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TOWARDS A FRAMEWORK FOR INVESTIGATING SOCIO-CULTURAL BARRIERS TO CRADLE-TO-CRADLE PRINCIPLES IN BUSINESS PARK DEVELOPMENT

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Abstract. *The cradle-to-cradle (C2C) philosophy has been described as a paradigm changing innovative platform for achieving ecologically intelligent and environmentally restorative buildings. Whereas conventional sustainability efforts focus on doing "less harm" to the environment, C2C proposes a radically new way of thinking about waste, renewable energy and promotion of diversity. Industry specific barriers to change however hinder adoption of C2C in the built environment. In this study, it is argued from a synthesis of extant literature that many of these barriers are rooted in socio-cultural factors, a better understanding of which could help accelerate adoption of C2C principles in the built environment. Using business park developments as a backdrop, a framework for interrogating the socio-cultural context within which development projects take place and barriers to C2C adoption is proposed. The framework incorporates the competing values framework which is adapted to facilitate diagnosis and matching of different organisational value profiles to the choices that development stakeholders are likely to make in relation to C2C implementation. A key theoretical proposition which derives from this framework is that stakeholder organisations that subscribe to open system values are more likely to overcome socio-cultural barriers and implement C2C principles as a design model compared to stakeholder organisations that orient towards internal process values. It is anticipated that culture profiles of key stakeholder organisations and the nature of their alignment towards C2C oriented changes will be identified through empirical testing of this framework.*

Keywords: *business parks, cradle-to-cradle, competing values framework, socio-cultural barriers.*

1 INTRODUCTION

The cradle-to-cradle (C2C) philosophy has been described as a paradigm changing innovative platform for achieving ecologically intelligent and environmentally restorative buildings (Mulhall and Braungart, 2010). Whereas conventional sustainability efforts focus on doing "less harm" to the environment, C2C proposes a radically new way of thinking about waste, renewable energy and promotion of diversity such that human systems can mimic the functioning of natural ecosystems where there is no waste generation and the primary source of energy is the sun. Despite the growing technological, social and economic prospects of C2C implementation in the built environment, its adoption as a design strategy for achieving a positive synergy with the environment has been rather slow. Hoffman and Henn (2008) have argued that in spite of overcoming formidable technological and economic hurdles in recent years, environmental progress in the building design and construction industry would

continue to stall if social and psychological barriers are not addressed. This argument clearly establishes the fact that a significant barrier to C2C adoption is the socio-cultural context within which development projects take place. There is the need therefore to fully interrogate potential socio-cultural barriers to the implementation of C2C in the built environment so as to aid the formulation of appropriate strategies for overcoming such barriers.

The aim of this paper is to identify the various socio-cultural barriers to C2C implementation in the built environment, using business park developments as a context. Based on this, a framework is proposed for pilot testing to guide further empirical studies on the extent to which such barriers inhibit the adoption of C2C principles amongst key stakeholders involved in business park developments. Business parks as used in this study consist of a clustered agglomeration of businesses involved in different functions which can range from manufacturing production, retail, and export processing, to technology or research parks (Memedovic, 2012). Such clustered developments are very ideal for C2C implementation.

The next section discusses the C2C concept followed by a review of the relevance of business parks as hubs for economic development with negative environmental implications. The relevance of C2C in this context as a long-term strategy towards the achievement of a truly positive synergetic relationship with the environment is presented before discussing potential socio-cultural barriers to the implementation of C2C principles. Based on these discussions, a socio-cultural study framework which is underpinned by the competing values framework is proposed as a guide to further interrogate the socio-cultural barriers to C2C implementation.

2 CRADLE-TO-CRADLE PHILOSOPHY

The C2C philosophy provides a platform for a conceptual shift in thinking from the linear cradle-to-grave model of development where waste is accepted as a by-product, sometimes recycled but then eventually ends up in landfill and where energy is predominantly from fossil fuels. Even with recent sustainable development efforts which have sought to alter this linear end-of-pipe development models such as circular economy and industrial ecology, a reductionist approach which does not create a true spiral loop/circular flow of materials and energy has often been the outcome. Sustainability in itself is viewed by most organisations as the simultaneous improvement in social and human welfare whilst reducing any ecological impact in the quest to effectively achieve the organisations objectives (Sharma and Starik, 2002). But the overarching question is why the target should be a reduction in negative ecological impact when a truly positive impact can be realised by re-configuring the current and pre-dominant model of development–zero carbon, zero emissions, and zero waste. This is the question that underpins the C2C design and development philosophy.

