

IMPLEMENTING THE CIRCULAR ECONOMY IN BUILDINGS: PROCESSES OF SENSEMAKING IN DESIGN AND DELIVERY

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Resource consumption is inextricably linked to growing populations, economies and living standards, however this trend is fundamentally at odds with the finite nature of key resources and the fragile ecology on which the planet depends. The construction industry is a key economic sector, with a significant environmental impact, and as such it needs to develop and operationalise business models that reconcile some of the tensions that exist between economic and environmental prosperity. A promising approach to improving the productivity of resources lies in the principles of the Circular Economy, a closed loop model that keeps products and materials at their highest utility for as long as possible. However, there is limited understanding of how processes will need to change across the industry to accommodate this transition. This research focuses on the behavioural dimension of adopting Circular Economy models in buildings, which is based on the assumption that it is people, rather than technology, that are the key to embracing circularity. Findings are derived from qualitative case studies which are developed from semi-structured interviews in order to capture descriptive, in-depth and contextual knowledge. The preliminary results highlight two key phases for the successful implementation of circular solutions in buildings. The first centres on the process of initial decision making and project framing, whereby a clear, consistent vision of sustainable aspirations enabled narratives to be built around circular solutions. Secondly, the implementation of these solutions benefits from continual communication and consistent translation, linking corporate and sustainability targets to site performance. This suggests that the implementation of circular solutions is supported when parties align along strategic narratives, making the translation, demonstration and sharing of benefits derived from sustainability easier.

Keywords: circular economy, decision theory, design, sustainability

INTRODUCTION

The relationships between population growth, economic development and environmental conservation are complex, but in general, as economies expand so does the associated consumption of planetary resources (Jackson, 2009). During the twentieth century global consumption of raw materials rose at around twice the rate of population growth (OECD, 2018). However, these trends are fundamentally at odds with the crucially finite nature of these resources and the fragile ecology on which the

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planet depends for survival (Jackson, 2009). These tensions between growth, economic prosperity and environmental conservation are also reflected in the construction industry, which is one of the UK's primary economic sectors, accounting for 6% of the nation's Gross Domestic Product. However, the built environment is also a primary contributor to the UK's overall carbon footprint, accounting for nearly 8% of all primary energy and 24% of the UK's total waste (Stubbs, 2015). As such, the construction sector needs to develop and operationalise business models that reconcile some of the tensions between economic and environmental prosperity.

One promising approach to this problem is found in the Circular Economy model, which aims to prolong the productive life of resources. The Ellen MacArthur Foundation (2017) describes the Circular Economy as, "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (The Ellen MacArthur Foundation, 2017). This circular model is built on reducing, reusing, recycling and recovering, with reducing seen as the highest priority and recovering as the final option (Kirchherr, Reike and Hekkert, 2017). The concept of a Circular Economy, and strategies for its implementation, are receiving increasing attention amongst practitioner communities, which Kirchherr, Reike and Hekkert (2017) argue is because it provides a model for businesses to effectively operationalise sustainable development (Kirchherr, Reike and Hekkert, 2017; Ghisellini, Cialani and Ulgiati, 2016).

This paper first reviews some of the barriers to adopting Circular Economy models in the built environment, with a particular focus on complexity and behavioural decision-making as part of a project's design and implementation. Empirical data is drawn from a case study on 1 Triton Square, developed through interviews with professionals engaged on the project. The findings that have emerged from this data suggest that circular designs were enabled through strategic alignment between project actors, initiated by the development of strong project narratives, and followed through into the construction phase with consistent processes of translation.

LITERATURE REVIEW

Pomponi and Moncaster (2017) note that current research on the Circular Economy tends to focus on either the macro-scale, such as cities and eco-parks, or the micro-scale, such as manufactured products. However, they argue that this focus ignores both the unique complexity and the significant potential of implementing Circular Economy in buildings (Pomponi and Moncaster, 2017). While buildings are constructed from a multitude of manufactured products and materials, when combined, the dynamics of the design and construction process do not necessarily fit conventional models of manufacturing. Instead, buildings may be more comparable to Complex Products and Systems (CoPS) (Gann and Salter, 2000), which are defined as high cost, highly customised, engineering-intensive products or services that require a degree of knowledge production (Hobday, 1998). CoPS are typically delivered within projects, and as such resources and technical expertise are rarely managed or mobilised within a single firm (Gann and Salter, 2000). Since projects are typically delivered in collaboration with other firms "almost all innovations in construction have to be negotiated with one or more actors within the project coalition" (Winch, 1998). Therefore, as part of construction processes, it is the

