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DEVELOPING A SUSTAINABLE HOUSING MARKETPLACE: NEW BUSINESS MODELS TO OPTIMIZE VALUE GENERATION FROM RETROFIT

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ABSTRACT

Buildings represent the largest untapped source of cost effective energy saving and CO_2 reduction potential within Europe. More than 40% of Europe's residential buildings predate the 1960s, when building energy regulations were limited; the majority of these buildings have not been brought up to modern energy standards. However, currently, the rate of building renovations in the EU comprises just 1% of the building stock, with only a small proportion of this activity comprising so-called deep renovations. Despite considerable market size and EU mandated retrofit targets, the sector continues to suffer from significant underinvestment, the market has not realized its full potential and a wide range of actual and perceived barriers impede stakeholders. For Energy Efficiency Conservation Retrofit (EECR) project actors, the challenge is to respond to this new business environment, while maintaining adequate value for stakeholders. For housing property actors, this means a growing impetus to understand the value propositions of other EER stakeholders and to consider new, innovative ways of doing business. The

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Business Model concept refers to organizational logic through which companies operate, defining the manner by which enterprises deliver value to customers, entice customers to pay for value, and convert those payments to profit. This paper posits that new collaborative approaches to developing business models are required to plan EECR projects such that value generation is maximized while value capture is satisfied.

Key words: Energy efficiency; Retrofit; Value creation; Value capture; Supply chain; Business models

Introduction

Rising prices, geopolitical concerns and climate change have increasingly prioritized energy efficiency for governments and businesses globally. Reducing energy consumption saves money, enhances energy security and reduces the emissions of anthropogenic greenhouse gases (GHG) [1]. Governments have in particular been motivated to focus on energy efficiency as a means of stabilizing atmospheric GHG levels at a level that would avoid the worse impacts of climate change [2]. Accordingly, there are a plethora of public policies globally, which mandate, promote and support energy efficiency measures.

As the built environment accounts for the largest share of energy demand, equating with ca. 40% of final energy consumption in the EU, buildings are seen as having the greatest potential for reducing energy consumption of any single domain [3]. Buildings however have very long operational lives with 80% of current European buildings predicted to be still in use in 2030. More than 40% of Europe's residential buildings predate the 1960s and were consequently built to low building standards [4]. The low turnover of buildings and the quality of the existing stock, means that while the design, construction and commissioning of new energy efficient buildings is important, a significant program of energy retrofitting of existing building stock will be required to meet the reductions in energy consumption and associated emissions expected from the sector [5], [6].

Notwithstanding the environmental, social, regulatory and increasingly financial reasons to reduce the energy consumption of buildings, the rate of energy renovation in the EU is just 1% of the building stock, with only a small proportion of this activity consisting of so-called deep renovations. Despite considerable potential market size and EU mandated retrofit targets [7], the sector continues to suffer from significant underinvestment. The market has not realized its full potential and a wide range of actual and perceived barriers impede stakeholders including perceived risk, lack of knowledge, split incentives, solution lock-in; behavioral inertia and market capacity [8]. For those involved in energy efficiency and conservation retrofit (EECR) projects,

the challenge is to respond to this new business environment, while maintaining adequate value for stakeholders. For housing property actors, this means a growing impetus to understand the value propositions of other EECR stakeholders and to consider new, innovative ways of doing business.

This paper provides a novel application of the business model concept in the context of EECR, providing an exploration of how materials and monetary flows, value interactions between stakeholders and stakeholder definitions of value are conceptualized and measured. To date, there has been a dearth of research on this topic. Business model concepts are not widely understood in the construction industry and the development of business model alternatives for individual firms presents a complex challenge, magnified significantly when considering the challenge of aligned business models across stakeholders, that is, multiple business models working in synergy. This paper discusses the applicability and potential of new business model typologies and EECR project configurations to enhance the EECR marketplace. 'Open Business Models' drawing on Chesbrough's concept of open innovation [9] are explored, with a focus on the customer orientation and the co-creation of value principles which underpin such collaborative business models.

