UNIVERSITY COLLEGE LONDON

FACULTY OF THE BUILT ENVIRONMENT

BARTLETT SCHOOL OF PLANNING

A Circular Cities Approach to Regeneration in London? Study of King's Cross Central

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Being a dissertation submitted to the faculty of the Built Environment as part of the requirements for the award of the MSc Sustainable Urbanism at University College London: I declare that this dissertation is entirely own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

06/09/2020

Word count

Main body: 10,014

Appendices: 814

Acknowledgements

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Abstract

Following the popularisation of the circular economy (CE), the circular cities framework has emerged as a guiding principle for cities to demonstrate sustainable development by reducing the consumption of resources and production of waste. The literature identifies three specific circular capacities: looping, adapting and regenerating, which offer strategies of urban renewal for regeneration schemes. The circular cities approach also strengthens the role of social and cultural aspects of the built environment which are often ignored in CE theory and in particular, recognises the importance of cultural heritage in achieving circularity.

This paper applies these ideas of circularity to King's Cross Central, an urban regeneration project led by Argent LLP under the King's Cross Central Limited Partnership in central London. The research is based on an in-depth case study of the scheme using qualitative content analysis of planning documents and interviews with professionals involved in the project. Recognising that circularity as a concept did not yet exist when the scheme was conceived, the aim is to explore whether the planning approach exhibits circular capacities through its sustainability framework, and any circular outcomes evident as a result.

The analysis suggests that the regeneration demonstrates looping, adapting and regenerating capacities through various strategies taken by the applicants. This is also reflected in the site's ongoing operation, for example in the multiple use-values that are generated from the green and blue public spaces. The urban heritage preserved through the adaptive reuse of buildings and other urban infrastructure has also added significant value that contributes to the scheme's looping and regenerating capacities. The study therefore concludes that King's Cross Central embodies some principles of a circular city and demonstrates its multidimensional benefits as well as the outcomes of a heritage-led regeneration.

1. Introduction

1.1 Research Context

The circular economy (CE) principle has quickly gained momentum and is increasingly being applied to the city-scale through the circular city framework, which aims for a comprehensive organisation of the city, based on decoupling growth from resource consumption (Girard and Nocca, 2019). This study understands the CE as a calculative strategy to achieving sustainable urban development. Whilst most understandings of the circular city are grounded in the Ellen MacArthur Foundation's (EMF) ReSOLVE model of CE, it is widely recognised that there lacks a fixed definition. For the purpose of this research, I will be approaching circularity as a form of urban renewal and adopting the circular capacities of looping, adapting and regenerating, as identified by Williams (2019a). The dissertation understands these terms in the following ways: looping as the closing of resource loops; adapting as about being flexible; and regenerating as the restoring of social and cultural capital in the urban landscape.

As the concept of circularity is originally rooted in the idea of a sustainable economy, there is less attention given to the social and cultural components to achieve human sustainability. This has led to a recently emerging focus on the role that cultural heritage can play in achieving circular cities (Gravagnuolo et al, 2017), which argues that heritage is part of the CE as it prolongs the use values of city components. Ideas around implementing circularity in an urban development are continually expanding to become more holistic in fulfilling the longstanding three-pillar approach (environmental, social and economic) of sustainable development.

Considering the heritage-led approach to circular cities, this study aims to explore the relationship between urban regeneration and CE through the lens of the Kings Cross redevelopment, an important former industrial heritage site in London. Kings Cross was chosen not only for its rich urban fabric and history, but it is also well known for the developer's stated awareness of incorporating sustainability principles (Gossop, 2016). Therefore, the purpose of the research is to assess whether regeneration projects on post-industrial sites can be successful in creating a circular, closed loop system as implied by the circular cities approach (Girard and Nocca, 2019; Williams, 2019b).

1.2 Research Question & Objectives

This research seeks to answer the following question:
"Does the Kings Cross urban regeneration exhibit the circular capacities – looping, adapting and regenerating – in its approach to development and what outcomes have been achieved?"

The study is guided by the following objectives:

1. Identify a methodological framework of circular cities to be applied to an urban regeneration site
2. Critically analyse primary documents related to the King's Cross Central development to identify any evidence of the application of circular actions (looping, adapting and regenerating)
3. Determine whether these circular actions have led to circular outcomes using secondary research and interviews with stakeholders of the development
4. Evaluate the role that the site's cultural heritage has played in the development process and its role in its circularity

Chapter 2 provides an overview of the literature around conceptualising and assessing circular city components, particularly looking at the influence of cultural heritage and heritage-led regeneration. It will also draw on the existing academic literature on Kings Cross and its significance as a nationally renowned regeneration project. Chapter 3 outlines the qualitative methodological process employed to conduct the research. Following that, Chapter 4 will present the data findings and analysis of the intentions and outcomes relating to circularity in the Kings Cross redevelopment, before reflectively concluding on the project in Chapter 5.

This project contributes to the growing interest in achieving sustainable development in cities through circularity and addresses the gap in the literature on assessing intangible factors, as the circular city approach is thus far dominated by a focus on material and energy flows. By following Girard and Nocca's (2019) integration of historical and cultural values of the built environment into the circular city framework, this study attempts to diversify the ways in which regeneration projects can achieve sustainability by focusing on a wider range of resources.

2. Literature Review

2.1 Circular Cities

2.1.1 The Circular Economy

The circular cities framework is rooted in the more commonly recognised circular economy (CE) system, which is acknowledged by Kirchher et al (2017) and Saidani et al (2018) as encompassing a broad range of definitions. Yet the most widely referenced approach by writers of circular cities is the one by the Ellen MacArthur Foundation (EMF), which identifies CE as being a 'multiple value-creation mechanism' based on principles surrounding the preservation and use of natural capital and resources (EMF, 2015). The CE is therefore an economic model for production and consumption processes, offering ways of reducing resource extraction, eliminating waste and promoting the continual use of resources, thereby reducing overall environmental impact (Foster, 2020). It is developed as a method-based concept according to specific actions and practices (Schroeder et al, 2018) such as the 'R-typologies' (reduce, reuse, recycle, recover, refuse, repair, refurbish, remanufacture and repurpose), as articulated by Kalmykova et al (2018).

Multiple authors of CE also articulate the idea that it creates resource loops and closes resource flows, illustrating the shift from a linear to a circular system across different scales (de Jesus et al, 2017), of which the 'city' is arguably one. However, Marin and de Meulder (2018) make the point that whilst this shift is recognised, it is largely unexplored in literature. The CE is increasingly being associated with ideas of sustainable development (Suárez-Eiroa et al, 2019; Saidani et al, 2018), but Foster (2020) notes that actually implementing the concept in the built environment sector is hindered by a lack of industry knowledge on how to practically execute circular actions.

2.1.2 The Circular City

According to Cavaleiro de Ferreira and Fuso-Nerini (2019), the circular city approach embraces the relevant parts of CE but shifts it to a city perspective by understanding the city as its own complex system that has significance beyond its economy (Williams, 2019b). This puts humans at the core of its processes for a more holistic conceptualisation of circularity, placing importance on the fundamental role of a city's inhabitants in the way it functions and operates (Girard and Nocca, 2019). Similarly, Williams (2019c) notes how a circular city implementation should not only be understood as a technical process but equally as a systemic change of economic and governmental restructuring. It also tackles issues around social equity, community engagement, and environmental justice (Williams, 2017).

As touched upon in Chapter 1, this study will be adopting the 'circular capacities' approach as established by Williams (2019a) in her research on the Stockholm Royal Seaport, of which this study has selected looping, adapting and regenerating as the areas of focus. Looping is about localising resource flows to reduce resource consumption and wastage. Adaptive actions enable infrastructure and processes to evolve with changing contexts to ultimately also reduce resource consumption and waste. This is also reflected in the recurring theme of flexibility and adaptability in the urban studies literature (Madanipour, 2018). Regenerating is originally used to describe the restoration of ecosystem services through natural capital but Girard and Nocca (2019) also allude to the creation of social capital through adaptive reuse therefore regenerating knowledge in terms of values, significance and skills.

