FORMULATING CIRCULAR BUSINESS MODELS FOR TRANSFORMING OFFICE BUILDING INTO COLLECTIVE SELF-ORGANIZED HOUSING

Ruowen Gao
Faculty of Architecture & the Built Environment, Delft University of Technology
Julianalaan 134, 2628BL Delft

ABSTRACT

This paper focuses on formulating feasible circular business models to help achieve circularity in transformed collective self-organized (CSO) housing projects. Transforming vacant office buildings into CSO housing projects using circular design strategies might be a promising attempt to mitigate housing shortage problem. This adaptive reuse can also contribute to the transition towards the circular built environment. Through literature review, the necessity of establishing circular business models to coordinate stakeholder interaction in a CSO housing has been discussed. Followed by case studies analyzing renowned pioneering CSO housing projects, this research explicitly studied how CSO housing management models operate in long-term. This research discovered the close relationship between CSO housing models and circular built environment: the non-profit, inclusive and collective orientation of CSO housing directly leads to coordinated and transparent interaction between all stakeholders, that substantially contribute to achieve circularity. The findings will be applied as guidelines to help increasing the level of circularity for a specific case afterward: the redesign of the vacant Tesselschadestraat 4, a former tax office in Leeuwarden.

KEYWORDS: *circular built environment, adaptive reuse, business model, collective self-organized housing*

I. INTRODUCTION

Circular economy (CE) strategies seek to reduce the total resources extracted from the environment and reduce the wastes that human activities generate in pursuit of human wellbeing (The Ellen MacArthur Foundation, 2021). In the building sector, one of the ways to contribute to CE is the adaptive reuse of abandoned buildings (Foster, 2020). It is beneficial for the environment since refurbishment usually creates lower carbon emissions than new construction, and the lifespan of the building usage is extended (Assefa and Ambler, 2017).

Energy inefficiency and costly refurbishment have caused an excessive stock of vacant office buildings in the Nederland (Remøy et al., 2011). New business opportunities are needed for these vacant office buildings, as the convention of demolition and new construction contradict the principles of CE (Ascott, 2021). Meanwhile, the lack of affordable housings urges the Dutch housing market to inquire about new possibilities (Housful Project, 2020). Housing business models are required to increase the circularity level in combination with affordability, durability, safety, health and comfort (3XN architects, 2016). Repurposing vacant office buildings into collective self-organized (CSO) housing (Di Giulio et al., 2013) projects using circular design strategies might offer opportunities to mitigate both problems (Geraedts et al., 2016).

However, only limited refurbishment projects or CSO housing construction explicitly examined and applied circular principles: it remains a niche market (Eikelenboom et al., 2021). One of the most crucial reasons is that linear business models are outdated and can no longer support the changing needs of the circular built environment (CBE) (Dokter et al., 2021). Therefore, new feasible and compatible business models are needed to support the transition to the CBE.

II. METHODOLOGY

Relevant academic literature and scientific articles were chosen to provide an overview of existing knowledge of adaptive reuse; circular economy and stakeholder interaction; collective self-organized housing models. In addition, a series of CSO projects were also selected as case studies, a table of comparative analysis was developed. An evaluation of these projects was given to explain further the reasons for their success (or failure). Main findings were categorized afterward. The feasibility of the findings will be further tested and discussed when applied to the re-design of chosen case: the former Tesselschadestraat 4 office building, Leeuwarden, the Nederland.

III. LITERATURE REVIEW

3.1. Adaptive Reuse Market and Circular Built Environment in the Nederland

Developers and investors are aware of the environmental benefits in adaptive reuse projects: buildings can be reused circularly through selective deconstruction and building system reuse (Bosone et al., 2021). However, they are concerned that it will be hard to assess conversion opportunities and risks to define conversion potential, stopping them from making massive investments (Remøy et al., 2009). Geraedts & Van der Voordt (2007) have developed a 'conversion meter' to tackle this situation. They have pointed out that the functional adaptability of vacant buildings is critical to conversion feasibility, mainly depending on the buildings' structural grid measurements. Mackay et al. (2009) found that the major cost generator for most office-to-housing conversions is facade-alteration (27%). Apart from the technical aspect, Remøy and van der Voordt (2014) also addressed that adaptive reuse requires that the location suits the demands of the new target group.

Despite the current trend to invest in adaptive reuse and its promising market expectation (Peter, 2021), Geraedts et al. (2017) had criticized that most transformed projects in the Netherlands were reused without adaptability and flexibility due to the lack of considering the end-of-life situation. The emerging concept of the circular building might provide leverage for change in this respect (Schneider & Till, 2005). The circularity and flexibility of the housing unit can, in turn, open up to new product supply chain and service models (Geldermans et al., 2019). However, the transition towards CBE is still at an early stage, focusing mainly on recycling materials (Benachio et al., 2020). Additionally, the initial investment in process changes has also caused stakeholders to avoid risks and thereby slow down the process of transition towards CBE (Kuebix, 2019).