Construction Industry Characteristics

The construction industry is a fragmented, heterogeneous, multi-relational, multi-dimensional and multi-disciplinary sector [10]–[12]. From a practices perspective, it is a conservative industry as illustrated by the fact that the majority of construction continues to be carried out using traditional organizational approaches and methods [13]. The construction sector displays a number of attributes that distinguish it from conventional industries including: unique construction sites; typically transient work force; involvement of multiple crafts and professionals; low margins and frequently short-time perspectives (notwithstanding the industry's products longevity) [14]. There are various activities associated with buildings throughout the lifecycle, from the extraction of raw materials through to demolition and end- of-life management. To better consider these activities, they may be consolidated into six stages or "Hubs of Activity" as outlined in Table 1 [15].

A significant feature of the sector is that it is delivered through transitionary and dynamic construction supply chains. These supply chains are centered on specific projects, in what might be termed temporary multi-firm configurations (TMFCs), whereby the component businesses relate through subcontracting arrangements of various degrees of formality consisting of a web of multiple bilateral contracts and/or informal commitments. Understanding the rationale by which these various companies carry out their business is an important step in increasing the value generated by EECR projects.

Table 1 : Typical EECR stakeholders associated with Hubs of Activities, after [16].

Hub	Key Stakeholders	Other Stakeholders
Upstream activities	Manufacturers; Policy Makers; Legislators; Regulators; Investors	Primary Producers; Material Processors; Financiers; Standard Bodies; R&D Institutions; Retailers and Distributors; Logistics; End-users.
Initiation & viability check	Owners; Investors; Solution Providers; Designers	Occupants / Tenants; End Users; NGOs; Neighbors; Municipalities; Insurers; Utilities; Financiers; Policy Makers, Legislators; Public
Design & planning	Designers; Owners; Project Managers; Investors; Solution Providers; Planning Authorities; Building control	Occupants; Public; NGOs; Neighbors; Financiers; Third Party Product Cert.; Infrastructure providers / Utilities
Construction / installation	Designers; Owners; Project Managers; Neighbors; Solution Providers	Occupants; Public; NGOs; Investors; Infrastructure providers; utilities; Policy Makers; Legislators; Financiers
Operation and maintenance	Owners; Project Managers; Neighbors; Occupants	Designers; Investors; Solution Providers; R&D Institutions; Public; NGOs; Infrastructure providers; Utilities; Financiers; Retailers and Distributors; Logistics
End of life and downstream activities	Owner; Planning Authorities; Waste Authorities; Local Government	Environment Agencies; Service Providers; Contractors; Public; Retailers and Distributors; NGOs; Infrastructure providers; Utilities.

Business Logic and Value

Business Model Concept

The organizational logic by which companies operate can be described as a business model; this defines the manner through which enterprises deliver value to customers, entice customers to pay for value, and convert those payments to profit [17]. While many authors have argued that the term 'business model' is not well understood & that the literature is inconsistent in its use [17]–[21]. Osterwalder et al., succinctly define the concept saying "a business model describes the rationale of how an organization creates, delivers and captures value" [22]. During the 'dot-com' era, many authors [17], [18], [23], [24] explored issues relating to the importance of the business model and the internet economy. More recently, the concept has been applied beyond e-commerce in fields as diverse as open source software [25], open innovation [26], 'long tail' business models [27], mass collaboration [28], smart grid [29] and increasingly sustainable innovation [30]. The low rate of energy retrofit activity would indicate that new business models are required to encourage, enable and incentivize the private sector to contribute substantially to energy and emissions savings targets in the built environment [8].

The business model concept can be used as an analytical tool to better understand how a company does business to assist in performance assessment, management, communication, and innovation [17], [31]. The Business Model Ontology [22] is forwarded in this paper as providing a means by which value flows can be described and understood. Osterwalder et al. [22], [32] describe the ontology having nine principal components, viz., (i) Value proposition: the bundle of products and services that are provide value to the customers; (ii) Target customers: the segment of the market at which the value proposition is aimed; (iii) Distribution channel: the means of reaching the target customers; (iv) Customer relationship: the link(s) between the company(ies) providing the value proposition and the target customers; (v) Value configuration: arrangement of activities and resources that are necessary to deliver value proposition to the target customers; (vi) Capability: ability to repeatedly perform the actions required to deliver the value proposition to the target customers; (vii) Partnership: voluntary agreements between companies to cooperate such that the value proposition can be delivered to the target customers; (viii) Cost: representation of the financial outlays throughout the business model; (ix) Revenue: counterpart to #8 is the means by which money is made through a variety of revenue flows. The relationships between these components are illustrated in Figure 1.