Whilst some cities have formally adopted variations of urban governance frameworks based on circularity, including London (LWARB, 2017), this research is more specifically situated in the recently emerging literature on the relationship between cultural heritage and circularity (Girard and Nocca, 2019; Gravagnuolo et al, 2017). This is explored in the Italian CLIC Project (Circular models Leveraging Investments in Cultural heritage adaptive reuse) (Garzillo et al, 2020) and also in investigations on port cities (Williams, 2019a; Gravagnuolo et al, 2019; Cavaleiro de Ferreira and Fuso-Nerini, 2019; Cerreta et al, 2020). Such studies have developed their own indicators that reflect their approach to urban circularity, in which the process of forming the indicators itself becomes a way of defining the concept. As explored further in the next section, there is also a body of work examining the role that cultural heritage can play in making cities circular, further reinforcing the importance of the social and cultural aspects of sustainable development.

2.2 Heritage-led Regeneration

Cultural heritage is commonly referred to as a 'public or common good' and one that can contribute to the socio-economic development of an area (Guzman et al, 2017). The literature on urban heritage understands cultural heritage as a resource for economic development and placemaking (Montgomery, 2003; Richards, 2011), which also provide opportunities for sustainable growth (Girard, 2014). On this note, English Heritage (2002) have defined heritage as an essential part of delivering regeneration, particularly for its ability to represent both the social and environmental significance of the urban landscape. Urban cultural heritage is therefore widely perceived as an urban feature that can foster economic development and social cohesion, but according to Fouseki and Nicolau (2018), greater attention is still needed on the social aspect.

For these reasons of economic growth being associated with heritage conservation, cultural heritage is progressively seen as an approach to sustainable regeneration. In the early workings of heritage

management, Pickard (2002) addressed the growing desire to handle and revitalise historic areas sustainably with effectively tailored funding mechanisms and conservation-led approaches. Since then, a new paradigm for heritage-led regeneration has emerged which expands the social importance and takes into consideration strategic partnerships, community participation and sustainable lifestyles (Fouseki and Nicolau, 2018). Thus, there is a strong consensus amongst both academics and planning professionals that there has been a shift from conservation-led approaches to one that is more socially and economically motivated (Strange and Whitney, 2003; Strange and Pendlebury, 2011). This interestingly parallels English Heritage's (2002) redefinition of conservation from that of preservation to one that embraces change instead of resisting it.

On the other hand, these socially and economically driven benefits of cultural heritage are challenged by some writers. For instance, Fouseki et al (2019) contextualises the role of heritage in regeneration by its lack of presence within the UN's Sustainable Development Goals, critiquing it as becoming a 'passive victim' of rapid urbanisation rather than an 'active agent' that can positively contribute to sustainable urban development. Moreover, there is also evidence for what has been termed the 'dark side of regeneration' (Porter and Shaw, 2013), described as the social and economic restructuring caused by regeneration schemes resulting in displacement of marginalised communities. Such consequences are discussed at length by Nasser (2003) who argues that heritage often becomes treated as a product for tourist consumption and by Rodopoulou (2016) who addresses the commodification of cultural symbols more broadly (Leeman and Modan, 2010). This is further enhanced in Reeve and Shipley's (2014) study which concludes that there is little evidence showing heritage-led regeneration schemes leading to significant social and economic development.

2.2.1 Adaptive Reuse

Within the literature on both circular cities and heritage-led regeneration, there is an exceptional focus on adaptive reuse, which is defined by Douglas (2006) as "any building work and intervention aimed at changing its capacity, function or performance…to suit new conditions or requirements" (quoted in Gustafsson, 2019: 27). This approach adds value to circular thinking as the building and construction industry is regarded as the largest CO_2 emitting sector and consumer of resources (WEF, 2016). The CLIC Project mentioned above, recognises this drive for adaptive reuse of cultural heritage, as Foster's (2020) study seeks to establish a CE framework for the adaptive reuse of heritage buildings. In particular, their definition of adaptive reuse recognises community needs and includes strategies aimed not only at the building's physical fabric but also for human interactions, for example through public space accessibility. Thus, this area of work highlights how adaptively reusing derelict buildings has the

potential to improve local economy and social cohesion (Rodwell, 2002; Reeve and Shipley, 2014; Said et al, 2013).

2.3 Kings Cross

As one of London's landmark redevelopment schemes, King's Cross Central is heavily discussed throughout academic literature and beyond. Described by Edwards (1992) as a 'microcosm' that represents wider processes of the city and society, approaches have been varied reflecting the multiple complexities of the scheme, of which this research is interested in its historic landscape and sustainability. On the one hand, the literature focuses on the site's assets and environmental performance (Adelfio et al, 2020; Gossop, 2016), whilst on the other, on the politics surrounding its development and planning process (Bishop and Williams, 2016; Holgersen and Haarstad, 2009). Both offer useful insights for this research project.

2.3.1 Historic Landscape

The historic significance of the Kings Cross site has been extensively written about not least in terms of the architectural design and infrastructure that represents over 200 years of history (Gossop, 2016). The area's physical and social landscape have both been preserved to represent its dynamic past of industrialisation and deindustrialisation (Rodopoulou, 2016). This fits nicely within the discussion above on heritage-led regeneration as the development proposals place emphasis on the existing historic structures and incorporates them into the public realm (ibid). The dualism of built heritage as both an important cultural and material resource is reinforced by Rodwell (2003) who argues that this is critical in providing a sustainable path for architectural conservation.

2.3.2 Sustainability

Broadly speaking, the development is well received in the industry as an example of good practice in terms of its sustainability achievements (ODPM, 2006; English Heritage, 2013; Arup, 2020) but academic perspectives tend to be more critical (Edwards, 2009). Amongst these discussions, Adelfio et al (2018; 2020) explored the scheme through a lens of urban compaction, situated within the wider discussion on the challenges of London becoming a 'compact city' in light of its status as a global city (Hofstad, 2012). From a more technical angle, there have also been studies attempting to assess its environmental performance (Gossop, 2016). Furthermore, Imrie (2009) frames the development as an example of a sustainable world city, which also promotes 'inclusive urban regeneration' and therefore focusing more closely on the community development aspect. Whilst very few, if any, deny the lengthy consultation process that took place for the development to proceed, there are perspectives that question

the developer's lack of accountability in delivering the community inclusion that was promised (Edwards, 2009; Holgersen and Haarstad, 2009).

3. Methodology

3.1 Research Scope – King's Cross Central

This investigation into the application of a circular city framework is based on the King's Cross redevelopment site, formally known as 'King's Cross Central', developed by Argent St George together with London and Continental Railways (LCR) and Exel, under the King's Cross Central Limited Partnership (KCCLP). Planning permission for the scheme was granted in 2006 and is now reaching completion. The study is focused primarily within the boundaries of the development site (Figure 1) but the surrounding communities in the London Boroughs of Camden and Islington are relevant.

Figure 1 *Map showing the site boundary (adapted from Allies and Morrison Architects et al, 2004a)*

As shown in Figures 2 – 4, King's Cross Central is a compact, high-density, mixed-use regeneration project on what was formerly the largest plot of under-utilised brownfield land in central London. It was chosen for this research over other large-scale projects for the combination of the developers' stated emphasis on sustainability and the rich heritage of the townscape. Moreover, extensive planning documents are made available by the KCCLP and the site is also widely discussed in a strong body of literature, suggesting not only is it a relevant scheme but there exists a solid base of existing commentary to elaborate on.

Figure 2 *Upper level of Coal Drops Yard (Source: author)*

Figure 3 *Upper and lower view of Coal Drops Yard (Source: author)*

Figure 4 *Pancras Square - restaurants, retail and workspaces (Source: author)*

For the theoretical framework, the study is carried out under the assumption that circularity was not intentional in the planning process as the concept was not yet widely developed when the scheme was conceived. Rather, recognising that the development's guiding sustainability framework (defined below) aligns closely with the holistic approach of circular cities to explore any existing evidence of circularity.