3.2. Circular Economy (CE) Plans Rely on Stakeholder Interaction

As the built environment needs to transform into a resource-effective one soon (Çetin et al., 2021), multiple circular strategies for the building sector have been identified. Technical-material oriented strategies have been applied widely in recent practices. Including the Shearing Layers (Brand, 1994), the R Principles (PBL Netherlands Environmental Assessment Agency, 2018), Design for Disassembly (Guy & Ciarimboli, 2005), Buildings as Material Banks (BAMB, 2019) and Material Passport ('Material Passport', 2021). Moreover, contrary to popular belief, Turk (2019) argued that the circular supply chain model is more economical in the long term for companies and users.

However, the transition towards CBE is not an isolated problem, and technology might not be the biggest bottleneck to achieve CBE (Peck & Klein, 2019). CBE calls for the collaboration of all stakeholders so that buildings can easily be changed in response to changing demand and preferences (Bektas et al., 2014). Therefore, the biggest challenge ahead will not lie in further technological innovation but in "the role of people, both individuals and society as a whole" (Visser, 2021). It has even been argued that without considering social elements, the CE will remain a technical tool that does not change the course of the current unsustainable economic paradigm (Korhonen et al., 2018).

Therefore, as we provide new technologies to provide answers, coordinated interaction and cooperation among people need to go with it (Piaia et al., 2017). In other words, feasible financial arrangements, increased interaction, collaboration and co-creation among all involved stakeholders is the precondition for success (Gorgolewski, 2017). To help implementing circularity in the building sector, Blomsma et al. (2019) developed a framework of how businesses among different actors can operate in CE.

3.3. CSO Housing Business Models for Coordinating Stakeholder Interaction

A collective self-organized community is where people choose to live in shared services, green spaces, collective areas and low energy buildings (Heffernan & Wilde, 2020). It aims to promote social interaction, mutual support and good neighbourly relations (Brunoro, 2016). The primary approach to realizing CSO housing model are: participating in design, service sharing, local management, energy-saving technologies and optimized energy sources at district level This approach leads to a shared ideology and a strong communal life (Brouwer et al., 2014).

Sharing is the foundation of the CSO approach (Palmer, 2020). The sharing of goods and services can reduce living's cost by reducing waste and optimizing external services (Brunoro et al., 2018). Sharing occurs in three overlapping realms: labour and resources; property; governance, among which shared governance plays out directly in management decisions. A community with shared governance is considered as a cooperative of all stakeholders, including its inhabitants. The cooperative has a decisive influence on approving expenditures, investments and future expansion based on democratic election. Members of the cooperative are encouraged to serve and discuss everything related to the community. This creates an ongoing feedback loop allowing management to respond to members' changing needs (Asani et al., 2021).

In this perspective, the approach of CSO housing coincides with the need of CBE: strong and coordinated collaboration of all participants during the whole lifecycle of a building. This nature of a strongly coordinated interaction of CSO housing business model might be the missing link to help realise a circular housing project.

IV. CASE STUDY

Firstly, a relatively comprehensive insight into CSO housing model was created by studying a series of CSO housing projects from authoritative publications and renowned offices, out of which nine cases were chosen to be discussed in detail (see Table 1.). They were specifically selected due to their distinguished features on business model. These projects have managed to be built under limited funding from various sources; implement interaction and participation of all parties from the beginning of the planning, and eventually come up with management model that stably operate in long-term. Table 1 is a summary of the main features of their ownership, operations and affordability.

F	G	H	I
[RO*SA]22 vienna	**VRIJBURCHT** amsterdam	**WARMBACHLI** bern	**KALKBREITE** zurich
2009	2007	2021	2016
NEW multifamily building	**NEW** mix used perimeter block building	**REUSE** existing building	**NEW** mix used perimeter block building
100 single parents, professional and unemploed	**151** family, singles, seniors youth with mental impairments.	**190**	**256** old and young, Swiss and non-Swiss.
6,660,000 euro	16,000,000 euro	40,000,000 euro	67,000,000 euro
rent 6.14€/sqm/month ind. shared spaces deposit 432€/sqm	purchase 2420€/sqm service cost 19€/sqm/year ind.shared spaces.	average 19€/sqm/month (cost induced)	250€/sqm/month indu. common spaces resident pay the 1000€ share in the cooperative when move in.
nonprofit housing developer *WPV-GPA* city of vienna	Vrijburcht Foundation Amsterdam city in cooperation with the De Key Housing Foundation	members' cooperative shares bank loans bequesta and donations commercial income	Housing cooperative Kalkbreite membership to share capital commercial income
site and building: property of building developer *WPV-GPA.* residential space: subsidized rental flat. (option to buy after 10 years)	site: property of the city. residential spaces: private owned/long-term lease agreements with tenants. commercial spaces: housing association.	cooperative and site: property of bern city heritable building right contract with *warmbachli cooperative*	owned by the *cooperative*
self-managed by building residents' association.	owner association manages private flats, building and general shared spaces. *vrijburcht foundation* manages special shared spaces.	owner association manages private flats, building and general shared spaces. *The Warmbächli housing cooperative* manages commercial	residents' association+external management. a full-time staffed service centre is installed to manage the daily activities. 200 jobs
/	40 employees (café+restaurant)	small business space is provided with reasonable rental price.	As the building contains many shared and commercial functions, partly ran by external operators, and partly by residents.