interactions between players in the market that becomes crucial to the implementation of new ideas and models (Edquist, 2011). Pomponi and Moncaster (2017) argue that this behavioural dimension to adopting Circular Economy models in buildings is seldom featured in the literature (Pomponi and Moncaster, 2017). However, they also argue that there is a strong case for accelerating this, claiming that "it is people, rather than technologies, who are the key to embracing circularity" (Pomponi and Moncaster, 2017). This idea is particularly true of the initial decision-making process of a project, where uncertainty is at its highest and it is where some of the most influential 'project shaping' choices occur (Miller and Lessard, 2008).

The importance of the front-end decision-making phase in construction projects is being increasingly recognised, with key themes including the alignment of project and organisational strategies, dealing with complexity, accounting for biases in the estimation of benefits and costs; as well as the social geography and politics that exist within decision-making groups (Williams and Samset, 2010). Apply a behavioural decision making lens, Flyvbjerg (2005) argues that one of the primary problems with infrastructure projects is misinformation about costs, benefits, and risk, which he believes is caused by deliberate misrepresentation in order to increase a project's chances of being approved and ultimately funded (Flyvbjerg, 2005). This view of behavioural decision-making in projects assumes that decision-makers can be influenced by political interests, which allows for the introduction of opportunistic behaviour and conflict of interests (Stingl and Geraldi, 2017).

However, another view of the behavioural aspects of decision-making in projects assumes that "decision makers do not 'make' decisions, but are actors constructing narratives which will shape processes of attention, prioritisation and ultimately decisions", as such decisions are processes of sensemaking that are intertwined in the negotiation of meaning before, during and even after a project (Stingl and Geraldi, 2017). Applying a sensemaking lens focuses on the interplay of interpretation and resulting actions, as opposed to the influence of evaluation on choice (Weick, Sutcliffe and Obstfeld, 2005). Communication is a central component of sensemaking and as such, translation, negotiation and the development of common narratives are key. For example, Sorrell (2003) notes that while one party may have all the relevant information on the costs and benefits of an energy efficiency investment, it may be difficult to convey this to others (Sorrell, 2003). Similarly, project specifications will, consciously or not, be written from the perspective of one stakeholder, and as such will be subject to variable interpretations through each actor's different frames of reference and processes of sense-making (Alderman and Ivory, 2011).

METHODOLOGY

Considering cases where elements of circular design have been successfully implemented in the built environment, this research's methodology is chosen in order to effectively answer the question, how do design and decision-making processes contribute to the successful implementation of circularity? Since these research questions are descriptive in nature, this research employs a qualitative methodology in order to capture equally descriptive, in-depth and contextual knowledge. This takes the form of a series of comparative case studies, which provide an in-depth investigation of a contemporary phenomenon (Yin, 2018). This aims to develop an understanding of the causal relationships and mechanisms that exist within what is a complex social system. Comparative case studies enable the observation of patterns regarding similarities and differences across a moderate number of cases, and

therefore combine depth with a more extensive approach (Bergene, 2007). Studying common phenomenon across contexts is not a basis for prediction but to explore the existence and activation of a mechanism within different settings setting (Williams and Wynn, 2012).

Each case study is set within Arup, a multidisciplinary consulting firm specialising in the built environment, with cases selected primarily on account of the fact that each of the projects they describe have successfully implemented elements of circularity. Case studies are also bounded temporarily, ensuring that the research investigates relatively contemporary phenomenon. As such, each of the case studies chosen will have been active within the last 5 years. The emerging results from 1 Triton Square will be presented in this paper, while case studies of Sky Believe in Better Building and White-Collar Factory will be presented in future papers.