The KCCLP's definition of 'Sustainable Development':

"A development which brings lasting environmental, economic and social benefits to the project and to the wider community. Furthermore, a sustainable development is delivered and managed with consideration for optimising the use of materials and resources." (KCCLP, 2016: 5)

3.2 Methodological Framework

To answer the research question, this study takes a qualitative approach to investigate firstly, the application of circular actions and secondly, to reflect upon these actions by exploring what outcomes have emerged from potentially circular approaches. Consisting of qualitative content analysis (QCA) and semi-structured interviews, this qualitative process is intended to construct a set of data from which to identify patterns (Gläser and Lauden, 2013) that respond to the research objectives.

The primary data consists of planning and guidance documents prepared by the various actors involved in the development process, and interview transcripts with individuals involved in and/or knowledgeable of the scheme. These findings are triangulated and reviewed alongside existing secondary sources that provide extensive comments on the development, in addition to the researcher's own observations from visiting the site (socially distanced and in accordance to government regulations) during August once lockdown had eased and visitor patterns slowly returned to normal.

3.3 Qualitative Content Analysis (QCA)

QCA is a method of "subjective interpretation of textual data through the systematic classification of coding and identifying themes or patterns" (Hsieh and Shannon, 2005: 1278). This allows an 'integrated view' (Zhang and Wildemuth, 2005) of the text-based content of primary documents with the context of what the development intended to achieve. This method was chosen as it allows a 'systematic and objective' way of making inferences from available textual data (Krippendorff, 2004) to validate the theoretical framework of circularity.

3.3.1 Analysis Content

QCA was conducted on a selection of publicly available planning, consultation and assessment documents (Appendix A) prepared by the developers, masterplanners, local councils and professional consultants, among others, indicating a range of perspectives and input on the scheme. The aim of this method is to seek any evidence of circular actions in pre-development documents (and the assumption that they were carried out) and of circular outcomes in the post-development reports.

3.3.2 Analysis Method

The method was carried out using direct content analysis to analyse the data deductively (Berg, 2001) using a set of indicators (Table 1), which was initially configured based on existing circular city research projects and categorised into the three circular capacities. However, following a pilot round of coding, the indicators were adjusted inductively (Miles and Huberman, 1994) to suit the ideas that were emerging from the text and also to select what themes to prioritise so as not to overwhelm the data analysis. In particular, the pilot study showed that it is better to have broader categories rather than very specific elements to maintain the flexibility of a qualitative study. The benefit of deciding the indicators both deductively and inductively is that it allows for a rigorous approach that is informed by both theory and practice (Zhang and Wildemuth, 2005). The coding was carried out using NVivo 12, a coding software which systematically manages the data and collects extracts from multiple sources together according to its categorisation (Bazeley and Jackson, 2013).

LOOPING	ADAPTING	REGENERATING
Renewable energy	Collaboration and engagement	Cultural heritage
Reuse of old buildings	Flexible planning	Economic opportunities and employment
Sustainable construction	Inclusivity and integration	Public space
Sustainable infrastructure	Policy and governance	Green space and natural resources
Transport and connectivity	Resilience and futureproofing	Recreational space

Table 1 *Indicators used to code documents with evidence of circular actions or outcomes*

It should be noted that due to the substantial number of features that have the potential to be circular, the analysis has focused on a carefully selected set of factors that best demonstrate the idea of a circular city. This selection prioritises aspects that incorporate the heritage, to meet objective 4, and is also influenced by the COVID-19 circumstances that narrowed the range of research material.

Transportation and waste assimilation are two particular areas that are highly relevant to circularity and frequently addressed in the site's development but was not able to be included in the scope of this dissertation.

3.4 Semi-structured Interviews

Semi-structured interviews are 'conversations with a purpose' that allow the natural progression of thoughts (Valentine, 2005) with an interactive element in which the data is co-constructed between the interviewer and the participant (Cloke et al, 2004). The advantage of a semi-structured interview is that it makes efficient use of the respondent's knowledge by addressing specific themes and it also allows the interviewer-researcher to become visible as a knowledge-producing participant in the process itself (Fontana and Frey, 2005).

3.4.1 Interview Participants

The purpose of the interviews was to gain a better understanding of how the development ended up on the ground and to draw on either the first-hand experience of subjects involved in the scheme or professionals in the field that have an insider's knowledge on the development's sustainability. As shown in Table 2, the intention was to draw on a variety of perspectives. Out of a total of 10 interview invitations, only 3 responded to accept the request for an interview. Whilst the rate of acceptance is low, it was fruitful to gain insight from three separate organisations that are all deeply relevant and involved in the scheme long-term.

Organisation	Anonymised name	Role / involvement	Relevance
LB Camden	Interviewee 1	Former Director of Environment	In-depth knowledge of the scheme from involvement in negotiations with Argent
Argent LLP	Interviewee 2	Oversees Sustainability Strategy	Site developer and sustainability point of contact
Historic England (previously English Heritage)	Interviewee 3	Inspector of Historic Buildings and Area	Former involvement in the advising of listed buildings in the site

Table 2 *Interview participants*

3.4.2 Interview Design

Owing to the current circumstances in light of the COVID-19 pandemic, all interviews were conducted online through video calls on Microsoft Teams. The video interaction allowed for the presence of non-

verbal cues (Stewart and Williams, 2005) and the audio-visual interactivity facilitated the real-time co-presence of traditional face-to-face interviews (Lupton, 2020). Being conscious that professionals in the field are likely to be particularly busy during the pandemic, interviews were set up to last half an hour. To make the most of that time, an interview guide (Appendix B) with questions that addressed information not captured in the QCA, was followed to ensure the critical questions were being asked. The interview recordings were then transcribed and coded using the categories from Table 1 to be incorporated into the analysis.

3.5 Research Ethics

To ensure their confidentiality and protection, all interview participants were asked to sign a consent form (Appendix C) prior to the interview. All personal data relating to the interviewee, including contact information, audio recordings and email correspondence, will be permanently deleted following submission of the dissertation. Moreover, all interviews were conducted in the privacy of the researcher's home, through a UCL issued Microsoft Teams account, and not listened by anyone else. All the primary and secondary documents used in the QCA are publicly available and free to access.

3.6 Limitations

The methodological framework presents a number of limitations that prevent the data from fully representing what the King's Cross development has achieved in terms of circularity. Firstly, the analytical framework and set of indicators proposed is only one interpretation of what a circular development requires and therefore, like all qualitative research, involves an element of subjectivity that will influence the data analysis (Burnard, 1995). Secondly, there were only a limited number of people that were interviewed due to the lack of responses and difficulty in reaching out to stakeholders. This means that certain perspectives of this highly contentious development scheme are missing, in particular the views of the local community. Thirdly, the methodological scope was also restricted due to the pandemic and it was not possible to capture the opinions of the general public visiting the site, for instance through a street questionnaire.

4. Findings & Analysis

This chapter will present a key selection of findings as justified in the methodology, based on the data and evidence of circularity identified in the qualitative content analysis and interviews. The chapter is organised according to the three circular capacities (looping, adapting and regenerating) and analysed within the framework of circular cities and heritage-led regeneration to assess the circular qualities exhibited in the King's Cross Central scheme.

4.1 Looping

The first circular capacity analysed is looping, the process of reducing consumption and waste by closing resource loops through re-use, recycling and energy recovery (Williams, 2017). Broadly, as the proposal set out to regenerate a brownfield site, a disused former industrial wasteland, the scheme inherently showcases looping actions as the development takes place on a site that is being re-used for a new purpose (Williams, 2019a). More specifically however, the redevelopment approach demonstrates looping capacities in two particular ways: firstly, in the adaptive reuse of buildings and secondly, through the implementation of renewable energy systems.