		A	B	C	D	E
	NAME location	**OSTELLOLINDA** milan	**VINZIRAST-MITTENDRIN** vienna	**L'ESPOIR** brussles	**REFUGIO** berlin	**ALTES SCHULE KARLSHORST** berlin
1	**year of construction**	2004	2013	2012	2015	2013
2	**building types**	**REUSE** of former psychiatric building as hostel	**RENOVATION** historical building	**NEW** multifamily building	**RENOVATION** historical building	**REUSE** of school building as muitifamily building
3	**residents**	**38** 3 permanent, up to 35 guests.	**27** 13 students and 14 homeless.	**80** 14 low-income immigrant families.	**40** 20 with and 20 without refugee experience.	**60** families, singles, senirs
4	**total project cost**	/	/	3,014,000 euro	few renovation were neccesary.	3,300,000 euro
5	**affordability**	rent-free by the management organization. *nirent gurda hospital* cover residents' expenses. hostel covers	approx. rent 10€/sqm/month incl.shared spaces	puchase 1727€/sqm 1402€ with subsidisies	rent 400€/room/month incl. shared spaces	rent 4.65-7.5€/sqm/month incl. shared spaces cooperative deposit 500€
6	**financing**	European Union, Fondazione Cariplo Niguarda Hospital , income of hostel	sponsoring and donation vienna housing construction subsidies income from rent and usage fees	NGOs: Brussel woningfond CIRE	Berliner Stadtmission income from rent donations, events, building	nonprofit trias Foundation for land, ecology and housing donation from SelbstBau
7	**ownership**	site and building: property of milan city. user rental agreement with social cooperative.	site and building: property of private *vinzirast foundatio.* coordination and renting: *vinzenzegemeinschaft st. stephan associatio.*	self-used private owned.	owned and rented out by *berliner stadmission.*	building: property of cooperative non profit foundation *stiftung tria.* long-term lease agreement with rental cooperative
8	**management and operation**	*La fabbrica di olinda* as project manager.	runs by *vinzenzegemeinschaft st. stephan* association.	self-managed	self-managed by building residents' association.	self-managed by building residents' association.
9	**job opportunity created**	people with mental disabilitie live and work in a hotel and are hosts for guests	long-term living and working opportunities	none	café run by residents and volunteer friends	people of different skills craft, architect, social work are rewarded with a commen meal or informal discussion.

Table 1. CSO housing ownership, operations and affordability

As can be concluded from Table 1, several common principles and reoccurring themes have made the business models of these projects successful, while there are issues that need to be avoided to prevent failure in long-term. Findings on their management approaches will be summarized in the next section.

V. FINDINGS

In most cases, the project is designed to be inclusive for various people, lifestyles and age groups within the community. As a result, the participants' different individual needs and the communal facilities' shared requirements interact in a multi-dimensional way. The main findings are concluded in the order of the forming of a CSO community: (5.1) choosing of location (5.2) initiating and funding (5.3) co-ownership (5.4) co-management (5.5) long-term operation.

5.1. Choosing of location: historical building renovation

1) A high architectural or cultural-historical value and being marked as a monument (B2&D2) will hinder demolition and thus stimulate adaptive reuse.
2) While requirements to keep and preserve its value can, in turn, hinder adaptive reuse. For instance, balconies cannot be added to the façade (B2).
3) Agreed government supervision can help with the preservation. For instance, in ‘Ostellolinda’ (A7), the Milan city reviews its contract with the cooperative every four years, which makes it difficult for Olinda to make a long-term investment and major renovation.

5.2. Initiating and funding: dealing with Limited and Insufficient Funding

1) The city owns the site and the building while providing a long-term leasing contract with a rental cooperative (E7&G7).

