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Adaptive reuse of former industrial production sites into mixed-use public space - The potential for social sustainability

A comparative case study between Groningen and Berlin



Adaptively reused industrial sites- Suikerterrein and RAW (Author, 2024)

Colophon

Full title: Adaptive reuse of former industrial production sites into mixed-use public space - The potential for social sustainability

A comparative case study between Berlin and Groningen

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Abstract

Urban populations are growing, and with them the consumption of space through development, aiming to meet the increasing demand for education, employment, leisure and health facilities. Especially open public spaces are consumed by neoliberal development, limiting the positive impact they have towards the social sustainability of cities. This social sustainability presents itself through the equal access (social equity) to places facilitating social interaction (social cohesion) and a feeling of safety or personal health benefits through provided activities (urban liveability). Theory suggests that adaptive reuse (AR) of former industrial production sites into mixed use public spaces can enhance social sustainability. AR employs the differentiated use of existing structures or sites, including their physical modification. In Groningen and Berlin, a survey was conducted with users of reused industrial sites, to discover how these can contribute to social equity, social cohesion and urban liveability. Social equity was measured based on the degree of access to the site and provided activities, social cohesion based on the facilitated social interaction, and urban liveability based on the contributions towards visitors' feeling of safety or personal health. The accessibility seems to depend on the position of entrances, distance to public transport facilities, the quality and maintenance of streets and paths on site, and the availability of parking spaces. Joined participation in leisure or work related activities makes visitors interact, though mostly in groups formed around specific activities and locations on site. The company of other users, sufficient light sources and open space contribute to a feeling of safety. In certain cases, these factors can not level out the impact of actual safety concerns on the feeling of safety. Opportunities for outdoor recreation, sport and creative outlive can contribute to the physical and mental health of users, enhancing urban liveability.

Key words: Adaptive reuse, Mixed-use public space, Industrial sites, Social sustainability

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1. Introduction

By 2050, 66 % of the global population will live in cities (Bibri and Krogstie, 2017). Urban development decreases access to public space, disabling opportunities for recreation, social interaction or health services (Badland and Pearce, 2019). The Sustainable Development Goal (SDG) 11.7 outlines the aim to provide universal access to safe, inclusive and accessible green and public spaces (UNEP, 2023). Berlin has committed itself to the SDGs (Department for Urban Mobility, Transport, Climate Action and the Environment, 2023), but continuous population growth and increasing tourism flows fuel the competition on and consumption of urban space (Huning and Schuster, 2015). The Dutch city of Groningen shares a similar experience. Increasing inflows of students, tourists and remote workers demand access to urban infrastructure, limited by the capacity of the dense city center. The municipality has stipulated the reclamation of public spaces a key challenge (Gemeente Groningen, 2021).

Adaptive reuse (AR) is an approach in Architecture and Urban Planning, in which existing sites and structures are used differently from their intended design and construction (Vardopoulos et al., 2023), including their physical modification (Mohamed et al., 2017). This research focuses on the reuse of former industrial production complexes, where multiple buildings are still contained and reused. Local governments rent out to organizations and individuals providing a mix of cultural-creative activities. Old industrial sites in Berlin Friedrichshain have been transformed into mixed use public spaces, offering a variety of socio-cultural activities (Ikeda, 2022). In Groningen, industrial production sites are open for temporal use by the local population (Schrijver, 2016). AR can counter the consumption of public spaces in Groningen and Berlin, as new ones can be created and made accessible to the public. Social interaction can be facilitated through new activities. The redesigned sites and activities can contribute towards a feeling of safety and to the personal health of visitors (Chileshe, Okoro & Ojowori, 2024). AR thus enhance social equity, social cohesion and urban liveability, which are the dimensions of social sustainability (Shirazi and Keivani, 2019).

This research aims to contribute to the academic knowledge about the impact AR of former industrial production sites can have on social sustainability. The research is guided by the question:

How does the AR of former industrial production sites into mixed-use public spaces in Groningen and Berlin contribute to social sustainability?

The following sub-questions help to answer the main research question:

In which ways does the AR of former industrial production sites into mixed-use public spaces in Groningen and Berlin enable access to users?

How does the AR of former industrial production sites into mixed-use public spaces in Groningen and Berlin facilitate human interaction ?

How can reused former industrial production sites in Groningen and Berlin contribute towards a feeling of safety and users personal health?

2. Theoretical Framework & Conceptual Model

2.1 Sustainable Development

Sustainable Development is a UN policy agenda aimed at balancing environmental, economic and social sustainability (Chileshe, Okoro, Ojowori, 2024). Environmental sustainability is the ability to preserve and protect the natural environment over time through appropriate practices and policies. Economic sustainability aims to achieve a balance between economic growth, resource efficiency, social equity and financial stability (Enel, 2023). This aim of balancing the forms of sustainability is stipulated in the 2030 Agenda for Sustainable Development, based on the 17 Sustainable Development Goals. Goal 11 is the most relevant one in relation to this research, as it stipulates the aim to make cities and human settlements inclusive, safe, resilient and more sustainable (UNEP, 2024). AR contributes to it by supporting SDG 11.7, which is the goal to provide universal access to safe, inclusive and accessible, green and public spaces, especially for vulnerable groups. As mentioned by researchers, social sustainability is the dimension currently most neglected, highlighting the need for more attention on how it can be facilitated (Chileshe, Okoro, Ojowori, 2024).

2.2 Social Sustainability

Social sustainability aims to increase inclusiveness, reduce inequality, ensure equal access to resources and promote the health and wellbeing of all members of society (Enel, 2023). In this research, social sustainability has been defined based on the three concepts of social equity, social cohesion and urban liveability (Chileshe, Okoro, Ojowori, 2024; Shirazi and Keivani, 2019). Social equity describes the extent of accessibility to resources or services, regardless of gender, race, ethnicity or social status. The geographic proximity of such services to the ones aiming for access is an important factor influencing social equity. As Shirazi and Keivani (2019) outline, social equity can also relate to the influence of socio-political barriers to access, like restrictive policies, limiting the accessibility of resources for certain societal groups. Social cohesion relates to the force that holds people within a group. It can be driven by social interaction, the creation of a sense of belonging or a community feeling. High crime rates or levels of social disorder in a city or neighborhood can be seen as signs of low social cohesion (Shirazi and Keivani, 2019). Urban liveability relates to the attributes of a place that make it attractive to live or work in, like ones improving the safety and health of visitors or recreational opportunities in a location (Shirazi and Keivani, 2019).

2.3 Adaptive Reuse

The AR of former industrial production sites results in publicly accessible spaces where recreational, sport or cultural-creative activities allow for social interaction. New combinations of labor-flexible and financially non-intensive activities are offered in places previously restricted by private ownership, urban form and limited public funding (Stevens, 2018). In terms of ownership, different users exist, manage, but also compete for the space (Lynch, 2021).