Project	Characteristics	Element of Circularity
1 Triton Square	Commercial property; London, UK; Refurbishment; Under construction	Refurbishment; Retention of existing structure and fabric; Health and wellbeing; Social focus
Sky Believe in Better Building	Commercial property; London, UK; New Build; Completed	Flexibility; Adaptability; Health and wellbeing; Social focus
White Collar Factory	Commercial property; London, UK; Redevelopment; Completed	Flexibility; Adaptability; Long life, loose fit; Easy to maintain; Health and wellbeing;

Basing each case study in a single organisation will, to some extent, control for the effects of organisational structure, business strategy and overarching design philosophy. Adopting a holistic, multi-case design will also account for the fact that contextual conditions and exogenous influences will vary across teams and individual projects. As such, it is important that each project case study receives equal empirical treatment and are analysed within their own project specific contexts. However, it is assumed that these case studies exist within open systems which are complex and have dynamic, permeable boundaries that are beyond a researcher’s ability to control. As such, it is assumed that this reality is hard to capture, and that we, often subjectively, experience only parts of it. Therefore, in order to holistically study these complex organisational phenomena, this research adopts a critical realist research paradigm (Bhaskar, 1975).

Data Collection

For the 1 Triton Square Case Study, data has been collected from multiple sources, including a non-exhaustive list of project practitioners, as well as associated internal documentation. This method enables the gathering of rich, descriptive data, which is collected within its real-world context and directly from the actors who have experienced the events being studied (Brinkmann, 2014).

Source	Affiliation	Type	Length
Project Director	Client	Interview	1 hour
Sustainability Manager	Client	Interview	1 hour
Sustainability Manager	Contractor	Interview	1 hour
Sustainability Consultant	Designer	Interview	1 hour
Project Leader	Designer	Interview	30 min
Sustainability Brief for Developments	Client	Document	33 pages
Project Tracker: Implementation of the 2015 Sustainability Brief for Developments	Client/Designer	Document	31 pages

The interview protocol adopts a semi-structured approach, which is designed to ensure that lines of enquiry are thorough and remain focused on the overarching research questions, while remaining open to potential avenues of questioning and avoiding those that are overly leading (Glaser and Strauss, 1967). Data gathering also occurs in parallel to the initial stages of analysis enabling the research to cycle between "emergent data, themes, concepts, and dimensions and the relevant literature" (Gioia, Corley and Hamilton, 2012). As such, the interview protocol recognises that the interview questions may change as the research progresses in order to follow wherever the informants lead the investigation of the overarching research question, "following the twists, turns, and roller-coaster rides involved in discovering grounded theory" (Glaser and Strauss, 1967).

Data Analysis

The data from these interviews has been coded thematically, first 'in-vivo' by remaining faithful to the informant's own language (King, 2012) and then by grouping these informant-centric terms and codes into categories based on more conceptual and theoretical terms (Gioia, Corley and Hamilton, 2012)

PRELIMINARY RESULTS

This paper presents results which have begun to emerge from the case study on 1 Triton Square, a significant redevelopment project in London's West End, providing environmentally responsible and socially active modern office space as well as improved public facilities. Key to the project's circular credentials is the retention of the existing structure and building facade, as well as the maximisation of wellbeing through exceptional amenities, daylight and social connectivity.

Emergence

A number of informants spoke about the early stages of the project as a process of exploration, with one noting that "there shouldn't be a ready-made template, because each job deserves that time of just letting it turn into something of its own accord". In the case of 1 Triton Square this process of emergence was described as being, in part, guided by "finding that special thing about that place, that location, what we're going to do there, and how that ties in everyone else", "it's the mindfulness of being in a nice place. You can't touch it, you can't measure it, but you know when you're there. You can clearly see that in different places." The intangibility of these aspirations were framed by the client British Land's almost conflicting priorities, with one informant noting that "they want to be [...] one of the landlords with the top end properties, but they [...] also want to feel like they're close to the ground [...] so their aspirations are on the whole [...] about creating, bridging that gap between the business side and making profit [...] and the people on the ground who they're not necessarily leasing the space to but it's [about] making sure that it feels open and united". However, it was noted that developing these aspirations into a physical scheme required extensive negotiation in order to translate this into a tangible design.