4.1.1 Adaptive Reuse

The scheme involved the complete demolition of one listed and three unlisted buildings, with the rest preserved and altered through Listed Building consent (RPS, 2005, Revised Non-Technical Summary (RNS)). Figure 5 is a spatial representation of building groups and structures that were subject to works of alteration, with a selected number of these buildings shown in Table 3.
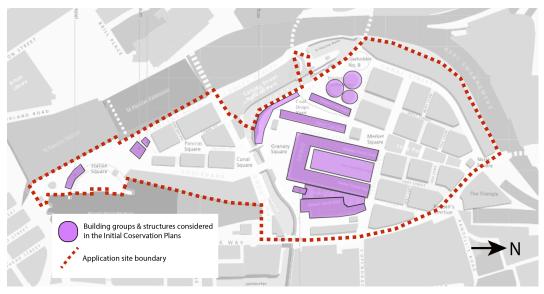

Figure 5 *Map of building groups & structures that have been preserved and subject to works of alteration (adapted from the RNS)*

Building	Pre-alteration	What it looks like today
The Granary (Grade II)	 (Argent et al, 2004a, Initial Conservation Plans (ICP): Section 3.2)	 (Townshend Landscape Architects, n.d.)
The Coal Drops (Grade II)	 (ICP: Section 2.2)	 (ULI, 2018)
German Gymnasium (Grade II)	 (Peel, 2016)	 (Peel, 2016)

Table 3 *Examples of refurbished buildings that underwent adaptive reuse at King's Cross Central*

The planning documents suggest that these works were carried out in close consultation with Historic England (formerly English Heritage), which was further confirmed by Interviewee 3:

"We worked very closely [with Argent and Camden Council] and with the project teams that were put forward...a working pattern [was established] where there would be somebody in charge of meetings, usually one of the developer's teams, and they would send a whole suite of issues and we would consider them and give feedback."

In fact, King's Cross Central has been named 'One of England's 20 Best Heritage-Led Developments' by English Heritage (Regeneris Consulting, 2017), and the Planning Statement (Argent et al, 2004b (PS)) identified the re-use of these buildings as *"an integral part of the sustainable regeneration of the area"* (p. 55). Re-using old buildings is a widely discussed circular city approach as it avoids demolition waste and unlocks other environmental benefits. The range of buildings and structures retained at Kings Cross gives an indication of how much construction waste was minimised as old buildings serve modern-day purposes, such as the former German Gymnasium being adapted into a sophisticated Mittel-European restaurant. This exemplifies the ability of adaptive reuse to change a building's capacity and function, whilst retaining the area's important history.

The other main environmental driver of adaptive reuse is the significant reduction of embodied energy, which is the cumulative energy inputs associated with a building's construction stages up to its completion (UKGBC, 2019). This energy consumption is thus avoided by restoring, rather than demolishing, existing structures and also by minimising the number of new buildings built. Interviewee 1 described the developer's approach to preserving the embedded energy in the building stock:

> *"The fact that the heritage buildings are pertained and reused means that we have buildings with embodied carbon in them which are 170 years old, which will last for another 170 years."*

However, these benefits are not necessarily always fully realised as adaptive reuse does not guarantee zero construction and it could also fall short in other environmental standards, for example in its operational carbon (Foster, 2020). Interviewee 2 acknowledged this, that because of the technology that was available at the time of conception, the buildings at King's Cross Central *"[don't] really incorporate the low carbon materials element"* but explained that net zero carbon targets are currently being introduced into their ongoing strategy for the site.

As an alternative to demolition, the scheme has also used a relocation approach in their preservation of the iconic gasholders, several of which were taken down to make way for the Channel Tunnel Rail Link (CTRL) development, also known as High Speed 1. Gasholder No. 8 and the Gasholder Triplet are the two that have been re-erected and integrated back into the development (Figures 6 and 7), the former as a public park and the latter as a luxury residential development.

Figure 6 *Gasholder No. 8 as a green park overlooking the canal (Source: author)*

Figure 7 *The Gasholder Triplet conversion into a residential development (Mairs, 2018)*

Beyond the re-use of the physical material of the frames, there is also an intangible value captured by closing this resource loop. According to Interviewee 3, *"lots of people recognised Kings Cross because of the gasholders",* and as there are fewer than twenty listed gasholders nationwide (Interviewee 3), they represent a diminishing but valued typology from Britain's industrial landscape. Although it may not be as genuine as preserving them in their original location, Interviewee 3 also described how *"they do still represent some of the atmosphere of Kings Cross as being an industrial site".*

Interestingly, one of Argent's early public consultations (Argent, 2003, Framework Findings (FF)) found that questions about the gasholders attracted the most comments and only 2 out of 69 responses preferred to have them removed altogether. The choice to repurpose the Gasholder Triplet into a residential scheme has been widely criticised but the financial value that it generates strengthens the circularity argument. Interviewee 3 explained:

> "…people are saying 'oh why can't this just be a park with a gasholder in it' and you're thinking that's lovely but maintaining a gasholder frame costs hundreds of thousands of pounds. You need to be confident it's part of a wider scheme and it's got money coming in that will actually maintain it into the future."

Thus, Historic England's approach to considering the long-term viability of the infrastructure reflects a circular approach in recognising that a financial output is required to sustain its use and to continue providing cultural values. Heritage plays an important role in the continuous development of the scheme due to its economic value, which in this case is enabled through adaptive reuse (Brenner, 2014), and the viability strengthens other resource loops in the overall scheme.

4.1.2 CHP and Renewable Energy

As buildings represent 30% of total energy consumption, Girard and Nocca (2019) suggest closed-loop energy systems as a way of achieving circularity to maximise energy efficiency and waste reduction. According to a study by the UKGBC (n.d.), the site's brownfield status shaped the decision to implement a site-wide district heating, building an on-site Energy Centre with three Combined Heat and Power (CHP) engines. The heat from the engines is used to provide hot water and heating for the development, which when fully operational is expected to provide 100% of heating and hot water and 80% of electricity (Regeneris Consulting, 2017). Furthermore, as illustrated in Figure 8, a range of other renewable energy systems including photovoltaics and micro wind turbines are implemented in the planning documents, with future plans for biofuel boilers and ground source heat pumps (KCCLP, 2016, Sustainability Report (SR)).
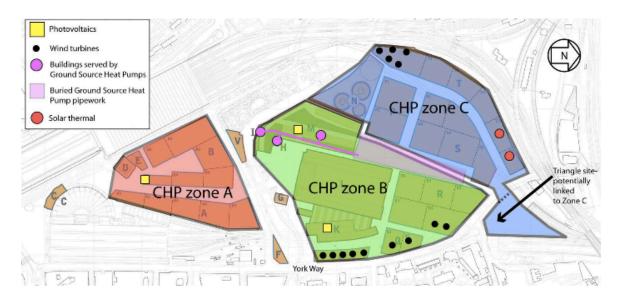
Figure 8 *Map from the Energy Assessment locating the site's CHP zones and renewable energy (Arup, 2005: 13)*

A CHP system not only creates a loop by capturing excess heat to produce thermal energy but ensures that the energy from any source is maximised. The Energy Assessment (Arup, 2005 (EA)) explains the benefits of the CHP unit as it:

"*extract[s] more energy per unit of fuel (or carbon) than it would if simply acting at a power station and delivering only electricity, by capturing the low grade "waste" heat. Thus, [in allowing] the distribution of lower grade heat alongside electricity, [it] make[s] better use of a wider range of future energy sources.*" (EA: 17)

The CHP therefore reflects the importance of energy efficiency that is central to circular cities as it contributes towards reducing total energy consumption and the waste produced alongside it. Yet, as recognised by the applicants themselves, there is a challenge in implementing renewable technologies in a high-density urban environment like Kings Cross. The EA also outlines:

"*While [the renewable energy technology] contribution is small in the context of the development…the Applicants have adopted a strategy of deploying these…where they will be most effective [and] make a significant contribution to the local energy supply requirements.*" (EA: 12)

By addressing that these systems will feed into the local energy supply indicate their awareness of closing energy loops at a localised scale. In fact, the approach appears to be succeeding, as according to Gossop's (2016) study of King's Cross Central, the CHP system is expected to eventually heat the whole

development and offset 79% of total power demand. Considering that this approach was not the most cost-effective at the time when emerging renewable technologies were largely untested and weakly backed by policy (Bishop and Williams, 2016), Argent's decision to invest early in energy efficient buildings and district heating demonstrates a circular approach by recognising the long-term value of reducing energy consumption.