AR can contribute to social equity by opening up previously inaccessible spaces to the public, providing a diverse mix of cultural-creative activities at different price points, meeting the needs and demands of a diverse audience (Otto and Chmielewska, 2014). According to Zheng, Heath and Guo (2022), physical accessibility to sites can be increased through the removal of physical barriers like gates or fences. The provision of mobility infrastructure like paths and streets can support the ease to move around, increasing the accessibility. Collaton and Bartsch (1996) argue that the reuse can increase physical accessibility, as many former industries would be located in close proximity to mass transport infrastructure. This allows less financially well-off populations to gain access. Car accessibility can be increased by sufficient volumes of parking spaces (Tu, 2022). Mehta (2014) argues that certain rules of behavior or entry fees can make public spaces less accessible.

Reused former industrial production sites can foster social cohesion by providing new activities which stimulate social interaction. This social interaction in the joint uses of the space can facilitate a sense-of-community and cultural identity (Gruis, Remoy, Vafaie, 2023). Stevens (2018) noted that the creation of activities for relaxation, sports, games, and cultural-creative action make visitors of sites interact.

Increased social interaction can enhance perceived safety, as users of the space engage in a passive form of surveillance in which being aware of the presence of others leads to decreased undesirable behavior. Perceived safety can furthermore be increased through the provision of enough light sources, open and visible space, security cameras and clear rules of behavior. Perceived safety and a sense-of-community contribute to social cohesion (Mousavinia, 2023). Reused sites can contribute towards visitors' personal health by providing nature bound spaces for recreation, or sport activities, helping to decompensate from urban stresses (Chileshe, Okoro & Ojowori, 2024).

2.4 Conceptual model

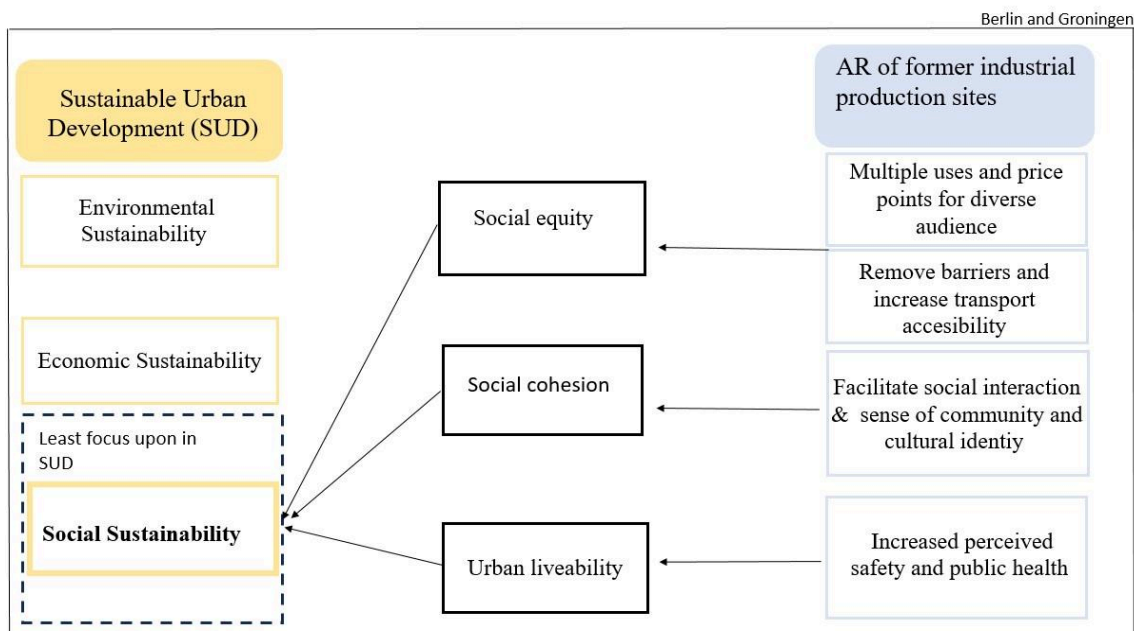


Figure 1: Conceptual Model

3. Methodology

3.1 Case Selection

Two cases were selected based on the following selection criteria. First of all, the case selected should be a former industrial production site, presenting a larger complex with a number of buildings preserved. This criteria follows from the type of AR focused on in this research. Secondly, the public spaces in the chosen cases should provide a mixed variety of cultural-creative activities. This is important, as these activities are vital to the facilitation of social interaction and furthermore contribute to urban liveability. Lastly, the chosen cases include an organizational structure in which one main contractor subrents to a variety of individual actors.

3.1.1 Suikerterrein Groningen

In Groningen, the case of the Suikerterrein is selected. It is located to the southwest of the city. On the 1 240,000 square-meter site, sugar used to be produced. In 2008, the factory closed, followed by its deconstruction in 2009. The area was sold to the municipality, which opened a public competition on the development in 2011. In the following years, multiple businesses and organizations received a plot. More than 50 companies and 320 temporary housing units are supplied, as well as festivals and sport facilities. The core objective is to provide a space for experimental and temporary commercial uses, which should increase the land value until the site

is handed back to the municipality in 2030 (Suiker Terrein, 2023). The current main contractor of the site is the development company Suikerzijde BV.



Figure 2: Location Suikerterein (Author, 2024)

3.1.2 RAW-Berlin

The case selected in Berlin is the RAW in Friedrichshain. On 71,000 square meters, rail vehicles of the Reichsbahn used to be maintained. The workshop closed in 1994 (Kvitkova and Manfredi, 2022). An association founded by locals provided cultural and recreational activities (Oswalt, 2007). In 2015, the property was sold to Kurth Group, a real estate company. After strong development pressure, the RAW Kultur L e.G. was found in 2018. It positions itself against large-scale redevelopment. The Society for City Development, a non-profit organization, became the general tenant of the site. Individual users and businesses can rent from the organization. A rich variety of activities is provided, like ateliers and clubs, workshops, creative businesses, gastronomy and sport opportunities (Kvitkova and Manfredi, 2022). According to the Kurth Group, the core objective is to keep the RAW lively, inviting and safe for everyone, despite the large scale investment projects realized in proximity. The focus lies on the creation and provision of neighborhood scale places for social interaction, the conservation and enlargement of cultural freespaces and the direct involvement of the local community (RAW, 2023).