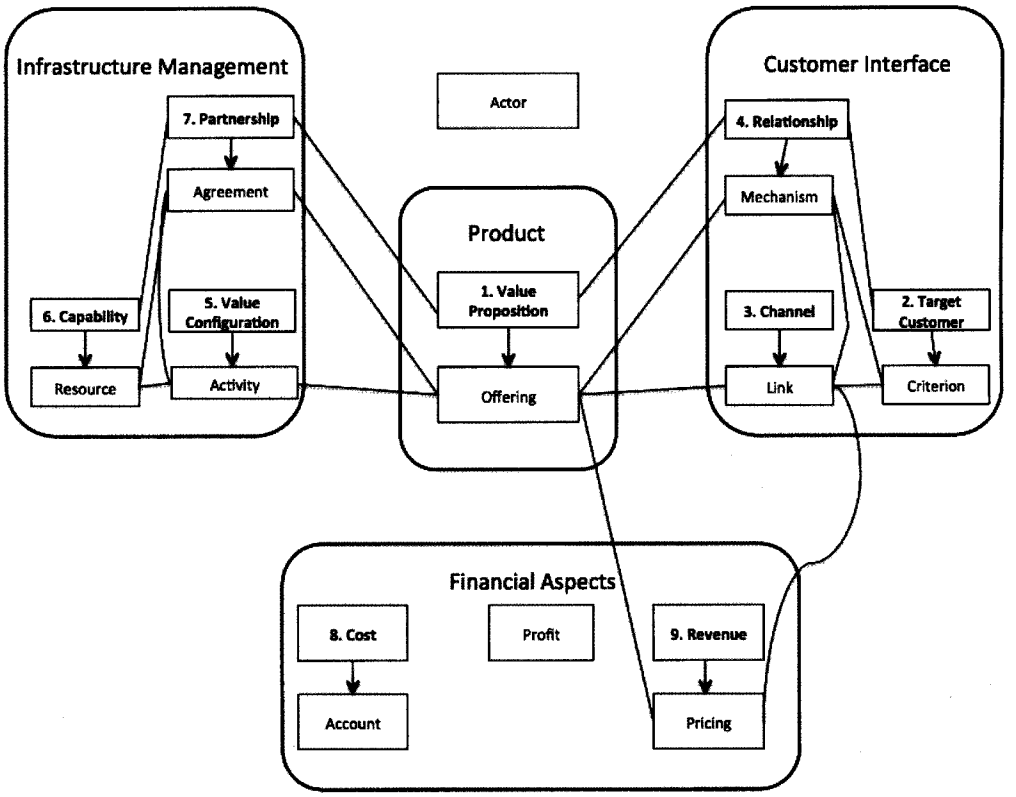

Figure 1 : Schematic of Osterwalder's Business Model Ontology [22], [33]

Metrics of Value

The conventional view of the business model and the development of the concept have to date centered on the principle of financial return. Monetary metrics are not the only measure of success however. In an energy-efficient building project for instance metrics such as energy savings, GHG emissions avoidance, etc. will be of interest in addition to financial return and depending on the project may even hold higher value. Dunphy and Morrissey [12] posit that Osterwalder's rigorous approach to mapping the flow of financial value can be adapted with some modification, for different types of values and also provide a means to capture the changing roles actors may have within a TMFC depending on the definition of 'value'.