These examples highlight the role of carbon in the circular city framework as circular adaptive reuse and energy systems involve the scaling down of carbon emissions. This suggests that having a carbon pathway plan or policy may be a critical component to facilitating circularity and that carbon is a key component of the looping process that should be considered in circular city thinking. Although ideas of net zero were not yet pertinent during the scheme's inception, Argent's understanding and performance of buildings refurbishment and energy production suggests that the site is suitable to apply future carbon reduction targets.

Together with other looping capacities not captured in the scope of this chapter, such as the re-use of on-site materials and zero waste to landfill achievement (Interviewee 2), the scheme exhibits a number of resource loops that re-uses and retains both material and cultural values of the site. All interviewees implied that growth and therefore increased consumption is inevitable, and so these looping capacities are critical to maintain its compact consumption model. For the future, Interviewee 2 shared that Argent are in fact looking to *close [more] of the loops [and] not create waste in the first place*.

4.2 Adapting

The second circular capacity examined in the research is adapting, which asks whether the urban fabric is adaptable, flexible and recyclable, particularly to people's changing needs throughout the development lifecycle (Williams, 2017). Following the KCCLP's claim that the development plan was based on 'consultation and flexibility' (Rodopoulou, 2016), this section examines Argent's uniquely collaborative approach, and its flexibility in planning and in the proposed infrastructure.

4.2.1 Collaboration and Consultation

From the early analysis stage, the consultation process by Argent stood out as a key strength of the scheme. According to the Urban Design Statement (Allies and Morrison Architects et al, 2004a (UDS)), 20,000 copies of documents were made available; over 150 meetings held with statutory and local interest groups; and the King's Cross development team discussed with over 4,000 people through consultation and presentations. The results from public consultations are captured in a public

document titled 'Framework Findings', published in June 2003. In the Planning Statement, the applicants recognised that:

"Different groups have different concerns, at different times in the development process, and that different tools for involvement will be required." (PS: 37)

Their range of consultation tools included workshop events, video interviews, 'roadshow' events and questionnaires (FF). The exact process to gathering respondents is not clear but the documents imply that there were a broad range of communities, business and other organisations targeted, as well as the young people of the Kings Cross area for an additional Youth Consultation Report (Fluid, 2002). This alludes to a participatory planning approach, which Fouseki and Nicolau (2018) argue is necessary for heritage-led regeneration to achieve social and economic resilience. The attempt by Argent to understand the public's opinions on the development promotes 'culture from the bottom' by working with different actors and stakeholders (Girard and Nocca, 2019).

On the other hand, there is also evidence suggesting that the approach was not fully inclusive. The King's Cross Railway Lands Group (KXRLG) was set up in 1987, bringing together tenant's associations, resident groups, small and medium businesses, conservation campaigners and others to represent community voices (Edwards, 2009). The group's response to the outline planning application states:

"The revised application provides no information about the involvement of local communities in the regeneration, and there is no reference to a Community Development Trust or Community Land Trust, or generally to the securing of community assets." (KXRLG, 2005: 13)

The group disbanded in 2013 which made it difficult to gather their inputs for this study, but this opposition of community groups is also reflected in the literature. According to Imrie (2009: 95), "the data suggests that community engagement in Kings Cross has been partial and piecemeal". Similarly, Edwards (2009) also asserts that local communities have felt 'disenfranchised' in the decision-making process despite the seemingly extensive rounds of consultation reflected in Argent's framework documents.

A potential explanation for this incongruency is that much of the community consultation was carried out through Argent's close collaboration with Camden Council, perhaps at the expense of unrepresented or marginalised community members. In 2002, Camden set up the King's Cross Development Forum as an umbrella group for community-based views, and the qualitative analysis

found that this Forum was repeatedly mentioned throughout planning documents. Yet, the issue of attempting to represent an incredibly diverse community under a singular body is that it cultivates a plurality of views and experiences under one broader system led by the developer and their pre-existing agendas (Imrie, 2009).

This is not to entirely dismiss Argent's efforts towards consultation, but the conflicting perspectives demonstrate that King's Cross Central does not fully embody an adaptive capacity as the experiences of some groups affected by the development has been lost in the process. However, this does not necessarily mean that the scheme cannot re-work its operation to enhance its adaptiveness, which there has been an indication of, for instance through the ongoing engagement with local people as discussed in Section 4.3.

4.2.2 Flexible Planning

An aspect of the early development approach that contributes to increased circularity is the flexibility of the plans. To avoid non-circular consequences like technological lock-in and resource wastage, projects need to be adaptable to changing local conditions in the long-term (Williams, 2017). The various planning documents consistently indicate the importance of flexibility, such as:

"The two outline planning applications seek an element of flexibility to adjust the balance of land uses over time and to phase development in different ways." (PS: 8)

"The development must be allowed to evolve to reflect changing market conditions and social economic needs…it should not be constrained by over restrictive conditions on phasing, timing, land use mix or location." (Arup, 2004, Regeneration Strategy (RS): 4)

By framing the development programme to last over 12 to 15 years, Argent's approach exhibits an adaptive capacity in its awareness for future changes, particularly unpredictable external impacts such as 'market conditions', that the development will need to accommodate in order to be future-proof. This is also reflected in Interviewee 1's vision when asked about the growth of the development, which they said is:

"…capable of doing without having to demolish the whole lot in 30 years' time because it becomes obsolete. We deliberately thought about 30-, 50-, 200-year time frames and we developed a masterplan that allowed the constant renewal of elements of the scheme without having to demolish the whole lot sometime in the future."

In fact, according to Interviewee 1, the flexible masterplanning approach contributes to circularity in a more tangible way through its awareness for retaining the physical infrastructure and therefore minimising potential resource wastage. Moreover, adaptability does not imply less-intensive planning, but that flexibility needs to be integrated within the planning process, as Interviewee 3 asserted the gravity of Camden's plan-led approach:

"[When I worked at Camden Council in 1997], they actually had a policy section that was devoted to Kings Cross because they knew the land was going to be released after the [CTRL] was created…there were a lot of discussions about what kind of aspirations the council and the local community had for the site, what uses they wanted to see there."

Thus, this case study shows that whilst flexibility is critical to achieving a circular city system, a solid understanding of the development's aims and goals are as important to ensure the adaptiveness is grounded in a strong framework and strategy. What makes Argent's approach particularly unique compared to other privately funded developments in London is that a large proportion of other developments are:

"…about maximising the value at the point of sale. King's Cross is about maximising the value over 10, 20, 30, 50 years and is held by a pension fund in their portfolio and that's their business management model." (Interviewee 1)

In addition to circularity being embedded at the planning stage, Argent's long-term interest in King's Cross Central suggests that the ownership and management model also influences the ability of a regeneration project to fulfil circular outcomes and become resilient to externalities.