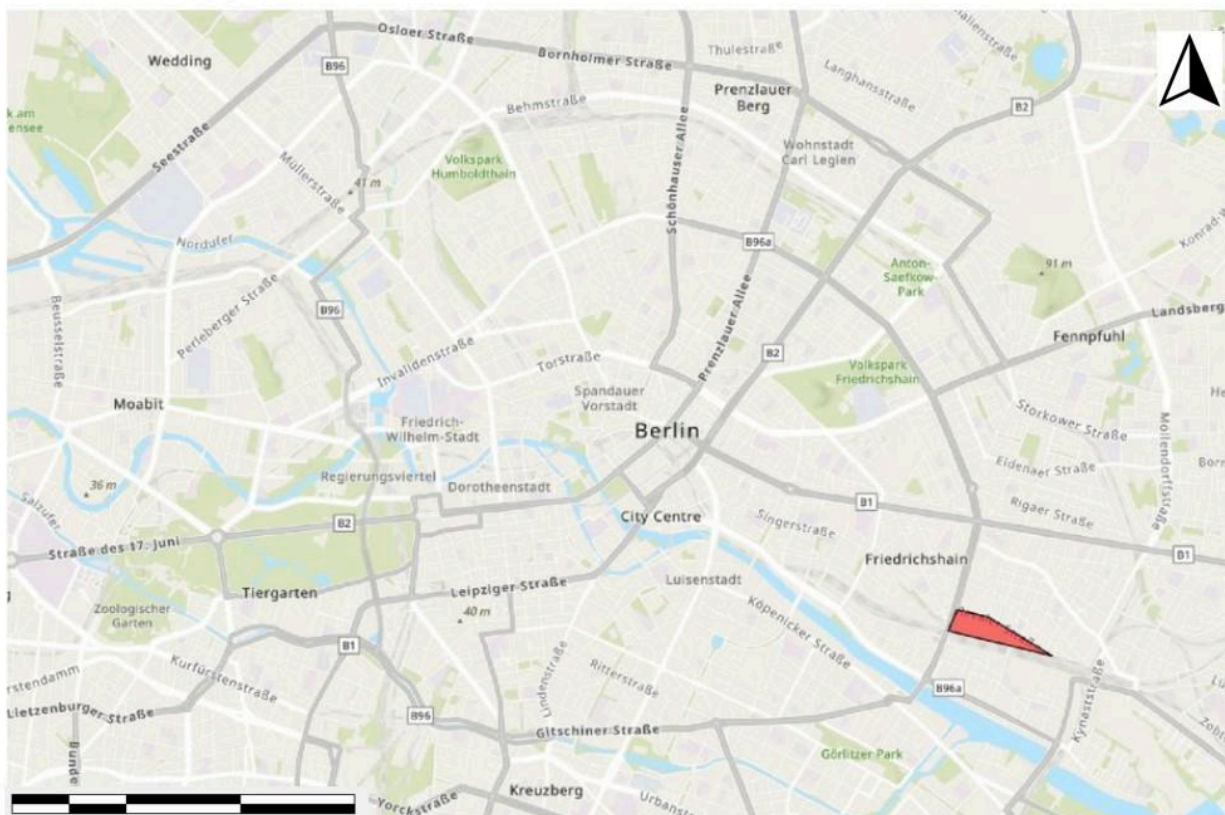


Figure 3: Location RAW (Author, 2024)

3.2 Primary Data Collection

Surveys are a popular qualitative method to study how people experience urban space (Parashar and Lakra, 2023). Janssen, Daamen & Verdaas (2021) argue that empirical research should increasingly focus on the human experience of urban space to understand how it serves people to meet their needs. The survey conducted was divided into 3 sections. Each individual section focused on one dimension of social sustainability. The total survey consists of 13 questions (Appendix Section A). It was constructed in an online format (Google Forms), because it enabled the researcher to gather data by either filling in the survey with respondents on site, or letting them fill out the survey on their own. In the latter case, respondents were provided with a QR code printed on paper, leading to the survey.

A purposive sampling approach was applied (Punch, 2013). Only visitors above the age of 18, able to speak either German, English or both were sampled. Adults need no legal guardian to participate, and the researcher only speaks the two named languages. No vulnerable individuals were chosen, the reason being provided in the next section. Surveys in Groningen were conducted on weekdays and weekends between 18 March and 20 April. In Berlin, surveys were conducted between 29 April and 4 May in a research group in the context of the ERASMUS + STONIE project 2024 (Sustainable Transitions of Neighborhoods in Europe). Respondents were approached politely, followed by a short introduction of the research.

The first question of the survey asked respondents whether they want to participate in the research. Answering this question with yes made the respondent agree with the informed consent sheet (Appendix Section B).

3.3. Research ethics and data management

To ensure that the data is kept *confidential*, no personal information was requested. Through informed consent, respondents were made aware about their right to let data be removed at any time, just as to request information about the use of it. The collected data was stored in the University Drive, inaccessible to third parties (Punch, 2013). By applying the above mentioned strategies, the *privacy* of individual respondents was protected.

The research followed the principle of *beneficence*, meaning the risk of causing harm to respondents or others is minimized. The assurance of confidentiality and privacy are contributing to beneficence (Punch, 2013). To further assure beneficence, vulnerable individuals or groups, such as children, disabled or homeless people were excluded (Liamputtong, 2011). Involvement in the research could cause negative emotions amongst individuals who might experience exclusion from public space more frequently than others. It can be more difficult to derive informed consent, limiting the researchers ability to ensure the ethical principles pursued.

3.4 Data Analysis

The approach for data analysis taken in this research is based on the Qualitative Data Analysis framework by Miles, Huberman, Saldana (2013), introduced in Punch (2013). Three steps are taken. First, data is *reduced*. This happens automatically through the collection of data by means of the online survey. In a further step, the data is *analyzed* by means of counting the individual responses to specific questions, in line with the approach taken in the study by Caseiro et al. (2024). This is done separately per case study. In the third phase, *conclusions* are drawn based on a comparison of the data gathered in Groningen and Berlin. The research questions are answered.

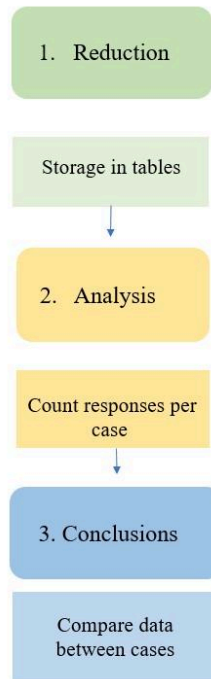


Figure 4: Data Analysis Scheme (Author, 2024)

4. Results & Discussion

The results are presented and discussed per case, structured among the dimensions of social sustainability.

4.1 Suikerterrein Groningen

4.1.1 Social equity

Accessibility

As can be inferred from Table 1, the majority of respondents traveled to the site by bicycle or car. Few respondents arrived by public transport, or even walked. Table 2 illustrates that most respondents found the Suikerterrein accessible, whilst only a few did not consider it as accessible or dependent on certain factors. Pedestrians found the site inaccessible due to the distance between the only pedestrian entrance (orange line Figure 5) and the nearest public transport station (bus symbol Figure 5). To walk to the Suikerterrein, the city center would be too far. Cyclists found the site accessible, based on the distance to the center. The bicycle entrance (green line Figure 5) increases the bike accessibility. Both entrances can be seen in Figure 6. Five respondents who came to the site by car found it accessible because of the proximity to the highway and the 24/7 opening hours. The remaining three found the accessibility limited by the low visibility and lack of signpost of the car entrance (car symbol Figure 5).

