extent the project complies with these specific criteria. For this purpose, a weighted evaluation was developed which not only expresses the importance of each of the seven criteria when compared to each other (cf. Table 3) but also the degree of compliance with the main criteria for each project analysed (cf. Table 4).

Table 3: Score value “a” to describe the importance of each criterion

Score value a for importance	Degree of importance
1	Low importance
2	Average importance
3	High importance

Table 4: Score value “b” to describe the degree of compliance with the main criteria

Score value b for compliance	Degree of compliance with main criteria
1	No compliance or compliance not required
2	Poor compliance
3	Average compliance
4	Good compliance
5	High compliance

4.4.2. Calculation of the evaluation factor

The success or quality of the redevelopment measure used in each project was assessed by applying the criteria outlined above. In order to mathematically express the result the following so-called “weighted quality factor” was developed. If the values in Table 3 are identified as “a” and those in Table 4 as “b”, then the result will be the desired “weighted quality factor” according to Equation1:

$$F_{qu} = \sum a \times b = (a_1 \times b_1) + (a_2 \times b_2) + \dots + (a_7 \times b_7) \quad \text{Equ. (1)}$$

where

“ F_{qu} ” is the factor to assess the quality of a redevelopment project in terms of sustainability and social impact

“i” is the numbering of the criteria, running from $i = 1$ to 7 (cf. Table 2)

“a” is the score value of importance taken from Table 3

“b” is the score value of compliance taken from Table 4.

Thus, the “weighted quality factor” represents a valuation score for each project analysed. If limits are set for score values “a” and “b”, then F_{qu} will result in a minimum value of $7 \times 1 \times 1 = 7$, and a maximum value of $7 \times 3 \times 5 = 105$, based on the seven criteria listed in Table 2. The F_{qu} -value of each project investigated was calculated according to equ. (1). Table 5 below shows the results.

Table 5: Score values a and b and weighted score F_{qu} of the redevelopment projects

criteria name of project		Score	crit	crit	crit	crit	crit	crit	Sum of weighted score F_{qu}	
			No. 1	No. 2	No. 3	No. 4	No. 5	No. 6		No. 7
1	Hamburg Moorfleet Industrial site before and after redevelopment	Score a	3	1	3	1	1	1	2	29
		Score b	3	4	1	1	4	2	3	
		Weighted score	9	4	3	1	4	2	6	
2	Frau Sophienhütte Süd, Langelsheim Industrial site before and after redevelopment	Score a	1	1	1	2	2	2	2	32
		Score b	3	2	3	3	3	3	3	
		Weighted score	3	2	3	6	6	6	6	
3	Schlieffen barracks, Lüneburg Commercial and residential use after military use	Score a	3	3	3	2	1	2	3	54
		Score b	3	4	2	4	1	3	4	
		Weighted score	9	12	6	8	1	6	12	
4	Channel Hamburg, Residential use after industrial use in harbour area	Score a	3	1	1	3	1	3		55
		Score b	3	5	1	5	1	3	5	
		Weighted score	9	5	1	15	1	9	15	
5	Bogenallee Hamburg, Residential use before and after redevelopment	Score a	1	1	1	3	2	2	3	47
		Score b	3	5	3	4	3	3	4	
		Weighted score	3	5	3	12	6	6	12	
6	Schmalenbroek, Hamburg, Refurbished residential building	Score a	1	1	2	2	1	2	3	44
		Score b	3	3	3	3	3	4	5	
		Weighted score	3	3	6	6	3	8	15	
7	Speicherstadt, Hamburg, Commercial refurbished building	Score a	1	2	1	2	2	2	3	45
		Score b	1	5	2	4	3	3	4	
		Weighted score	1	10	2	8	6	6	12	
8	Bleiweißfabrik, Ingelheim (Rhein), Commercial use after industrial use	Score a	3	2	3	2	2	2	2	53
		Score b	3	3	4	3	3	3	4	
		Weighted score	9	6	12	6	6	6	8	
9	Messerschmidt airplane facilities Regensburg, Commercial use before and after redevelopment	Score a	2	2	3	1	1	2	2	44
		Score b	3	3	4	3	3	4	3	
		Weighted score	6	6	12	3	3	8	6	
10	One.family house, Rosengarten (Hamburg), Residential use before and after redevelopment	Score a	3	1	3	3	1	1	2	21
		Score b	2	1	1	1	1	5	1	
		Weighted score	6	1	3	3	1	5	2	
11	Water City Povel, Nordhorn, Residential use after industrial use	Score a	2	2	3	3	2	1	3	55
		Score b	3	3	4	3	3	4	4	
		Weighted score	6	6	12	9	6	4	12	

4.5. Outcome

The results, as shown in Table 5, can be further analysed by determining an average importance and average degree of compliance for F_{qu} . If score values “a” and “b” are taken as average values in Tables 3 and 4 and are inserted in equ. (1), then the weighted score will yield the following factor:

$$F_{qu, av} = 2 \times 3 \times 7 = 42$$

Based on this average value, an evaluation scheme (cf. Table 6) was developed that enables the interpretation of the individual F_{qu} values in relation to the average value $F_{qu, av}$. As outlined above, in each redevelopment project F_{qu} is the sum of the product of “a” times “b” covering all of the seven main criteria listed in Table 2.

Table 6: Evaluation scheme to assess the quality of the redevelopment project

F_{qu}	Up to 31	32 to 41	42 to 51	More than 52
Final assessment of the project	Very poor quality, project carries unforeseeable risks, not successful	Poor quality, project carries considerable risks, not successful, should be revised	Average quality, successful project, but still carries risks to bear in mind	Good quality, successful project, few risks but kept under control

Table 6 allows to judge whether the project is successful or not and/or if it still carries risks. As a result of the evaluation of Tables 5 and 6, it can be concluded that three cases exhibit a poor or very poor redevelopment quality, four cases an average quality (F_{qu} between 42 and 51), and another four cases a good quality (F_{qu} over 52). Taking a closer look at the way the high weighted scores are composed of, it becomes apparent that in most cases both the ecological and social aspects of the project carried out are predominant. This underlines the fact that the success of a redevelopment project mainly depends on the ecological and social benefits that are created by the project itself.

5. Conclusions

For all the projects analysed in the present investigation the seven main criteria developed within the evaluation process proved to be appropriate as a means of judging the redevelopment measures adopted. Using the evaluation scheme, therefore, it is possible to assess the quality of each redevelopment. Most of the projects considered showed good weighted quality results in terms of sustainability, ecology, market acceptance and social benefit to both the users and the built environment. The results suggest that the success of a redevelopment project mainly depends on the ecological and social benefits that are created by the project itself. The sustainability of an area after redevelopment is dependent upon the contribution it makes to the social life of the users and residents of the area. The application

of the “quality factor” F_{qu} proved to be a helpful tool for investors, planners and other decision makers who are involved in the redevelopment of real estate properties. It is believed that the process of analysis based on the mathematical approach presented, rather than a vague rough estimation, can be employed in all phases before, during and after redevelopment.

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