4.2.3 Flexible Urban Infrastructure

The research found that flexibility can also be practiced through physical spaces, termed 'circular economic spaces' by Girard and Nocca (2019) in which circularity is linked to multi-functionality. Following the scheme's prioritisation of flexibility discussed earlier, the proposal specified for flexible workspaces supported by a 'flexible floorspace' strategy (Figure 9):

"The proposals include scope for a range of different commercial building formats, with modern office floorspace suitable for a variety of businesses. The plots are designed to accommodate efficient, flexible buildings, which allow sub-division to cater for multiple lettings and a mix of large and small occupiers in response to market demand." (PS: 33)

Table 1: Total Floorspace Proposed within the King's Cross Central Main Site[456789101112131314]

	Total Floorspace Applied for (sq. m.)	Maximum amount of floorspace, within the total applied for, that may be developed as (sq. m.):								
		Business & employment (B1)	Residential	Hotels(C1)/ Serviced apartments	Shopping/ food & drink (A1/A2/A3/ A4/A5)	Uses within D1 (see Note 4)	Cinemas	Uses within D2 and night clubs (see Note 5)	Multi Storey Car Park	Other (see Note 6)
South of Regent's Canal	244,250	221,510	2,200	32,625	15,060	3,950	0	4,455	0	1,375
North of Regent's Canal	468,840	234,000	171,275	14,600	30,865	67,880	8,475	24,275	21,500	0
TOTAL	713,090	455,510	173,475	47,225	45,925	71,830	8,475	28,730	21,500	1,375

Figure 9 *Copy of 'Table 1: Total Floorspace Proposed within the King's Cross Central Main Site' as shown in the Main Site Revised Development Specification (Argent et al, 2005: 13)*

Flexibility is represented in Argent's approach to floorspace allocation, not only in the wide variety of floorspace uses to achieve multiple functions but also in calculating 'maximum floorspace' to seek planning permission for "up to" this figure instead of fixating on static measures (Argent et al, 2005). As captured in Regeneris Consulting's (2017) report, this was also combined with:

> *"…a flexible approach to business needs and workspaces…focus[ing] on the specific requirements of companies rather than trying to provide a more speculative offer which tries to reflect the needs of a specific sector or a current trend for working."* (p. 56)

This offers a unique approach to the use of modular and co-working spaces (evidence at King's Cross Central), which are common examples of flexible infrastructure in the circular city literature. By offering both spaces for multiple uses and responding to different commercial needs, the scheme embodies an adaptive capability to meet changing needs of the future.

This long-term approach and adaptive planning of King's Cross Central represents the core of the circular city objective which is to be a future-proof city (Prendeville et al, 2018) and to ensure its viability. Interviewee 1 supported this view by saying:

> *"I think the whole estate is definitely futureproofed in the sense that it can evolve over time and remain relevant and be able to adapt to whatever happens."*

This is particularly remarkable considering that the outline planning application was prepared in 2005 and thus the scheme is now 15 years old. For it to not only still be relevant, as the discussion so far has

suggested, but to also exemplify a futureproofed strategy enhances its adaptive capacity and the potential to further incorporate it as the site advances and new technologies are conceived.

4.3 Regenerating

The third and final circular capacity examined in this study is regenerating. Modified from Williams' (2017) original definition of it as a process of restoring ecosystem services and waste assimilation, this section argues that from a more social sustainability perspective, it can also be demonstrated in the restoration of social and cultural capital through improvements in the urban fabric. In King's Cross Central, regenerative capacities are seen in the impacts of the site-wide adaptive reuse approach, the KCCLP's training and employment opportunities, and through the multi-functioning public realm.

4.3.1 Site-wide Adaptive Reuse

Whilst the earlier section on looping argued how adaptive reuse of buildings and the gasholders illustrate circularity by forming a resource loop, the overall revitalisation of a former derelict land (ULI, 2014) and the outcomes from the buildings' new uses (Gravagnuolo et al, 2017), facilitates the regeneration of a range of cultural benefits. This is specifically evident in the scheme's spatially integrated technique of adaptive reuse, transforming the heritage into a public good and as a result enabling it to form a strong sense of identity in the area.

The scheme's urban design guidelines are explicit in their vision for the preserved historic buildings to integrate with the new to allow the development to feel cohesive. This is expressed under the design principle of 'Embedded Heritage', detailed across multiple documents as:

"…the job of the new buildings [is] to create a new context for the German Gym and the Stanley Building in the spirit of the old and, at the same time, to embed them into the new city." (Allies and Morrison Architects et al, 2004b, Urban Design Guidelines (South): Section 4.2)

"Rather than setting [the existing buildings] apart, putting them in a heritage 'peak', they are woven into the fabric of the living and working community." (UDS: Section 3.4)

This idea of 'embedding' the heritage was echoed by Interviewee 2 who described the presence of heritage as *"really subtle but beautiful [and] adopted and adapted into the development"*. Similarly, Interviewee 1 explained that:

"The masterplan was designed to embed the [retained] buildings. We didn't want to use them as museum pieces sitting in bits of bad public space…we wanted them to feel as if they are totally integrated with the new development and the public spaces."

This approach to urban design and masterplanning activates cultural capital as the historic façade is complemented by the newer architecture whilst maintaining a sense of historical continuity (Lynch, 1976). Cultural capital is generated from the unique historic and cultural characteristics of the old buildings, which extend beyond the re-used building itself to the surrounding area, thereby becoming a public good (Foster, 2020). As a result, visitors and users of the development are able to appreciate new use values of the formerly abandoned site. Interviewee 3 asserted this by recognising how the development has:

"created new communities…spaces…[and] activities, all of [which] have massive value, and people being able to appreciate the culture and the buildings for the first time because you could never get up near them unless you were on a canal boat."

Another social value that the site regenerates as a result of the cohesive adaptive reuse is a strong sense of place and civic pride, as having history marked in the landscape enhances the local awareness for heritage (Gravagnuolo et al, 2017). Descriptions of the heritage as contributing to a *"sense of having 'come from somewhere; a collective memory"* (UDS: Section 3.4) and as a *"sense of place afforded by the historic environment"* (Argent et al, 2001) exemplifies this. Interviewee 1 also explained how the technology of adaptive reuse and refurbishment has been around for decades but that it is the methodology that has been carefully developed and successfully showcased in Kings Cross.

Drawing on the circular city framework, King's Cross Central suggests how this cultural capital also has the capacity to strengthen the local economy with new businesses and local expenditure (Girard and Nocca, 2019) as it becomes an attractive place to visit. Whilst it has for this reason previously been critiqued for deploying the heritage as a way of producing surplus value rather than appreciating it as a cultural asset (Rodopoulou, 2016), thinking through circularity shows that these different benefits are regenerated as a result of the other values being co-created.

4.3.2 Training & Employment Opportunities

Social capital is also created through the scheme's 'King's Cross Recruit' (KCR) service and 'The Construction Skills Centre' (CSC), which are part of the development. These initiatives were born out of the discussions that Argent had with Camden Council around why local people were struggling to

find employment in the area and their wider aim of ensuring the development improved the wellbeing of the local community (Bishop and Williams, 2016). KCR was therefore the solution to increasing local employment, specifically targeting future occupants of the site to employ locally, whilst the CSC was formed to support local residents with construction qualifications and involvement with the large-scale construction process that the scheme would oversee.

This is believed to have led to positive outcomes, such as employment in the King's Cross Opportunity Area increasing by 134%, with a 237% increase in knowledge jobs (Regeneris Consulting, 2017: 29). Regeneris Consulting (ibid) also quantified the economic impact of the apprenticeships offered at the CSC as valuing £0.8 million per annum for the total number of placements provided on-site and an estimated £16.8 million 'lifetime public value' over an average working lifetime of 40 years. The programme was initially secured through a Section 106 agreement but based on its success, the CSC has since expanded with the additional costs being shared between Argent and Camden Council (Bishop and Williams, 2016). Interviewee 2 confirmed that the KCR service is also still operating through a close partnership between the two parties.

One way in which circular cities achieve 'growth from within' is having an active and skilled society (Caveleiro de Ferreira and Fuso-Nerini, 2019) thus these efforts to increase local employment and skills contributes to the scheme's potential circularity. Regeneration occurs as the development is sustained by a source of candidates to recruit from on the one hand and on the other, socio-economic growth is encouraged in the wider local area through the employment opportunities.

4.3.3 Multi-use Public Realm

The public realm was a deeply strategized aspect of the development and as a result, its design and multiple uses demonstrate a regenerative capacity by providing a range of values to the overall site. Of the 67-acre site, 40% (26 acres) has been designated as open public space (Regeneris Consulting, 2017) and the phasing was structured in a way that most of it was completed before individual buildings were delivered to provide these key spaces for early users and occupiers (UKGBC, n.d.). Some of these public spaces are shown in Figures 10 - 12, illustrating the aesthetic diversity and sense of openness to the general public.