Mode of Transport	Number of Respondents
Bicycle	16
Car	8
Foot	4
Public Transport	2

Is the space and provided uses accessible to you?	Number of Respondents
Yes	22
It depends	5
No	2

Table 1: Mode of Transport chosen / Table 2: Is the space accessible to you ? (Author, 2024)



Figure 5: Entrances, public transport stop and car entrance Suikerterrein (ArcGIS Online, 2024)



Figure 6: New temporary bridge across the Hoendiep (Afdeling Kunst & Cultuur, 2014)

Table 3 shows that the majority of respondents found it easy to navigate the site, many of them reasoning that the asphalted main street provides access for multiple modes of transport. Parking spaces for cars and bicycles increase the accessibility and ability to navigate the site. Cyclists and pedestrians mentioned the non-asphalted and badly maintained paths to limit the ease to move around and access activities. Figure 7 illustrates the bad quality of mobility infrastructure. Concerns were raised about the ability of disabled visitors to gain access and move around. The lack of clear signage and information about locations and opening hours of activities were mentioned as factors negatively affecting the accessibility.

'Is it easy for you to move around in this space?'	Number of Respondents
Yes	22
It depends	7
No	1

Table 3: Is it easy for you to move around this space? (Author, 2024)



(Figure 7: Entry stairs (De Unie Architecten, 2019)

The reuse of the Suikerterrein does not provide accessibility by public transport and for pedestrians. Whilst Collaton and Bartsch (1996) suggest that the reuse of old industrial facilities can increase public transport accessibility, the research can not confirm this argument in the Groningen case. People who want to access the site and are restricted to walking or public transport experience lower accessibility than those being able to choose for a bicycle or car. This supports the argument made by Shirazi and Keivani (2019), who pointed out that the geographic distance to a resource, in this case the site, has a strong influence on the equity in access to it.

The results suggest that the location of entrances is a crucial factor influencing accessibility. For many, the pedestrian entrance provides a barrier to access, as Zheng, Heath and Guo (2022) would call it. One reason is its remote location (perspective from the city center), the other one being its narrowness. Even though the bicycle entrance is at equal distance to the city center, cyclists did find it to increase accessibility, possibly being grounded in the higher ease of overcoming the spatial distance between the center and the site by bike. In the case of the car entrance, its location was not the deciding factor on whether it would provide a barrier to access or increase it, but rather the information about where it is.

Zheng, Heath and Guo (2022) argue that the construction of new mobility infrastructure can increase accessibility. The new asphalted road was seen as a major reason for increased accessibility to the site. Oppositely, the bad condition and low-maintenance of the remaining paths and streets on the site were seen as limiting the accessibility. The author's argument can thus be confirmed. Tu (2022) argued that the provision of parking spaces on site can be a factor increasing the accessibility. The research supports this claim. A number of respondents mentioned the 24/7 opening hours to positively influence accessibility. This result relates to what Metha (2014) calls 'rules of behavior'. New rules, as a social factor created in the reuse process, can enhance or restrict the accessibility. In this case, the rule allows visitors to access the site at any moment. One respondent mentioned that previous to the reuse, the site was surrounded by a fence. Within the reuse process, the fence was removed, opening the site to its current uses. The reuse of former industrial sites can indeed lead to the removal of physical barriers to access, and thus increase accessibility, as mentioned by Zheng, Heath and Guo (2022).

Provision of activities

Table 4 provides an overview of the main activities respondents came for. The distribution mirrors the diversity in activities provided. Figure 8 shows the padel courts on site. Respondents were asked about their satisfaction with provided activities. The answers indicate that more places and activities should be provided, which are freely accessible to the public without the need to consume a product or participate in an activity. 22 respondents found the visitors of the site diverse. The diverse activities were mentioned as a reason attracting different demographic and cultural groups to the site. Especially the temporal forms of living and creative businesses would draw in an international audience. The affordability of most activities was seen as a contributing factor. Eight respondents stated that the diversity depends on the activities that people participate in, as many would only interact with others within the realm of certain activities.

Activity	Number of respondents
Leisure activities (camping, meet friends, padel, parties, gym)	17
Work	8
Housing	5

Table 4: Activity (Author, 2024)



Figure 8: Discover-Suikerterrein (Suikerterrein, 2024)

The results support the argument made by Otto and Chmielewska (2014), which is that an increased diversity of activities provided translates into a higher diversity in the visitors coming to the site. The affordability of the activities does contribute to a higher diversity, as more visitors with varying financial means can participate in the use of the site. Activities can though also have effects limiting the diversity in visitors, as enclosed interest groups can form around specific activities.

4.1.2 Social cohesion

Facilitation of social interaction

Social interaction can foster social cohesion. Respondents were asked how often they interact with others. The results are depicted in Table 5. Ones who indicated interacting with others answered that parties or cultural events, work projects and sports bring them together. The same answers apply to the respondents who answered 'from time-to-time'. Respondents who indicated that they usually do not interact with others reasoned that they are not frequent visitors, or that activities which make them interact with others are seasonal dependent ones. Table 6 shows the answers to the question: 'Does the interaction make you feel like being part of a local community or culture, in which people care...?'. 16 respondents said that participation in activities such as living on site or work related projects would foster shared experiences and interests, bringing people together. Those who did not recognize that people care for each other, or that they feel like part of a local community or culture, mentioned that many people would stick to themselves and only be interested in their personal benefit. Two respondents specifically found this to be related to a division between creative workers involved in workshops, interested in collaboration, and on the other hand profit driven businesses, focusing on economic gains.

Interaction?	Number of respondents
Yes	12
From time-to-time	11
Usually not	7

Table 5: Interaction ? (Author, 2024)

Does the interaction make you feel like being part of a local community or culture, in which people care for and support each other?	Number of respondents
Yes, I feel like part of a local community or culture in which people care for ...	16
I do feel like part of a local community or culture, but I do not recognize that people care for ...	7
I do not feel like being part of ...	7

Table 6: Feeling of local community or culture (Author, 2024)

The results partially confirm the argument made by Stevens (2018), that the provision of activities for relaxation, sports, games and cultural-creative action can enhance social interaction. In the case of the Suikerterrein, the creation of shared experiences and interests is what makes the activities induce social interaction. Gruis, Remoy, Vafaie (2023) argue that social interaction can facilitate a sense of community and cultural identity. This does not necessarily apply in the case of the Suikerterrein. The feeling of being part of a local community was limited for some respondents by the self-centric focus of certain actors, creating a division between individual groups visiting and using the site. This result draws attention to the argument raised by Lynch (2021), who argued that different groups manage and also compete for the site, which as the research shows, can undermine social cohesion.

4.1.3 Urban liveability

Feeling of safety and personal health

Most respondents indicated that the site contributes to a feeling of safety or towards their personal health. Being among others provides a feeling of safety, even without social interaction taking place and in the case of actual safety threats being experienced by four respondents. The high volume of free space, lack of crowdedness and low frequency of conflicts seem to positively influence the feeling of safety. A lack of sufficient light sources in parts of the site was mentioned as a limiting factor. Opportunities to participate in sport activities, relax in the open space or access to nature were seen as beneficial towards personal health. Some described the site as calm and relaxing. By providing a sense of belonging or purpose, the provided activities benefit mental health.