This approach allows for the reconciliation of multiple value perspectives, in essence the financial aspects of the ontology as shown in Figure 1 may be replaced with an alternative balance sheet. There is potential to use an adopt business model ontology to show energy or GHG measurements, assessed in units saved across the project's lifecycle for example. In this way a multilayered perspective of the 'business model' may be constructed such that the various success metrics of importance can be represented. The relative importance of each value metric will be specific to each case and reflect the characteristics of the organizations involved.

TMFC Business Models

As discussed earlier, EECR projects are delivered by variants of project-based organizations – TMFCs, which are single-purpose ad hoc temporary coalitions of actors that combine in a variety of formal and informal partnerships to carry out the work required to complete a project The makeup of such configurations differs from project to project due to the substantial variation in the different projects' characteristics and context [12], [34].

TMFCs are focused around a lead actor who will be principal coordinating entity in the delivery of the project. Meeting the success criteria of the project sponsors is the raison d'être of these configurations; they often demonstrate features of independent entities, significantly including implicit organizational principles and objectives. These organizations perspectives are not necessarily aligned with that of their component businesses, which themselves will have multiple and sometimes competing objectives [12].

Optimizing value generation from energy retrofits requires the development of new approaches to assembling TMFCs for project delivery. The EECR project objectives and the business models of the organizations, involved in the project's supply chain, need to be aligned such that all actors can be satisfied [35]. In this approach the (potential) actors agree either explicitly or implicitly, on the minimum value that would be satisfactory to them for their involvement in the project [8]. The lead actor then

configures a TMFC to deliver the project successfully, meeting business objectives of lead actor while at minimum satisficing key actors for their involvement.

Increasing Value Generation

Mina [36] observes that traditional technologist perspectives fundamentally underestimate the role, extent and effects of innovation in services. This is reflected in the construction sector where technology and engineering innovation continues at a high level, but that innovation in business models, the implementation of projects, inter-firm relationships etc. has been neglected. The construction sector is see as a conservative industry, whose low margins often impede innovation because of its perceived associated risks [37].

Maximize value generation in EECR projects requires that it be done in the context of satisficing value capture so that sufficient buy-in is achieved ensuring that the (key) actors involved are aligned in their activities and objectives. This requires meeting the EECR project objectives with the an alignment of the business models of the (key) actors involved in the project and a shared view as to how the project is going to be delivered and how value (in what so ever way that is measured) will be distributed. This degree of alignment necessitates the development of a project delivery model (PDM) that would function as a framework for coordination of the individual business models of the various actors in the context of the EECR project goals. Companies valorize new ideas through their business models [38], similarly to maximize value, companies involved in a EECR project would need to share ideas and experience in the development of the PDM; this may be problematic in an industry as traditional as construction.

Within many industries there is an increasing acknowledgement the benefits of so-called open innovation, which recognizes that "valuable ideas can come from inside or out of the company and can go to market from inside or outside the company as well" [9]. When this has predominately been a feature of high-tech industries, the nature of the construction industry, especially collaboration involved in the delivery of projects and the preponderance of smaller enterprises involved means that it is more receptive to innovation from external sources; Lee [39] observes that SMEs typically look outside of their organizations more so than large firms, and are more open to considering alliances or network as ways to increase competences.

Conclusions

There can be multiple perspectives on value depending on the view of different actors. Improving the value return from building retrofit projects requires the temporary configurations of companies involved to align their business models, to create a project delivery model maximizes value generation while satisficing value capture. The

consideration of multiple value metrics in a business model (or a project delivery model) result in complexity in decision-making and poses a problem in optimizing 'success' for the various stakeholders. However, the consideration of non-monetary success metrics will result in a greater awareness of the trade-offs involved in balancing multiple aspects of sustainability (for example, financial, and environmental considerations) and provide for a structured means to develop value propositions to meet the prioritized success metrics of key stakeholders.

The alignment of business models requires companies to share a great deal of information and engage in collaborative and/or open innovation. However, there is reluctance to share information and particularly that seen as been innovative – as the nature of the EECR activity means that a current partner may be a competitor in another project, or a future date. While selective use of intellectual property rights or other informal means of appropriability [40] may overcome some of this dubiousness, the transient nature of alliances in the industry may have to change in order to build the trust required for such collaboration.

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