Figure 10 *Granary Square (Source: author)*

Figure 11 *Coal Drops Yard (Source: author)*

Figure 12 *Canalside Steps amphitheatre (Source: author)*

The ability of well-planned public space to raise the overall value of the site was expressed by the interviewees:

"The creation of a vibrant place has meant that they're now achieving some of the highest commercial rents in London, which are actually almost three times the scale we were expecting when the scheme was being developed." (Interviewee 1)

"…through transforming this area, the public now has the use of it…that has not only increased [its] value for people in London, it's also created the value for the developer…if people want to be somewhere, the value of the land has probably increased to reflect that." (Interviewee 3)

A particular typology of public realm that demonstrates this value-creation is the scheme's prioritisation of green and blue spaces. In addition to the proximity of Camley Street Natural Park and the incorporation of Regent's Canal, the planning application's supporting documents also specify nature conservation strategies for ecological protection throughout the site. The King's Cross Pond Club, for example, serves as *"an art-installation, a micro-ecological environment and a place for people to enjoy"* (SR: 16). Moreover, the charity Global Generation facilitates a local community engagement activity in Skip Garden, an urban garden made of moveable skips, which has led to collaborations between onsite contractors, local residents and visitors (UKGBC, n.d.), further indicating socio-economic value being created through the public realm.

Furthermore, KCCLP's approach to the public realm reflects Girard and Nocca's (2019) theory that circular city strategies should focus on human-centred development, as the spaces in King's Cross are evidently created with the people that will use them in mind. Upon being asked about the public realm of King's Cross Central, Interviewee 3 concluded that *"as soon as somewhere feels welcoming, it attracts people and therefore the value goes up"*. This feeling of the site being "welcoming" is encouraged by the delivery of community initiatives such as local volunteering, school events and community markets that take place in the public realm (Regeneris Consulting, 2017). It is also the mix of tenants, with the University of the Arts (UAL) bringing in students alongside office workers and residents, that contributes to the area being vibrant and diverse.

Hence the interventions taken by the applicants during the planning process, along with the continuation of implementing events and activities that activate public space, exhibit the capacity to continuously regenerate social and cultural capital. This is perceived in the form of new knowledge,

relationships and skills emerging from the use of these spaces, and as a result of the added value that the strategically embedded heritage brings.

5. Conclusion

5.1 Summary

This research has sought to answer the research question of whether the development plans and ongoing operation of King's Cross Central exhibits the circular capacities of looping, adapting and regenerating. The analysis found that all three capacities are evident in varying degrees in both the scheme's development process as well as on the ground today. Resource loops are closed to an extent through adaptive reuse of buildings and structures, and the implementation of CHP and renewable energy systems throughout the development. This retained both the material-based and non-tangible values of the historic site. Adaptive capacities are achieved primarily in the collaborative and flexible planning approach which showed an attempt to include different perspectives into the development plan, whilst ensuring the ongoing development programme is flexible in design and land use. For the regenerative capacity, the social sustainability approach of circular cities was used to consider the heritage value, local socio-economic development and other community and user benefits emerging from the scheme's people-focused interventions.

Whilst the full range of circular features were not analysed due to the limited scope of this research, the outcomes that were observed represent combinations of social, cultural, economic and environmental factors. This reinforces the understanding that a circular city approach creates multidimensional benefits (Girard and Nocca, 2017) to meet the broader aims of sustainable urban development. The Kings Cross regeneration also successfully demonstrates heritage-led circularity through its extensive use of adaptive reuse, not only for individual buildings but across the site in ensuring that old and new infrastructure are cohesively integrated. Hence, this case study strengthens the existing literature on heritage as a valuable asset to enhance a development, and specifically in using circular principles to achieve this sustainably.

King's Cross Central therefore embodies a strong set of circular principles despite the CE or circular city concept not being considered in the original framework at the time of development. However, this is not particularly surprising as circularity is firmly rooted in the ideas of sustainable development, which was central to Argent's proposal and in the KCCLP's ongoing management of the site. In fact, it was revealed in the interview with Argent that they are now setting targets around CE and developing CE statements, further confirming that the site has potential to continuously embody circular city capacities.

5.2 Limitations

The research process and therefore the findings have been restricted by a number of limitations. Firstly, due to the barriers imposed by the COVID-19 pandemic, it was not possible to reach out to certain perspectives which has made the data slightly one-sided and unrepresentative of all who are affected by the scheme. Specifically, the views of the local community and on-site users (tenants, visitors, etc.) are absent. This was further exacerbated by the dispersal of two key community groups, the KXRLG and the King's Cross Community Forum, which made it difficult to contact past members for interviews as well as to access archived documents.

Secondly, the secondary data used to assess the outcomes of the scheme may be biased as most were either produced or commissioned by Argent who will have a specific interest as to how the scheme is represented and understood. This made it difficult to identify evidence that would directly reject circularity and other sustainability-led impacts. Thirdly, it is also worth keeping in mind that King's Cross Central is a very well-funded, megadevelopment in central London. This means that their approach to implementing circular capacities is not necessarily straightforwardly replicable to other urban regeneration schemes due to financial, resource or political advantages.

5.3 Recommendations

As this research has shown that circular city-led efforts can create sustainable outcomes, further practical research is recommended on how to apply these strategies on the ground at a development-scale. There is a lack of knowledge in the building sector to put circularity into practice and this was expressed both in the literature (Foster, 2020) and also by the Argent interviewee who stated that whilst the idea is there, the skillset is not.

With regards to future regeneration schemes, there are three key recommendations from this research. Firstly, that it is important to plan long-term into the future of a development and not view sustainability as one thing but use the circular city capacities to break down the sustainability agenda into different components. Secondly, this case study investigation has demonstrated the importance of planning and designing a development with the users in mind. This involves making decisions, such as investing in events or services, that increase people's quality of life. Thirdly and relatedly, is to listen to the local community and in a way that does not homogenise them into one group. The circular framework and analysis adopted in this study suggested that achieving adaptivity requires consultation with all groups that will be impacted by the development.

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Appendix A: List of Documents Analysed

No.	Document name	Year	Prepared by	Document type	Pre- / post- development
1	Planning Statement	2004	Argent, LCR and Exel	Planning	Pre-
2	Implementation Strategy	2004	Argent, LCR and Exel	Strategy	Pre-
3	Regeneration Strategy	2004	Arup	Strategy	Pre-
4	Environmental Sustainability Strategy	2004	Argent, LCR and Exel	Strategy	Pre-
5	Public Realm Strategy	2004	Argent, LCR and Exel	Strategy	Pre-
6	Main Site Revised Development Specification	2005	Argent, LCR and Exel	Planning	Pre-
7	Revised Non-technical Summary	2005	RPS	Planning	Pre-
8	Urban Design Statement	2004	Allies and Morrison Architects, Porphyrios Architects and Townshend Landscape Architects	Assessment	Pre-
9	Urban Design Guidelines (North)	2004	Allies and Morrison Architects, Porphyrios Architects and Townshend Landscape Architects	Assessment	Pre-
10	Urban Design Guidelines (South)	2004	Allies and Morrison Architects, Porphyrios Architects and Townshend Landscape Architects	Assessment	Pre-
11	Initial Conservation Plans	2004	Argent, LCR and Exel	Planning	Pre-
12	Supporting Statement for LBC	2004	Arup	Planning	Pre-
13	Heritage Baseline Study Part 1: Historic Buildings	2004	International Heritage Conservation and Management	Assessment	Pre-
14	Principles for a Human City	2001	Argent, LCR and Exel	Assessment	Pre-
15	Parameters for Regeneration	2001	Argent, LCR and Exel	Assessment	Pre-
16	A Framework for Regeneration	2002	Argent	Assessment	Pre-

17	Framework Findings (Interim report)	2003	Argent and Fluid	Assessment	Pre-
18	Energy Assessment	2005	Arup	Assessment	Pre-
19	Landscape Report	2014	King's Cross Central Limited Partnership	Report	Post-
20	Sustainability Report 16/17	2016	King's Cross Central Limited Partnership	Report	Post-
21	Regeneration and Planning Authority Monitoring Report 2016/17	2018	LB Camden	Report	Post-
22	The Economic and Social Story of King's Cross	2017	Regeneris Consulting	Report	Post-
23	Response of the King's Cross Railway Lands Group	2005	King's Cross Railways Lands Group	Consultation	Pre-

Appendix B: Interview Guide (Interviewee 1 sample)

Introduction

- Firstly, check that you have gone through the consent form and you are happy with the interview being recorded

- Introduce research topic – circular city framework; drawing on the research arguing that there is a close relationship between heritage conservation and circular economy

- Purpose of interviews – to find out more about how the development has turned out now, the outcomes from a planning professional's point of view

- Start with a broad question – Do you consider the scheme to be 'sustainable'? Feel free to use your own definition of sustainability.