In terms of beginning to draw out and shape this vision British Land were guided by their overarching strategy, which is to deliver sustainable long-term value by creating 'Places People Prefer'. This includes developing attractive and engaging real estate through placemaking that promotes health, productivity and enjoyment. As well as a commitment to making a positive contribution locally through the promotion of social inclusion, interaction and accessibility. Bringing together the vision and the strategy, British Land were able to converge around a number of aspirational social, economic

and environmental trends by aligning their corporate and sustainability strategies around four focus areas. These include skills and opportunities, wellbeing, community and futureproofing. British Land used these four areas to successfully and strongly link their sustainability and corporate strategies, recognising that the value derived from sustainability, wellbeing and place making also have a positive impact on driving financial value, with one informant noting that “sustainability is very much part of what we do, and it is very much part of our business model, it has to sit with that”, “otherwise as a business we would not succeed.” Beginning the project with a lack of preconceptions enabled the emergence of ideas based around value-based outcomes, as opposed to technical outputs.

Adopting this approach meant that, as one informant put it, “you’re not always faced [with the fact] that demolition and rebuild is the only model in town”, with another noting that the translation of the vision and aspiration into a tangible design was “where the legacy piece comes into place for reuse and for respecting the space as it is and then seeing [...] what else does that mean [...] in terms of what’s there”. In terms of pushing the sustainability of a scheme this openness and clarity of vision allowed designers to demonstrate the strategic alignment of more sustainable, and in particular, circular solutions. For example, in addition to thorough investigation, calculations and data, informants noted the importance of creating narratives that were in line with the client’s language and values in order to inform and persuade. In doing so, designers were able to turn the retention of the facade “into a good story in terms of legacy for the client”, appealing to both their sustainability and corporate strategies, citing the market value increase and differential market positioning, as well as the significant reductions to carbon.

Delivery

However, an important aspect of implementing these sustainable and circular interventions is ensuring that they are followed through on, since there is a risk that solutions are lost as the project progresses. For example, informants noted that “we do know that sometimes further down the line, unless they are absolutely embedded in the spec there’s likely to be some push back when the cost comes into play and value engineering starts to take over.” In order to counteract this, the sustainability brief was designed to support this follow through by assigning clear lines of responsibility and accountability as part of the design team set up. Additionally, it was noted by informants that this responsibility didn’t “just land on a sustainability person, who’s sat in a corner somewhere and struggling to be heard. It is actually owned by every member of the team, and they’re aware of it from the offset.”

Another informant agreed, arguing that “having that clarity in terms of exactly what needs to be done by whom is essential.” In the case of 1 Triton Square, fostering this sense of ownership has been dependent on a number of factors. Firstly, it began with the client, with informants noting that you “start from your top level stakeholders”, and that “once you’ve secured that pitch and you have a really clear target, [it] makes it easier to translate that corporate target into something tangible for your design team and site team.” This was then furthered by a process of continual communication and consistent translation, constantly “linking the corporate world [...] to site performance and appreciating that those languages are very different”. For example, a goal of reducing embodied carbon in construction by 15% is a relatively abstract target, and while, as one informant put it “some people know what a tonne of carbon is [...] unless you are quite clear, I mean this much materials, I mean these are the things we

want you to do in terms of [...] passive design or, this is what we mean and it's in a spec, but we want you to make sure you do something else on site to push it. So, unless you've translated it then it's a no-go.”

However, there are a number of barriers that hinder this process of translation. In particular, the psychological barriers associated with asking people to re-evaluate and change their everyday practices, with one informant noting that “it can often feel personal to them. They've done things a certain way for years, they pride themselves on work they're doing”. As such, the skill in translating the benefits of sustainable interventions and creating shared understanding of intermediaries among actors, comes not just from having knowledge and data, but from being able digesting that information and communicate it in language that a site person will be able to relate to. For example, it was noted that when the design team “talked to the contractor [they] talked to them about why would it be good for them, [and] how it can reflect well on them to [...] implement this tougher methodology and change their practice.” Practically, this meant upskilling the workforce through consistent toolbox talks, with informants noting that “it goes from the top level all the way to the bottom level, and it's [about] having this meaningful unifying culture and to make sure that it is filtered through and communicated all the way down that enables us to perform, ultimately to perform better.”