With inspiration from the earth's natural ecosystem where biogeochemical processes which are powered by the sun's energy sustain all biological systems without any waste generation, the C2C philosophy aims for designs that function in the same manner as naturally occurring and regenerative processes (McDonough and Braungart, 2003; Debacker et al., 2011). Thus rather than managing waste, the C2C goal is to design products and systems that are ecologically intelligent so that materials from products and systems eventually serve as "nutrient" feeds for other biological or technical systems after their service life. This approach envisions a total eradication of waste as these become beneficial nutrients that support/feed into other useful processes (McDonough et al., 2003). McDonough et al.

(2003) proposed three tenets of C2C as:

- Waste is equal to food: waste either serves as a technical or biological nutrient
- Use of current solar income: dependence on solar sources of energy
- Celebrate diversity: promoting biodiversity, cultural and conceptual diversity.

3 CRADLE-TO-CRADLE IMPLEMENTATION IN BUSINESS PARKS

Business parks provide the institutional framework, modern services, physical infrastructure and assistance for local companies through forward and backward linkages that can support new enterprise incubation, start up's and knowledge sharing for the mutual benefit of all businesses and are often conceived as hubs for economic development (Ratinho and Henriques, 2010; Memedovic, 2012). The planning and development process of business parks is somewhat underpinned by the concept of cluster development in regional planning which is an umbrella concept for the agglomeration of interlinked businesses. Business parks can vary based on their core function and are either categorised as science/technology parks, research parks, light industrial parks, heavy industrial parks, export processing zones/parks, retail parks or even mixed use parks. A key strength of cluster developments is the provision of common services to businesses that might otherwise be too costly for any single business to invest in (Memedovic, 2012).

Business parks have in the past been associated with poor environmental management, pollution, traffic congestion and reduced quality of life (Memedovic, 2012) even though it is a good model for economic development. High energy consumption as well as waste from industrial production can contribute to negative environmental and social impacts. Despite well-intended efforts from industrial ecology and circular economy studies which have sought to create a closed-loop of material and energy flows through symbiotic sharing of materials and utilities (Gibbs, 2003), a true closed loop system has not been achieved. Eco-industrial parks (EIPs) for instance have often focused on a vision of reduction in negative environmental impacts by creating inter-linkages between businesses to ensure that energy, water, and materials are managed sustainably (Lowe et al., 1998). Consequently there is scope to explore opportunities for realising a truly positive ecological impact of business parks whilst at the same time promoting economic and social benefits. Tudor et al. (2007) have even suggested that there should be more emphasis on thinking beyond "sustainability" in the development of EIPs. This dovetails neatly into the C2C agenda for business park developments.

The C2C vision proposes to integrate features into the spatial development of business parks that would facilitate true recycling of technical and biological nutrients, promote cultural, intellectual and bio-diversity and derive energy from solar or other renewable energy sources. These features could be bio-digester, constructed wetlands, waste water treatment ponds, and rainwater recycling installations all of which can aid the extraction of biological nutrients in wastewater from the business park. The business park can also be designed with recyclable building components, interiors and materials as well as planning to support a symbiotic sharing/circulation of technical nutrients that would otherwise have become waste. Positive emissions could also be promoted through use of self-cleansing and self-purifying façades (Hüsken et al., 2009), roof gardens and vertical gardens throughout the park.

Biodiversity can be promoted through incorporation of features such as gardens, fish ponds, green roofs and aquaponic ponds that provide space for flora and fauna to flourish. Cultural diversity can be promoted through joint sharing of infrastructure, incorporation of

local materials and features in designs as well as incorporating features that support livelihoods of local communities around the business park. Conceptual diversity can be promoted through aesthetically pleasing features, design innovation and flexible, adaptable mixed use park designs. The energy vision is to promote direct utilization of solar energy through the incorporation of photovoltaic roofs and skylights, solar roof and wall panels or stand-alone solar photovoltaic or solar thermal installations. Indirect utilization of solar energy can also be promoted in the business park through features such as bio-gas plants, geo-thermal plants, wind turbines or small-scale hydro plants depending on local conditions. The C2C objectives as well as how these can be achieved in business park developments have been summarized in Table 1.