Space contributes towards feeling of safety or personal health	Number of respondents
Yes	20
In a way, but it depends	8
No	2

Table 7: Contributions towards feeling of safety or personal health (Author, 2024)

The results challenge the assumption by Mousavinia (2023), that social interaction is required for people to feel safe. For some it is enough to be surrounded by others. It can provide a feeling of safety even when the actual safety is rather low. In a similar vein as Mehta (2014), the author outlined the relevance of physical design aspects towards a feeling of safety. The results reconfirm the relevance of sufficient light sources. The argument made by Chileshe, Okoro and Ojowori (2024), that reused industrial sites can contribute to personal health of visitors by giving access to natural spaces or sport facilities, was found to apply in the Groningen case. The results add that opportunities for creative outlive and socializing with others, enabled through the provided activities, can enhance the mental health of visitors by providing some with a sense of belonging or purpose.

4.2 RAW Berlin

4.2.1 Social equity

Accessibility

Table 8 provides an overview of how respondents traveled to the site. The proximity of the tram and metro station Warschauer Straße (Figure 9) makes it very convenient to access the site by public transport. The respondent who came to the site by car found it not very accessible, due to high traffic congestion in the surrounding districts and a lack of parking spaces. In Table 9, the degree to which respondents found the RAW accessible is illustrated. The majority of respondents indicated that the site is well accessible because of the various entrances which are open 24/7 (orange lines Figure 9). Figure 10 shows an example of such an entrance. The two respondents who did not find the site accessible mentioned the high cost of most activities to limit accessibility to certain activities, even though the general entry is not restricted by any fees.

Mode of Transport	Number of Respondents
Public Transport	8
Bike	4
Car	1
Foot	1

Table 8: Mode of Transport RAW (Author, 2024)

Is the space and provided uses accessible to you?	Number of respondents
Yes	12
It depends	2

Table 9: 'Is the space accessible to you?' -RAW (Author, 2024)

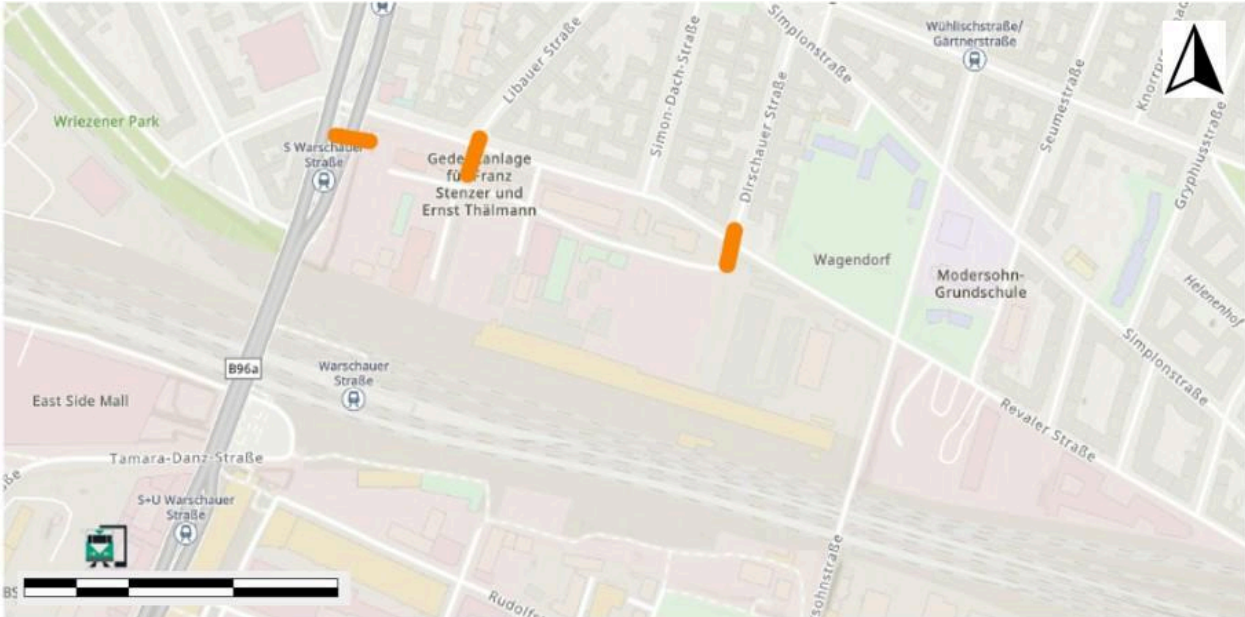


Figure 9: Entrances RAW site (ArcGIS Online, 2024)

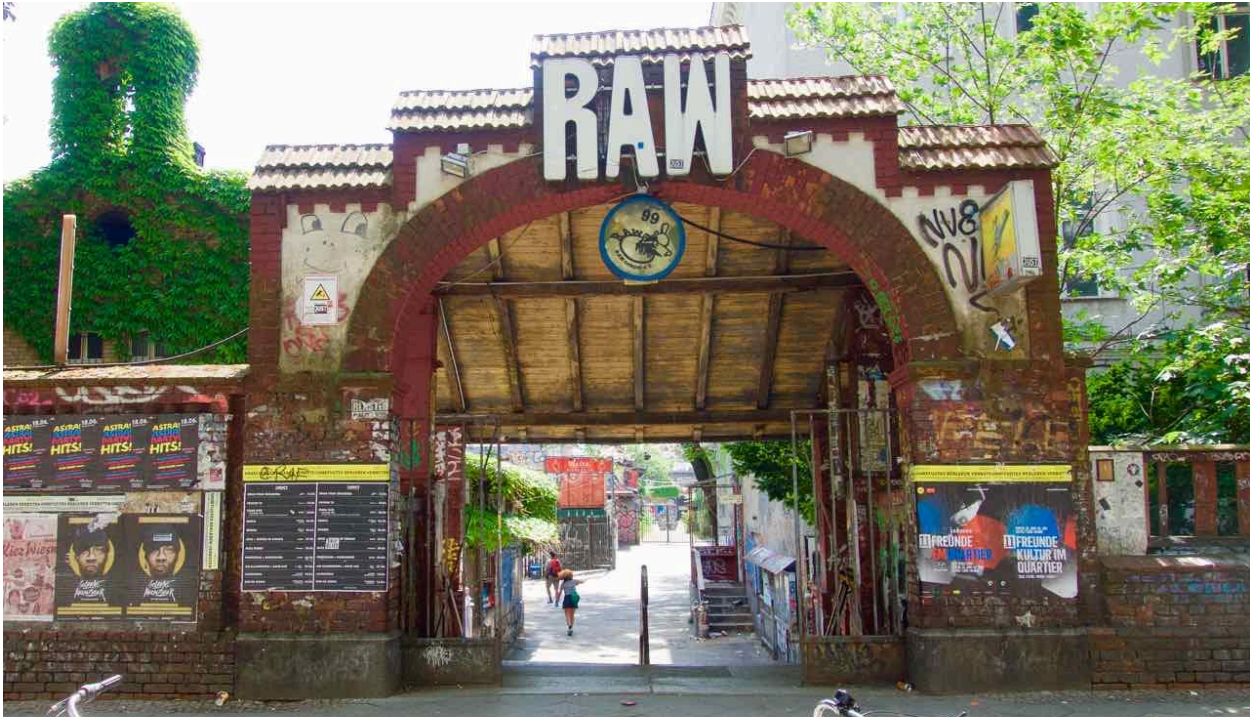


Figure 10: Das RAW-Gelände (Peterstravel, 2016)