DISCUSSION

As discussed, one of the primary barriers to implementing more sustainable solutions in the built environment has historically been the organisation of the construction industry itself, and in particular, the asymmetry of information and incentives between parties. For example, Sorrell (2003) notes that while one party may have all the relevant information on the costs and benefits of an energy efficiency investment, it may be difficult to convey this to others, arguing that enabling frictionless sharing of information would allow for more the more equitable distribution of benefits (Sorrell, 2003). Emerging from this research to date is a focus on processes of convergence and translation as well as the interplay of social geographies that exist within decision-making groups (Williams and Samset, 2010). Notably summarised by one informant, “it's about linking the corporate world [...] to site performance and appreciating that those languages are very different [...]. Often that is the performance gap that we see between [...] what the aspiration is, and what the end product is.” The preliminary results highlight two key phases for linking corporate and site performance in order to successfully implement circular solutions in buildings.

Project Framing

The first centres on the process of initial decision making and project framing. Here Weick, Sutcliffe and Obstfeld (2005) argue that the process of “sensemaking starts with chaos” and the organisation of flux (Weick, Sutcliffe and Obstfeld, 2005). Beginning the project with a period of flux and a lack of preconceptions enabled the emergence of ideas based around value-based outcomes, as opposed to technical outputs. As such, a clear, consistent vision of sustainable aspirations enabled narratives to be built around circular solutions. In addition to thorough investigation, calculations and data, parties were able to utilise narratives that were aligned strategically, as well as to each other's language and values in order to inform and persuade. For example, designers were able to turn the retention of the facade “into a good story in terms of legacy for the client”, appealing to both their sustainability and corporate strategies, citing the market value increase and differential market

positioning, as well as the significant reductions in carbon and material impacts. As such, the implementation of circularity and the associated decision-making processes were dependent both on evaluation, through thorough investigation, calculations and data, as well as what Weick, Sutcliffe and Obstfeld (2005) describe as the interplay of interpretation and resulting actions, which included the translation and negotiation of design (Weick, Sutcliffe and Obstfeld, 2005).

Translation

Secondly, the implementation of these solutions benefited from continual communication and consistent translation, linking corporate and sustainability targets to site performance. Communication is a central component of sensemaking and as such, translation, negotiation and the development of common narratives are key. In this case the skill in translating the benefits of sustainable interventions and creating shared understanding of intermediaries among actors, came not just from having knowledge and data, but from being able to digest that information and communicate it in language that a site person will be able to relate to. This empathetic approach to translating and communicating benefits was particularly important in overcoming some of the psychological barriers associated with asking people to re-evaluate and change their everyday practices. When combined, the strong project narrative, as well as the empathetic translation created a meaningful unifying culture, suggesting that the implementation of circular solutions is supported when parties align along strategic narratives, making it easier to translate, demonstrate and share the benefits of sustainability.

CONCLUSIONS

The preliminary results from this research have highlighted two key phases for the successful implementation of circular and sustainable solutions in buildings. The first centres on the process of initial decision making and project framing. In the case of 1 Triton Square, a clear, consistent vision of sustainable aspirations enabled narratives to be built around circular solutions. For example, the retention of the facade provided a “good story in terms of legacy for the client”, appealing to both their sustainability and corporate strategies, citing the market value increase and differential market positioning, as well as the significant reductions in carbon and material impacts. Secondly, the implementation of these circular solutions, have to date, benefited from consistent follow through, including clear lines of responsibility and accountability, as well as processes of translation, which creates a unifying culture that ensures sustainability targets are filtered through and communicated to those on-site.

While split incentives are often cited as a primary barrier to achieving sustainability in the built environment, it is understandable that differing priorities exist between parties acting with a project coalition. However, these preliminary results suggest that instead of attempting to align incentives, there is a benefit in parties aligning along strategic narratives, making the translation, demonstration and sharing of the benefits from sustainability easier. This supports previous work by Alderman and Ivory (2011), which theorises that translations are more efficient in convergent projects where “understanding of intermediaries among actors is shared” (Alderman and Ivory, 2011). This work contributes to literature on behavioural decision-making in Complex Products and Systems (CoPS), with a focus on this in the context of applying Circular Economy models in the built environment. Applying a behavioural decision-making lens to the implementation of circularity suggests that decision-

making processes may need to be cognisant of both technical evaluation, through thorough investigation, calculations and data, as well as what Weick, Sutcliffe and Obstfeld (2005) describe as the interplay of interpretation and resulting actions, which included processes of translation and negotiation (Weick, Sutcliffe and Obstfeld, 2005).

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