C2C objectives	C2C implementation strategies
Environmental objectives To ensure that waste generated is equal to food for other processes To ensure that energy is wholly derived from solar and other renewable energy sources To ensure that biodiversity is promoted	Design business park to be wholly dependent on renewable energy sources Design individual units that can clean the surrounding air, generate energy, recycle water and serve as habitat for flora and fauna. Design individual building units so that they can easily be dis-assembled and recycled without reducing material value. Avoid the use of toxic and hazardous materials both in development and operation of business parks Design flexible and mix-use building units that can easily be adapted for different functions Cluster businesses/companies to support industrial symbiosis Create habitats for flora and fauna in the business park.
Economic objectives To ensure that businesses are more profitable To engender local and regional economic development Increased commercial attractiveness of business park	Operate the facility on solar and renewable energy sources to alleviate cost of energy Treat and reuse wastewater to alleviate cost of water. Exchange materials as nutrients across businesses to alleviate cost of waste disposal.
Social objectives To improve the quality of life of local community To conserve local culture and heritage by promoting cultural diversity To provide facilities and services to serve development needs of local community	Use locally available materials for development as well as design to reflect local heritage Provide opportunity for training and development of workers and community Integrate features that create a comfortable and healthy working environment and community. Integrate features that create livelihoods for local community

Table 1: Cradle-to-cradle objectives and implementation strategies in business parks

4 SOCIO-CULTURAL BARRIERS TO C2C IMPLEMENTATION IN BUSINESS PARKS

Hoffman and Henn (2008) have argued that overcoming technological and economic hurdles alone are not sufficient for making environmental progress in the building, design and construction industry unless social and psychological barriers are overcome. The development of business parks involves a wide range of stakeholders. These range from planning and regulatory authorities to private developers, regional development agencies, engineers, architects, contractors as well as preservation groups and local community groups. Socio-cultural barriers could therefore manifest to varying degrees amongst these development stakeholders and thus inhibit C2C adoption irrespective of the potential social, economic and

environmental prospects. Petersen and Andersen (2009) and Hoffman and Henn (2008) provide some insight into such socio-cultural barriers to change. Barriers identified in these studies and other supporting literature is discussed under five main themes.

4.1 Self- interest versus collaboration

Hoffman and Henn (2008) revealed that some stakeholders could resist a more integrative approach to green construction as they may feel threatened that this would disrupt already existing structured role systems of designs flowing from the architect to engineers and then to contractors. The same argument could apply to C2C implementation where new structures that can promote collaborative joining of forces to stimulate and promote "new thinking" during design development could be resisted by some stakeholders. This lack of collaboration can also be fuelled by competing interests amongst stakeholders leading to sub-optimal decisions (Bechky, 2006). For instance developers may only be concerned with initial capital costs, whereas users may be more concerned about long-term cost savings (Van Bueren and Priemus, 2002). This situation creates a lack of leadership or power vacuum for implementing C2C in business parks. A high level of early collaboration involving non-traditional design development stakeholders such as environmental experts, chemists or even energy experts is needed to achieve C2C designs. At the operational stage of the business park, a high level of collaboration amongst users is also needed to facilitate the symbiotic sharing/exchange of technical nutrients and sharing of common utilities and infrastructure. Petersen and Andersen (2009) have however argued that the modern society favours individualism at the expense of collaboration which then inhibits communal use of technologies.

4.2 Short-term versus long-term focus

It has been argued that developers and consumers alike are more concerned with immediate returns irrespective of the longer term benefits that can be reaped from lower operating costs of facilities (Hoffman and Henn, 2008). Chalifoux (2006) also revealed that construction professionals tend to eliminate green building features during value engineering exercises without taking life cycle cost assessments into consideration even though this raises the operational costs of buildings. Similar findings have been echoed by Grosskopf and Kibert (2006) who revealed that consumers are more willing to buy into features with shorter capital cost recovery periods. This short-term focus could be a potential barrier to C2C implementation in business parks given that C2C is a life-cycle phenomenon that can be facilitated by a longer-term focus.