The answer distribution to the question: 'Is it easy for you to move around in this space?' is shown in Table 10. Almost all respondents found it easy to move around, a major reason mentioned being that the floor space is level and thus easy to walk on. This contrasts the reasoning provided by the three respondents who found the poor quality of the surface and non-barrier free nature of many activities to limit the ease of navigation. Figure 11 provides an example of the poor-quality surface on site. The respondents who found the surface quality poor raised concerns about the accessibility of the site for disabled users.

'Is it easy for you to move around in this space?'	Number of respondents
Yes	11
It depends	3

Table 10: Is it easy for you to move around in this space?-RAW (Author, 2024)



Figure 11: Floor quality RAW (Author, 2024)

The results of the survey show that the geographic proximity to the station Warschauer Straße provides high public transport accessibility, supporting the argument made by Collaton and Bartsch (1996). High traffic congestion in surrounding districts is a factor apparently limiting the accessibility by car. This factor can not be influenced by developments on the site. A factor which does seem to increase the accessibility by car is the provision of parking spaces, arguing for the claim made by Tu (2022). Overall, most people seem to prefer traveling to the site by public transport. A further physical design aspect increasing accessibility is the opening of the

various entrances. Zheng, Heath and Guo (2022) mentioned that the removal of physical barriers to access can turn previously inaccessible sites into accessible public spaces. The results show that apart from physical aspects, certain social factors can have a strong influence on the accessibility to the site. High cost of activities limit the accessibility for some respondents. Mehta (2014) argued that entry fees can be a factor excluding people from access to resources and services, in turn limiting the social equity the reuse can contribute to. A social factor contributing to accessibility are the 24/7 opening hours, a behavioral rule as mentioned by Mehta (2014). The quality of the mobility infrastructure at the RAW site is a factor providing good accessibility for some respondents, whilst for others it provides a physical barrier. In any case, the argument made by Zheng, Heath and Guo (2022) seems relevant. The perception of the accessibility enabled by the mobility infrastructure seems to depend very much on the subjective experiences and abilities of people.

Provision of activities

Table 11 shows the type of activities respondents came for. Various activities attract people to the site. When asked about their satisfaction with activities, ten respondents indicated to be satisfied, mentioning the variety of activities on the relatively small site as very interesting and inviting. The respondents who indicated to not be fully satisfied mentioned that gentrification and touristification have made everything too expensive. Lower costs are wished for. Eight respondents found the users of the space to be very diverse. A respondent described Friedrichshain as an 'epicenter of diversity and creative culture'. There would be no judgment, and everybody could be how they want to be.

Activity	Number of respondents
Leisure (parties, relax, meeting friends)	9
Work	5

Table 11: Activity-RAW (Author, 2024)

The argument made by Otto and Chmielewska (2014), being that the provision of a rich diversity of activities at different price points can provide social equity in access, seems to not apply in the case of the RAW. Processes of gentrification and touristification are factors increasing prices, making certain activities inaccessible for some visitors. Increasing prices are a factor limiting equality in accessibility, as mentioned by Mehta (2014). The management of the site, a factor mentioned by Lynch (2021), seems to be a relevant factor in this regard, as the existing modernization plans support gentrification and touristification, negatively affecting the accessibility of activities towards the future.

4.2.2 Social cohesion

Facilitation of social interaction

The answers to the question: 'Do you interact with other people while being in this space?' are depicted in Table 12. Overall, people interact regularly. Table 13 shows that only three respondents indicated to feel like being part of a local community or culture, in which people care for each other, united through the experience of participating in communal projects. The majority felt part of a local community or culture, but that people would not really care for each other. Reasons mentioned are the increasing commercialization and touristification, and that many organizers and users of the space focus on themselves. Conversations and meetings with others were described as superficial. Many organizers of activities who came to the site after the Covid-19 pandemic would not understand the history of the space and the necessity to support each other. The four respondents who did not feel part of a community added that fewer people from Berlin come to the site.

Interaction?	Number of respondents
From time-to-time	7
Yes, always	6
Usually not	1

Table 12: Interaction-RAW (Author, 2024)

Does the interaction make you feel like being part of a local community or culture, in which people care for and support each other?	Number of respondents
I feel like part of a local community, but I do not recognize that people care for ...	7
Yes, I feel like part of a local community, in which people care for...	3
I do not feel like part of a local community	1

Table 13: Feeling of local community or culture-RAW (Author, 2024)

The results challenge the arguments by Gruis, Remoy and Vafaie (2023) and Stevens (2018), that opportunities for social interaction foster a feeling of community. Even though the majority of respondents indicated interacting with others on a regular basis, the created feeling of community is limited. Only 3 respondents felt that people care for and support each other. The management of the site, relating to Lynch (2021,) seems to be the main issue. People communicate on a superficial level and act in personal interest rather than working towards joined goals. The modernization plans the Kurth group supports limit social cohesion at the RAW site by increasing prices and leading to the formation of conflicting interest groups, creating tension. This shows that interaction itself can not motivate cohesion, unless the involved actors share a common vision for the future of the site.

4.2.3 Urban Liveability

Feeling of safety and personal health

Table 14 depicts the answers to the question whether the site contributes to respondents' feeling of safety or personal health. Ones who answered 'it depends' or 'no' mentioned the presence of 'strange people', the consumption of alcohol and the general high levels of crime as relevant factors. One said that Friedrichshain would overall not be the safest district, and the site would be crowded during events. A respondent who answered with 'yes' said that after an incident, bushes were cut back and lights were installed, increasing the visibility. The police are on site relatively fast. Social interaction and cohesion did not seem to be relevant factors influencing the feeling of safety on site, as no respondent mentioned the presence of other people as relevant. Two respondents described that being on the site contributes to their personal health, being able to participate in sport and leisure activities.