2) Subsidies from administration level and housing allowance from the tax office to lower rents (C5, D5&F5).
3) Providing job opportunities within community, for example, jobs in café and restaurants (A9, D9, E9, G9, H9&I9). As people with housing problems are often dealing with social exclusion, this can also help them to be included in society again (D9).
4) To lower the risk and difficulties of large initial investments, with an existing building renovation (where the construction is relatively simple and low-tech), tenants can help reduce the construction costs: they can directly participate or be trained to work on the construction (D4). Tenants can move in with little renovation work done.
5) CSO housing models are mainly based on partnerships among municipalities, housing companies and communities formed by renters interested in sharing services and expenditures (B8, E8, F8, G8, H8&I8).

5.3. Co-ownership: a third way between renting and owning

1) Meaning residents have the right to use/profit/alter, but no/limited right to sell. This offers a non-profit, stabilising compromise between renting and owning.
2) As a third way between renting and owning, it is important to gain cooperatives as partners in the planning of community housing projects to stimulate synergies between all parties (A6, B6, H6&I6).
3) In the design phase, together with the architect, contractor, organisation and housing cooperative, decisions are made collectively.
4) Discussion and decision workshops are usually held to develop a method and structure to guarantee democratic planning (I8).
5) cooperatives can vary in structure depending on size and mission, but some features are common to all. Members elect the (volunteer) board and various (volunteer) committees, and the board makes strategic decisions and appoints the (professional) management. The purchase of a share makes a member a resident and co-owner of the cooperative (B8, D8&F8).
6) A cooperative's equity is crowdsourced among its residents through the sale of shares. A share is a certificate of partial ownership of the cooperative corporation and entitles residents to participate in the governance of the organization.

5.4. Co-management: residents' self-managed association

1) In most cases, participants themselves select tenants and the manager of the shared spaces (G8, H8&I8).
2) In small scale projects, the whole community is run by residents themselves, including the public accessible spaces such as rentable outdoor gardens and theatres (C8&D8).
3) Large scale projects need more management assistants than the tenants' association alone. For example, in 'Vrijburcht', advisors and contractors were hired by the Vrijburcht foundation during the development process to monitor financing; the foundation ensures the involvement of 'the key' housing association to provide financial assistance for apartments.
4) Most commercial spaces require qualifications (café/restaurant/fitness) are run by professionals. They need to share income or pay rent to the community (H9&I9).

5.5. Long-term operation: diversity of target groups improves the stability

1) Various groups can encourage communication while contribute various skills (craft/design/ management/finance) to the community (A9, D9&E9).
2) The multi-group composition may require certain limitations. For example, income certificate is needed (B3, C3&F3).
3) However, binding of certain group of people might not be feasible in long-term (B3).

VI. Conclusion and Discussion

To conclude, CSO housing management models must have a non-profit orientation to prevent speculation and gentrification. In addition, the approach must be systemic and needs to create incentives for all involved parties to start the transition (GXN & Responsible Assets, 2018). This approach also

offers solutions for those with lower incomes with its inclusive and collective orientation. To unlock and stimulate interaction, governments of all scales play a vital role (Cramer, 2021). This top-down approach also encourages bottom-up participation, as citizens can get involved from all sorts of organisations (LaFond et al., 2017). In the integrated design process, the reuse of the previous best solutions and sharing collective knowledge is essential to encourage interactions between actors (Brunoro et al., 2018). Apart from reasonable planning and design, it is the ability and willingness to compromise that have made these projects eventually work. Yet, people need to be realistic about what they can achieve within the boundaries of their own project. In this way, inhabitants can avoid struggling with utopian dreams but instead, realising the best possible scenario for themselves. That is, to recognise cooperation and conflict, not to romanticize autonomy and empowerment.

Shared governance and shared ownership of CSO housing directly shape the configuration of cooperative architecture (Gao, 2015). The fact that resources are limited and must be shared has encouraged cooperatives to respond with new spatial strategies (JOVIS, 2013): in this kind of projects, offering places for interaction and others for retreat is, in fact, a necessity, not a luxury. Bigger space is provided for each to create and change. In this way, the project can be spontaneously and automatically refined by the users. CSO housing management nature has resulted in several de-hierarchical spatial and design advice, this can be further discussed afterward in the upcoming design phase.

Additionally, architects play an essential yet very different role in a transformed CSO housing project. It is not just about design. Architects should start to realise their radically changing roles and responsibilities. Instead of creating something new, it has come to the time that we no longer find ourselves in a situation like that of the 1970s and 80s: when those great assignments 'in which one could believe in the possibility of inventing the city' were plentiful (Lacaton et al., 2013). From this perspective, conversion is rather a cultural act. All this ends up leading us to a contemporary position as an architect and how can architect contribute to the circular new world.

The limitation of this research is that very few of the reviewed studies explicitly examine the circular transition of the housing sector; not many projects have combined circularity and CSO housing in the current market. Future research can be done when more detailed data is available.

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