4.3 Risk Aversion versus Risk Affinity

Given that building projects and more so spatial developments like business parks cannot be prototyped and tested like manufactured products, design and construction stakeholders are more apprehensive about adopting new technologies and processes due to the fear of unknown risks (Hoffman and Henn, 2008). Cousins (2011) for instance have highlighted several problems in buildings that were designed to test emerging renewable energy technologies. These ranged from external rainwater harvesting systems that burst in cold weather due to lack of insulation, ventilation and condensation build up problems with heat recovery systems, high energy for running communal biomass and green water recycling systems to other maintenance problems of installed renewable energy technologies. A key

stakeholder involved in these projects even raised questions about the true maintenance requirements of renewable energy technologies and subsequently claimed that had these requirements been clearly known initially, they would have been more circumspect in adopting such technologies for their projects. Adopting new processes could giving rise to new routines (Petersen and Andersen, 2009), which would require staff re-training and establishment of new structures without full knowledge of the potential future risks (Hoffman and Henn, 2008). Even financial institutions are known to be hesitant in financing unproven environmental technologies and the same applies to building inspectors who are known to reject environmentally sound technologies because they are new and unproven (Hoffman and Henn, 2008).

4.4 Knowledge rejection versus knowledge seeking

Project delivery professionals are most likely to disregard unfamiliar emerging technologies and even the acquisition of knowledge on unfamiliar terminologies irrespective environmental implications because these challenge conventional terminologies (Kempton et al., 1996; Hoffman and Henn, 2008). For instance, the vinyl chloride monomer in poly vinyl chloride (PVC) products has been criticized for its highly carcinogenic and toxic effects but terminologies such as polyolefin-based products which are proven to be safe throughout their lifecycle as well as provide the performance benefits of PVC (McDonough et al., 2003) is likely to be unpopular amongst construction professionals nor even arouse their interests because of the unconventional nature of the terminology. This could be more so the case in the presence of pluralistic terminologies and competing ideas relating to sustainable development. This attitude towards unconventional knowledge and terminologies amongst some stakeholders is likely to pose a barrier to the adoption of C2C in business parks.

4.5 Projection of positive illusions versus improvements in actual practices

Research has revealed that people, businesses and society often tend to project an aspiration of their virtues rather than the reality of their behaviours when it comes to environmental responsibility (Hoffman and Henn, 2008). Thus, most developers are more likely to claim that their properties are environmentally friendly (Bazerman et al., 1999) especially when they have implemented some energy saving, waste cutting or emissions cutting strategies. Hoffman and Henn (2008) argue that such projections could however be far from the reality of negative impacts of their activities on the environment. Businesses and society at large are therefore “locked-in” (Petersen and Andersen, 2009) to their current practices and would easily find reasons to supplant and justify their current practices than make changes to actual behaviours/practices irrespective of the positive prospects of change.

4.6 Bureaucracy/Rigidity versus flexibility

Hoffman and Henn (2008) have argued that many regional building codes do not support the installation of composting toilet or greywater systems, suggesting that there is the tendency for the standards and regulations to draw attention to the law rather than the purpose behind the law. Tenbrunsel et al. (1997) for instance have revealed that sub-optimal decisions can be reached by decision makers due to strict adherence to standards. Similarly, Williams and Dair (2007) have also revealed that in many instances, stakeholders were unable to implement sustainability measures in their designs because they were not allowed by

regulators. They suggested that perhaps, policies and regulations were lagging behind best practices. Debacker et al. (2011) have also revealed that inflexible laws and regulations were a major barrier to C2C implementation as this was usually cited by stakeholders as a major hindrance in C2C inspired developments.

5 FRAMEWORK FOR UNDERSTANDING SOCIO-CULTURAL BARRIERS

5.1 Competing values framework (CVF)

The competing values framework (CVF) is an appropriate framework for understanding the extent to which socio-cultural barriers amongst different development stakeholders inhibit C2C implementation in business parks. The CVF, which is empirically derived and validated and has been applied to several studies on cultural change especially in relation to sustainability (Linnenluecke et al., 2009). The CVF can be used to diagnose different stakeholder organisational cultures which could then be mapped onto the socio-cultural barriers that are revealed to be prevalent in these organisations. Organisational culture here is defined as a pattern of basic assumptions – invented, discovered, or developed by a group as it learns to cope with its problems – that has worked well to be considered valid and, thus to be taught to new members as the correct way to perceive, think, and feel in relation to such problems (Schein, 1992). The CVF consists of four competing values in organisations that can influence the priorities they place on change implementation (Figure 1). The internal process quadrant of the CVF represents organisations that focus on the use of formal structures to achieve organisational efficiency with an ultimate aim of economic profitability. Such organisations are dominated by a hierarchal culture (Zammuto et al., 2000) where decision making is data driven and any innovations that are promoted within the organisation are aimed at increasing productivity and maximizing profits and economic gains. The focus on conformity to roles which constrains employee choices and actions (Scott, 2003) as well as existence of formalized structures and emphasis on profitability suggests that such organisations are less likely to be open to collaboration and pursuance of long-term goals.