Adapting

- How successful is the scheme in terms of being future-proof?

- Can you see a change in land use or buildings adapting to other functions?

- What is your opinion about the relationship between the KCCLP and the local community/LB Camden today?

Regenerating

- How would you describe the preservation of cultural heritage in the landscape?
    - Compared to other developments in London?
    - Is it successful? Has it lost any of its historical significance?

- Have you identified any social or cultural capital that's being created as a result of the development/regeneration?
    - E.g. cultural knowledge, skills development, biodiversity

- How are these cultural resources and/or urban heritage generating economic value?

Looping

- Are there any closed resource loops – e.g. renewable energy system, but any others in terms of waste management, recycling materials

- Was there a 'designing out waste' approach to the development process?

Closing question

- Do you expect Kings Cross to grow? Will on-site consumption increase once the development is complete?

Appendix C: Consent Form

Consent Form

The title of the research project is *'Circularity of the King's Cross Urban Regeneration'*. The project aims to find out more about the sustainability of the King's Cross development scheme. This interview is designed to uncover different perspective regarding how the development exists on the ground today, addressing both physical sustainability as well as social sustainability outcomes such as community development and heritage knowledge production.

The purpose of this research is for an MSc thesis (Sustainable Urbanism) and the information provided will only be used for assessment purposes kept within the University.

Please read the following points and tick the boxes if you agree with them:

- ☐ I have been briefed about what the project is about and how the interview will work
- ☐ If I don't want to answer a question, I can say so and I will not need to answer it
- ☐ I give permission for the interview to be audio recorded
- ☐ If I want a copy of the final report I know how to contact the researcher to arrange this
- ☐ I am aware that the information I give and the audio recording will be kept anonymous throughout the report
- ☐ I am aware that all the data will be destroyed after the project is over

For further queries following the interview please feel free to contact me, the researcher, below:

Name: Kana Nomoto

Phone number: +44 7492994303

Email: kana.nomoto.19@ucl.ac.uk

Please sign below and return to the researcher if you agree with the information provided above

Signed …………………………………………

Name…………………………………………

Date…………………………………………

Appendix D: Risk Assessment Form

RISK ASSESSMENT FORM
FIELD / LOCATION WORK

^UCL

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form
http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION: BARTLETT SCHOOL OF PLANNING
LOCATION(S): LONDON
PERSONS COVERED BY THE RISK ASSESSMENT: KANA NOMOTO

BRIEF DESCRIPTION OF FIELDWORK: DESK-BASED RESEARCH OF PLANNING-RELATED DOCUMENTS INCLUDING PLANNING APPLICATIONS SUBMITTED TO LOCAL COUNCILS AND ONLINE INTERVIEWING USING ZOOM/SKYPE.

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.

If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.

Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals.	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ? All fieldwork will be carried out indoors in my home environment thus no risks are identified.
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

N/A	work abroad incorporates Foreign Office advice
YES	participants have been trained and given all necessary information
N/A	only accredited centres are used for rural field work
YES	participants will wear appropriate clothing and footwear for the specified environment
N/A	trained leaders accompany the trip
N/A	refuge is available

N/A	work in outside organisations is subject to their having satisfactory H&S procedures in place
N/A	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life Fire, heatwave

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

NO	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
YES	fire fighting equipment is carried on the trip and participants know how to use it
YES	contact numbers for emergency services are known to all participants
YES	participants have means of contacting emergency services
YES	participants have been trained and given all necessary information
YES	a plan for rescue has been formulated, all parties understand the procedure
YES	the plan for rescue /emergency has a reciprocal element
N/A	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

FIELDWORK   1   May 2010

EQUIPMENT	**Is equipment used?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any** **risks**
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	the departmental written Arrangement for equipment is followed
	participants have been provided with any necessary equipment appropriate for the work
	all equipment has been inspected, before issue, by a competent person

	all users have been advised of correct use
	special equipment is only issued to persons trained in its use by a competent person
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	**Is lone working a possibility?**	**NO**	**If 'No' move to next hazard**
			If 'Yes' use space below to identify and assess any
			risks
e.g. alone or in isolation lone interviews.	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	the departmental written Arrangement for lone/out of hours working for field work is followed
	lone or isolated working is not allowed
	location, route and expected time of return of lone workers is logged daily before work commences
	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
	all workers are fully familiar with emergency procedures
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

FIELDWORK   2   May 2010

ILL HEALTH	**The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.**

e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? Food poisoning, flu, stress-induced headache – low risk
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

YES	an appropriate number of trained first-aiders and first aid kits are present on the field trip
YES	all participants have had the necessary inoculations/ carry appropriate prophylactics
YES	participants have been advised of the physical demands of the trip and are deemed to be physically suited
YES	participants have been adequate advice on harmful plants, animals and substances they may encounter
YES	participants who require medication have advised the leader of this and carry sufficient medication for their needs
N/A	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT	**Will transport be** **required**		**NO**	**Move to next hazard** **Use space below to identify and assess any risks**
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training			
	Is the risk high / medium / low?			

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	only public transport will be used
	the vehicle will be hired from a reputable supplier
	transport must be properly maintained in compliance with relevant national regulations
	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
	drivers have been trained and hold the appropriate licence
	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
	sufficient spare parts carried to meet foreseeable emergencies
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	Will people be dealing with public	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	all participants are trained in interviewing techniques
	interviews are contracted out to a third party
	advice and support from local groups has been sought
	participants do not wear clothes that might cause offence or attract unwanted attention
	interviews are conducted at neutral locations or where neither party could be at risk
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

FIELDWORK   3   May 2010

WORKING ON OR NEAR WATER	Will people work on or near water?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk

	lone working on or near water will not be allowed

	coastguard information is understood; all work takes place outside those times when tides could prove a threat
	all participants are competent swimmers
	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
	boat is operated by a competent person
	all boats are equipped with an alternative means of propulsion e.g. oars
	participants have received any appropriate inoculations
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	**Do MH activities take place?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any** **risks**
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	the departmental written Arrangement for MH is followed
	the supervisor has attended a MH risk assessment course
	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
	all persons performing MH tasks are adequately trained
	equipment components will be assembled on site
	any MH task outside the competence of staff will be done by contractors
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

FIELDWORK   4   May 2010

SUBSTANCES	**Will participants work with** **substances**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any** **risks**

e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?
CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

☐	the departmental written Arrangements for dealing with hazardous substances and waste are followed
☐	all participants are given information, training and protective equipment for hazardous substances they may encounter
☐	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
☐	waste is disposed of in a responsible manner
☐	suitable containers are provided for hazardous waste
☐	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	**Have you identified any other hazards?**	**NO**	**If 'No' move to next section** **If 'Yes' use space below to identify and assess any** **risks**
i.e. any other hazards must be noted and assessed here.	Hazard: Risk: is the risk		
CONTROL MEASURES	**Give details of control measures in place to control the identified risks**		

Have you identified any risks that are not adequately controlled?	**NO**	**Move to Declaration** **Use space below to identify the risk and what** **action was taken**

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research?	NO

If yes, please state your Project ID Number	

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION	The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

✓	I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk

✓	I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

NAME OF SUPERVISOR   **Joanna Williams**

FIELDWORK   5   May 2010