Space contributes towards feeling of safety or personal health	Number of respondents
It depends	9
No	3
Yes	2

Table 14: Contributions towards feeling of safety or personal health-RAW (Author, 2024)

The argument by Mousavinia (2023), being that the provision of more light sources and open spaces can contribute towards an enhanced feeling of safety only applied to one respondent. In all other cases, the high levels of criminal activities, just as event related nuisance, have a negative effect on the feeling of safety. The presence of or interaction with others does not increase the feeling of safety, contrasting Mousavinias (2023) argument. This might be grounded in the superficial and more distanced nature of human interaction. Chileshe, Okoro and Ojowori's (2024) argument that the provision of facilities for sport and outdoor recreation can contribute towards personal health can be confirmed for some visitors, whilst others found the site to be a dirty and rather unhealthy place, because of many parties, events and incidents.

5. Conclusion & Reflection

The research aimed to contribute to the knowledge about the potential effects the AR of former industrial production sites into mixed-use public spaces can have towards the social sustainability in cities. Based on the data accumulated in both cases, the research questions can be answered through the lens of the three dimensions of social sustainability.

5.1 Social equity

This section answers the question: 'In which ways does the AR of former industrial production sites into mixed-use public spaces in Groningen and Berlin enable access to users?'

In both cases, access is offered through the removal of physical barriers. Whilst in the Groningen case, a fence was removed and a pedestrian and cycling bridge provided, multiple entries were opened to the RAW site in Berlin. Both sites are open to the public 24/7. Geographic proximity of entry points to public transport stations can increase accessibility, as was found in the case of the RAW. The remoteness of entrances for pedestrians and cyclists limits the accessibility in the case of the Suikerterrein. Considering visitors aiming to access the site by car or bicycle, the provision of sufficient parking spaces seems to be an enabling factor. In both cases, the poor condition of the mobility infrastructure on site limits the accessibility of activities. The RAW case showed that high prices can limit the accessibility for visitors with lower financial resources. Processes of gentrification and touristification can lower access by increasing prices. A diverse range of activities attracts a diverse audience in both cases.

5.2 Social cohesion

In this section, the question is answered: 'How does the AR of former industrial production sites into mixed-use public spaces in Groningen and Berlin facilitate human interaction?'

On both sites, the participation in socio-cultural activities (leisure or work related) makes people interact. Interaction is facilitated largely through participation in shared activities, such as working together or visiting parties. In both cases though, social interaction seems to happen within smaller groups. With increasing gentrification and touristification, many people stick to themselves and focus on economic, rather than communal interests. These processes, just as conflicting interests, undermine social cohesion. Sites demand a management that can promote social cohesion by fostering shared goals and aims for the site's development.

5.3 Liveability

To discover how the sites contribute to urban liveability, the question was asked: 'How can activities offered in reused former industrial production sites in Groningen and Berlin contribute towards a feeling of safety and users personal health?'

At the Suikerterrein, respondents who previously experienced safety incidents felt safe when being among others, even without interaction taking place. Interaction can thus have a positive impact towards a feeling of safety, even if the actual safety is limited. The low-crowdedness of the site makes people feel safe, just as the provision of sufficient light sources and open spaces. At RAW, respondents indicated that parties, in combination with drug consumption and conflicts limit feelings of safety. Social interaction did not play a role towards respondents' feeling of safety.

Respondents on the Suikerterrein indicated to experience contributions to their personal health by being able to participate in sport activities, or recreate in a less busy, natural environment outside of the city. Some also mentioned being offered the opportunity to live out their creativity, or experience a sense of belonging and purpose, contributing to their mental health. At the RAW, the opposite effect was largely detected, related to the crowdedness and party related activities. Overall, the activities offered and the physical design (lights, open & natural space) had a stronger influence on the feeling of safety and personal health than the factor of social interaction.

5.4 Implications for professional practice

Considering the implications of the results, professionals involved in AR of former industrial sites should consider the physical design and social organization of the site just as the individual perception of social equity, social cohesion or urban liveability as equally important. To provide social equity in access, well accessible and signposted entrances in proximity to public transport should be provided. Constant renewal and maintenance of mobility infrastructure, just as sufficient provision of parking spaces enhance accessibility among all modes, especially for less-mobile users. Freely accessible communal places are needed, where different users can come together and socialize. Open and well lit spaces can contribute to a feeling of safety. Activities on site should be carefully selected and balanced. Quiet, green and open spaces allow users to recreate and experience a safe feeling whilst being among others. Socio-cultural events like festivals lead to crowdedness and activities that not all visitors enjoy. Natural spaces and sport facilities contribute towards visitors' personal health. Cultural-creative facilities where collaboration and creative expression happens contribute mental health, providing a sense of belonging and purpose. Considering the social organization, shared activities and joint projects, regular meetings and the creation of a shared vision can bring visitors closer together.

5.5 Implications for future research

A number of directions for future research can be pointed out. Both cases showed that the accessibility for disabled users does not seem to be considered much. Future research could therefore aim to focus on enabling factors AR of former industrial production sites can provide for disabled/ less mobile users. Current literature on the relation between AR of industrial sites and urban liveability focus very much on physical health contributions. Contributions towards the mental health of visitors are possible as well. The factors that can contribute towards an improved mental health of users can be a vital focus of future research, as a study from 2017 shows that mental health illnesses are more prevalent in cities than in rural areas (Grübner et al., 2017). Processes of gentrification, touristification and existing development plans cause tension between different groups of visitors. Future research efforts could be directed towards the development of strategies to alleviate the negative impact of the above mentioned processes for social cohesion.

5.6 Methodological limitations

The methodological approach presents certain limitations. 30 responses were collected in Groningen, 14 in Berlin, due to time constraints. In future research, the number of responses should be increased to make more general statements with certainty. For improved comparability, a similar number of cases should be collected. With regards to the time scale, the research focussed on relatively short periods (one to multiple weeks). AR is a long-term process, and the effects of it on social sustainability can vary accordingly. For this reason, future research could engage in longitudinal studies to focus on the long-term effects. This can be relevant with regards to the influence of urban development pressure on the future of the sites. In this research, a single qualitative method was chosen, presenting a limited perspective on the topic. Future research could apply a multi-method approach, allowing for a more in-depth and diversified consideration of the effects of AR on social sustainability. Considering the geographical focus, this research focuses on former-industrial areas, whereas there are different urban places that can be reused and potentially contribute to increased social sustainability. A consideration of different spatial units can enable the identification of new vital grounds for AR processes. The collected data is case-specific and influenced by the local conditions. In cases where similar historical developments, geographical contexts, organizational structures and uses of the site can be identified, results of this study could be considered as relevant only after critical reflection.

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Figures

Figure 6: Afdeling Kunst & Cultuur II. (2014). *New temporary bridge across the Hoendiep*. [Photograph]

Figure 7: De Unie Architecten. (2019). *Entry stairs*. [Photograph]

Figure 8: Suikerterrein. (2024) *Discover-Suikerterrein*. [Photograph]

Figure 9: Peterstravel. (2016). *Das RAW Gelände-Hotspot in Berlin Friedrichshain*. [Photograph].