The human relations quadrant represents organisations that focus on employee development and the creation of a stimulating work environment that facilitates social interaction and high interpersonal relations. Such organisations are dominated by a group culture and there is a focus on upgrading the skill and knowledge base of their employees as this is considered a core business strategy (Zammuto et al., 2000). The rational goal quadrant represents organisations that focus on rational goal setting and planning based on the demands from their wider external environment (Zammuto et al., 2000). Thus, the structure and decision making process of the organisation is designed to facilitate planning; forecasting and control so as to achieve efficiency in relation to their competitors. Unlike the internal process quadrant which focuses purely on economic profitability to the detriment of the wider external environment, organisations in the rational goal quadrant consider the impact their operations have on their external environment and society at large in their quest to achieve efficiency (Zammuto et al., 2000). The fourth quadrant which is the open systems quadrant represents organisations that focus on adaptability and readiness in their quest to achieve growth and place a lot of emphasis on the external environment. Such organisations are dominated by a development culture and are flexible enough to adapt to changes that take place in the external environment. They also place emphasis on innovation, promote risk-taking and setting of new challenges.

The different quadrants of the CVF arguably reflect different organisational characteristics that could either be compatible or incompatible with the socio-cultural barriers discussed. The CVF can thus be used to gain a more detailed understanding of how socio-cultural barriers manifest and inhibit C2C implementation in business parks. The entire study framework presented in Figure 1 relates stakeholder organisational characteristics - as defined by the CVF - to the extent to which these socio-cultural barriers/drivers would influence the implementation of C2C actions and achievement of C2C outcomes. The C2C actions and outcomes in the framework are derived from Table 1.

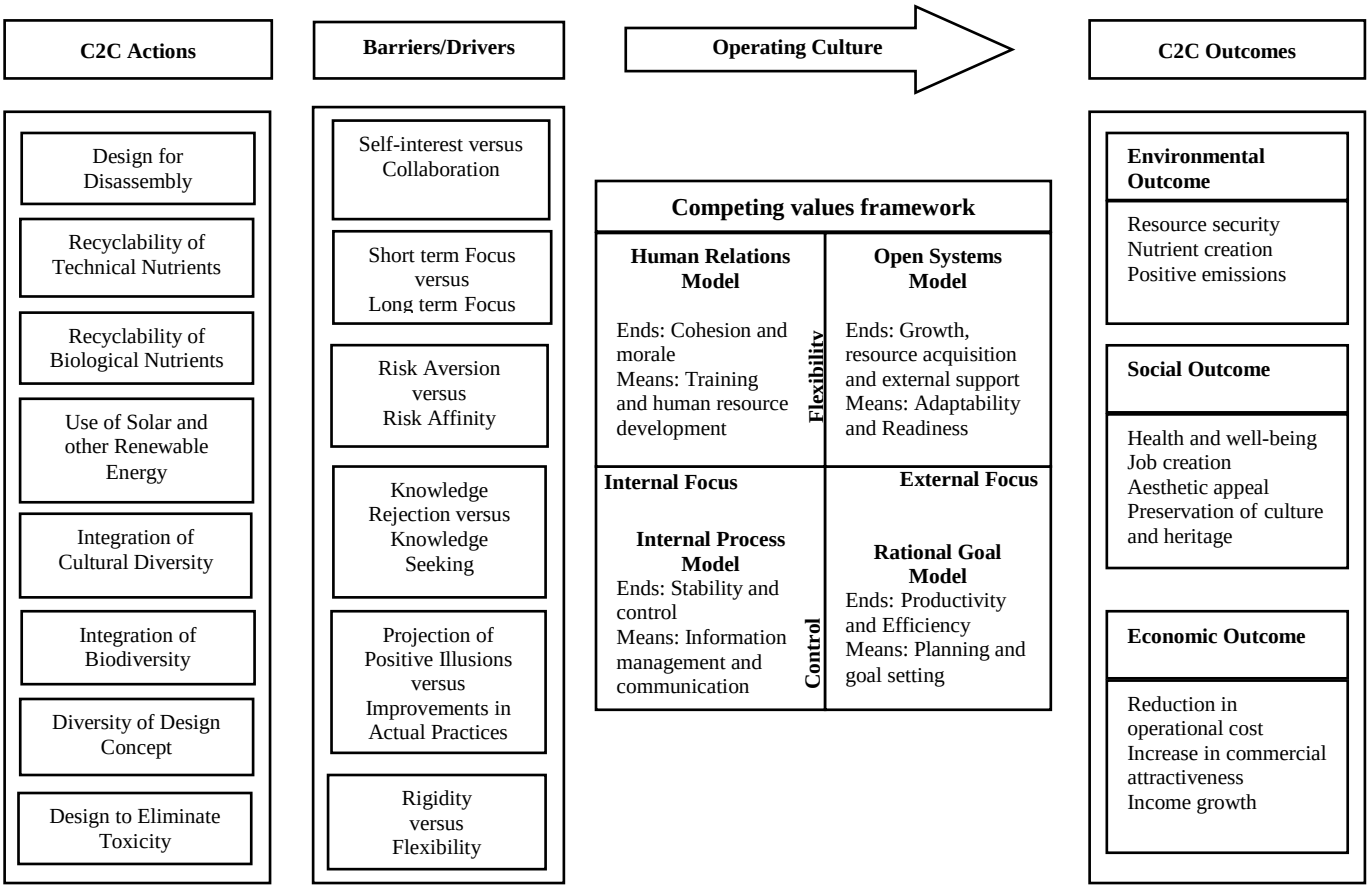

Figure 1: Proposed framework for assessing the socio-cultural influence of C2C implementation

It is proposed that stakeholder organisations that are more oriented towards the internal process culture will emphaise control through risk minimization and conformity. Barriers such as risk aversion, bureaucracy and self-interest are likely to be more pronounced although they may seek knowledge towards incremental improvements in relation to C2C especially when viewed as a means to achieve conformance with existing regulations. Conversely, stakeholder organisations that are more oriented towards the open systems culture create by promoting innovation, vision and constant change. They are most likely to overcome all barriers as they focus on the long-term, encourage risk taking, seek knowledge and are very flexible especially when C2C is conceived as a means to achieve innovation. It is also proposed that stakeholder organisations that are more oriented towards the human relations culture would promote human resource development and seek long-term C2C outcomes that

are predominantly social in nature. Barriers such as short-term focus and knowledge rejection are thus likely to be overcome except their internal focus may still present barriers to external collaboration. Stakeholder organisations that are more oriented towards the rational goal culture compete and focus on achieving immediate gains. Barriers such as knowledge rejection are likely to be overcome whereas bureaucracy, short-term focus and self-interest may still be well pronounced. There is also the tendency that such stakeholder organisations would be mostly driven by C2C outcomes that are predominantly economic in nature.

Though the framework in Figure 1 can be applied to different developments, it is been applied in this study to business park developments. The validation of this framework as a tool to interrogate the socio-cultural barriers to C2C implementation in the context of business parks is however yet to be undertaken as part of an on-going study.

6 CONCLUSIONS

The C2C philosophy has been discussed as a paradigm changing innovative platform for creating a positive ecological footprint in the built environment. C2C has been argued as a development model that can transform business parks to economic growth hubs that provide truly positive social and ecological benefits. Though several strategies have already emerged from circular economy and industrial ecology studies on how to realise “closed loop” systems in business parks, it has been argued that such efforts have not been entirely successful as they often focus on reduction of negative impacts rather than the promotion of positive gains. The three C2C principles are advocated for as strategies for realising positive impacts in the business park context. However, implementation of C2C principles is likely to be hindered by socio-cultural barriers prevalent amongst development stakeholders. There is the need to further interrogate the extent to which such socio-cultural barriers influence C2C implementation. To guide further empirical investigation, the CVF has been proposed as an ideal framework for understanding the extent to which socio-cultural barriers manifest amongst development stakeholders and inhibit C2C implementation. The resulting study framework has led to some theoretical propositions that would subsequently be tested with field data using business parks as a backdrop. A key proposition is that stakeholder organisations that are more oriented towards the open systems culture would be the most likely to overcome all socio-cultural barriers and implement C2C actions as a means to promote innovation. The proposed socio-cultural study framework, which can also be applied to other developments, is however yet to be validated through a pilot study involving business park stakeholders.

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