Appendix A - Online Survey

First section: Social equity

1. How did you travel here today? / Wie sind Sie heute zu diesem Ort gereist?

Multiple answer:

- Car/ Auto
- Public transport/ Öffentlicher Nahverkehr
- Bicycle/ Fahrrad
- Foot/ Zu Fuß

Sub-question: Do you think it is easy to travel here by your chosen mode of transport?/
Empfinden Sie es als einfach, diesen Ort mit dem von Ihnen gewählten Transportmittel zu erreichen?

2. What made you come here today? / Warum sind Sie heute hier?

3. How often do you come here to participate in his specific or other activities? / Wie häufiger kommen Sie hierher, um dieser oder anderen Aktivitäten nachzugehen?

Multiple answer:

- Daily /Täglich
- Multiple times a week/ Mehrmals die Woche
- Weekly/ Wöchentlich
- Rarely/ Selten
- Never/ Nie

4. Is the space and the uses it provides easy to access for you? / Ist dieser Ort und die hier angebotenen Nutzen für sie einfach zugänglich?

Multiple answer:

- Yes/ Ja
- It depends/ Es kommt drauf an
- No/ Nein

Sub-question: Why is that the case?/ Warum ist dies der Fall?

5. Is it easy for you to move around in this space? / Ist es einfach für Sie, sich innerhalb dieses Ortes zu bewegen?

Multiple answer:

- Yes/ Ja
- It depends/ Es kommt drauf an
- No/ Nein

Sub-question: Why is that the case?/ Warum ist dies der Fall?

6. Are you satisfied with the variety of activities and uses offered in this space? / Sind Sie zufrieden mit dem Angebot an Aktivitäten und Nutzen an diesem Ort?

Multiple answer:

- Yes/ Ja
- More or less/ Mehr oder weniger
- Not at all/ Überhaupt nicht

Sub-question: Which activity opportunities or possible uses are you missing in this space? /Welche Aktivitäten oder Nutzen vermissen Sie an diesem Ort?

7. Do you experience the people visiting this space as diverse? / Nehmen Sie die Menschen, die diesen Ort besuchen, als divers wahr?

Multiple answer:

- Yes, very diverse/ Ja, sehr divers
- The diversity is limited / Die Diversität ist limitiert
- No diversity at all /Keine Diversität

Sub-question: Why do you think the visitors of this space are diverse/ not diverse? /Warum denken Sie sind die Besucher dieses Ortes divers/nicht divers?

Second section: **Social cohesion**

1. Do you interact with other people while being in this space? / Interagieren Sie mit anderen Personen, wenn Sie an diesem Ort sind?

Multiple answer:

- Yes, always/ Ja immer
 - From time-to-time /Von Zeit zu Zeit
 - Usually not /Meistens nicht
 - Never /Nie
2. Which activities or uses provided in this space bring you and these people together? / Welche Aktivitäten oder Nutzen an diesem Ort bringen Sie und andere Personen zusammen?
 3. How would you describe your interaction with other people in this space?/ Wie würden Sie Ihre Interaktion mit anderen Personen an diesem Ort beschreiben?
 4. Does the interaction make you feel like being part of a local community or culture, in which people care for and support each other?/ Gibt die Interaktion mit anderen Personen an diesem Ort das Gefühl, Teil einer lokalen Gemeinschaft oder Kultur zu sein, in der Menschen sich umeinander kümmern und sich gegenseitig unterstützen?

Multiple answer:

- Yes, I feel like part of a local community or culture, in which people care for and support each other / Ja, ich fühle mich als Teil einer lokalen Gemeinschaft oder Kultur in welcher Menschen sich umeinander sorgen und sich gegenseitig unterstützen
- I feel like part of a local community or culture, but I do not recognize that people care for or support each other/ Ich fühle ich als Teil einer lokalen Gemeinschaft oder Kultur, erkenne aber nicht das man sich umeinander sorgt oder gegenseitig unterstützt
- I do not feel like being part of a local community or culture/ Ich fühle mich nicht als Teil einer lokalen Gemeinschaft oder Kultur

Sub-question: Why is that the case?/ Warum ist dies der Fall?

Third Section: Urban Liveability

5. Do you feel like being in this space contributes to your feeling of safety or personal health?/ Haben Sie das Gefühl, dass dieser Ort positiv zu Ihrem Gefühl von Sicherheit oder zu Ihrer Gesundheit beitragen kann?

Multiple answer:

- Yes/ Ja
- In a way, but it depends/ In einer Art und Weise, aber es kommt drauf an
- No/ Nein

Sub-question: In which way do you think the space contributes to your feeling of safety or personal health/ In welcher Art und Weise denken Sie, trägt dieser Ort zu Ihrem Gefühl von Sicherheit oder Ihrer Gesundheit bei?

Appendix Section B - Informed Consent Sheet



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Information for the respondent within the Bachelor project study: *'Adaptive reuse of former industrial production sites into mixed-use public space and the potential for social sustainability'*

The given study is part of the students Bachelor Graduation Project at the Faculty of Spatial Sciences, University of Groningen (Netherlands).

The **purpose of the study** is to discover how the reuse of former industrial production sites as mixed-use public spaces can contribute to an increase in the accessibility to public space and offered activities, independent of an individual's socio-cultural or economic background. The researcher would like to discover how individual users of the space experience their capability to enter the space, just as to participate in provided activities. In this way, an idea can be generated, as to whether the created space is inclusive or not. Lastly, the research aims to understand how the space can enable human interaction, and whether the users feel that being in the space contributes towards their feeling of safety or health.

Insights can enable an understanding of the contributions the reuse of former industrial production sites, available in a high abundance in many cities, can have towards the ability of urban residents to access qualitative public spaces, allowing them to interact with other people, whilst experiencing health benefits in a safe environment. The increasing growth of cities and their populations increasingly challenges this ability.

To gain these insights, a **survey** is planned to be conducted, consisting of ten questions pointed at discovering the experienced accessibility of the space, and ability to participate in activities and uses offered. Ten additional questions are provided to uncover how the space facilitates human interaction, just as contributions towards a user's safety and health. The survey can be filled in with the researcher on paper, or as an online-version, accessible via a printed QR-code

You are able to withdraw the data provided at any moment after the survey has been completed. In order to **protect your privacy and the confidentiality of your data**, no personal information is asked for. This includes your name, age or address. All data is stored in the researcher's Google Drive folder in tables, inaccessible by any third party and protected by a password. The researcher is the only person with access to the data. Data collected on paper is destroyed after being transferred into the tables in the Google Drive folder. Even though the study includes questions about whether you experience the space as contributing to your feeling of safety or your health, no details about either of the aspects are going to be asked.

After the research is completed, the data will remain in the researcher's Google Drive folder. A copy of the raw data is going to be sent to the supervisor of the Bachelor project, who follows the same ethical conduct as applied in this research. Except for an analysis of the survey data in the context of the Bachelor thesis, no further use will be made of the data.

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A handwritten signature in black ink, appearing to be 'L. Terhoeven'.

Signature researcher

Signature Respondent