CONSTRUCTING ARCHETYPES: MAPPING BUSINESS MODELS IN THE CONSTRUCTION VALUE CHAIN

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Construction value chains are characterised by institutionalised roles, such as architects, engineering consultancies, contractors, and material suppliers. These roles constitute an important reference point in an industry like construction, where few processes are standardised, and few projects are repeated. However, as these roles rely on different business models, and as most construction projects are organised in a cross-organisational way, the construction of buildings tend to be a matter of coordinating and aligning different business models. Recent research shows a rising interest in business models of construction. However, the differences between construction business models are underexplored. The purpose of this paper is to investigate the archetypical business models in construction. The aim is to create a foundation from which further business model research can be conducted. It presents findings from a series of workshops and interviews with companies representing the whole construction value chain. Building on an analytical framework, we explore archetypical characteristics of different business models found in the construction industry. This includes identifying the priorities (value proposition and profit formula) and capabilities (resources and processes) of companies representing different institutional roles. We identify four business model archetypes, which utilise three distinct profit formulas. The findings show that professional service providers, like architects and engineering businesses, build on a profit formula concentrating on selling hours to cover high variable costs; general contractors build on a sustained cash-flow model to cover high variable costs and contractual risks; and material suppliers sell products and optimise the capacity of their production facilities to cover high fixed costs. Each business model is sustained through unique capabilities in the form of resources and processes, which support a specific value proposition. The identification of business model archetypes represents a platform for further research and discussions on how new technologies and changes in boundary conditions influence different types of construction businesses.

Keywords: business models, capabilities, archetypes

INTRODUCTION

The construction industry is often criticized for being less productive than other industries and being conservative and slow, when it comes to implementing innovation. The systemic challenges pointed out in Egan (1998) and Dubois and Gadde (2002), coupled with the reports published by government agencies in other countries, including Denmark, show that this criticism seems legitimate. An example of this is Nielsen *et al.,* (2010), who show that the index adjusted construction cost in Denmark has doubled in the last 50 years, and this cannot be explained by an increase in quality of construction. Despite the increasing costs, an analysis made as part of

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This paper was presented as a working paper at the ARCOM 2019 Conference, Leeds, UK, 2-4 September 2019. Please contact the authors before citing.

this project (see Methodology) based on financial data from Danish trade publication (Asmussen, 2018) about companies in the construction industry show that companies' ability to make a profit is very different through the value chain. While large Danish main contractors in 2017 had EBIT margins (Earnings Before Interest and Taxes divided by turnover) of 8.5% to -7.3%, in the same period several large developer companies were reporting EBIT margins in the +20% range. The analysis showed that the companies in both ends of the value chain have a reasonably healthy business with a steady income, whereas companies in the centre of the value chain, i.e. contractors and professional service companies, are struggling to create a decent profit.

According to Ballard (2012), the challenges of the construction industry stem from the fact that construction production differs noticeably from repetitive manufacturing, mainly because of the nature of the product and the role of the customer. The product of a construction process is arguably unique and as such, measures and techniques from repetitive manufacturing does not apply. In the construction project, the customer has a special place as the product is made to a specific customer and not a customer type.

The construction industry hosts the typical examples of project-based organisations (Chinowsky, 2011), working in dynamic environments and short-term collaboration patterns. Eriksson (2013) argues that due to the project-based nature of the industry, project teams tend to focus on short-term results and move on to the next project without the opportunity for reflection, thus resulting in discontinuities in the knowledge flows and learning. After construction projects are terminated project teams are usually dissolved (Bower, 2003) and therefore the transfer of the valuable experience gained during the project execution is limited.

The construction value chain is organized around institutionalised roles, such as architects, engineering consultancies, contractors, and material suppliers. These roles constitute an important reference point in an industry like construction, where few processes are standardised and few projects are repeated (Thomasson, 2004). However, as these roles rely on different business models, and as most construction projects are organised in a cross-organisational way, the construction of buildings becomes a matter of coordinating and aligning different business models.

Research on aligning business models in construction has been ongoing for the last couple of decades, with searches for integrated models that span the entire construction value chain (Brady el al, 2005). This vertical approach has a counter point in models, where a supply chain is looked at as a business network, and where alignment happens, not in a common business model, but by aligning the individual business models towards a common goal (Bakhtiyari, 2016). Regardless of viewpoint on integrated or business network model, it is necessary to have an understanding of the current prevailing business models found in construction, if we wish to advance.

The purpose of the paper is to identify distinct archetypical business models in the construction value chain. This will form the basis for improved understanding of incentive structures and collaboration patterns in construction.

Conceptualizing structures and patterns of the business models of construction will enable a better understanding of how different institutionalised roles act and interact and open an agenda for improving their relationships (e.g. through strategic partnerships or in other ways). This could lead to improved productivity and innovativeness of the construction industry as a whole.

While not specifically addressing the combination of business models, this paper aims to contribute with an understanding of the archetypical business models of construction. We start by reviewing literature on business models in construction and present a theoretical frame for understanding different types of business models. Hereafter, we present the applied methodology, the findings, the discussion and conclusion.

Business Models in Construction

The use of business models and the development of business models in construction has been a field of research with a very broad scope. From research, which shows that participants in the construction industry have little to no understanding or ability to use business models (Pekuri *et al.,* 2013 and Abuzeinab *et al.,* 2014), to the barriers of implementing green business models (Mokhlesian *et al.,* 2012 and Abuzeinab *et al.,* 2017). Thus, the focus areas are many and varied.

Recent research shows a rising interest in business models related to construction (e.g. Wikström *et al.,* 2010, Kujala *et al.,* 2010 and Bos-de Vos et al, 2016). While Bos-de Vos has an explicit focus on business model of architectural companies, Wikström and Kujala review business models with a focus on project organizing and identify various types of project-based business models.

Kujala *et al.,* (2010) propose five types of business models used by project-based firms; Basic installed base services, customer support services, operations and maintenance outsourcing, delivery of life-cycle solutions and development of life-cycle solutions. They further observe that:"…there is a solution-specific nature - or solution specificity - to business models. A solution includes a project component and an after-delivery service component, and the related offering is comprised of these two components as separate parts (project-led solution) or as an integrated whole (life-cycle-led solution)."

Wikström *et al.,* (2010) developed a categorization of business models for the understanding of the specific and unique characteristics of project business, namely business models for single projects, project networks and business networks. They further identified two questions for future research and practice: 1. "Who takes care of the overall elaboration and development of business models in project business?" and 2. "Who is able to reap the benefits from value creation from increasingly intertwined and inter-organizational business models?"

Consequently, further research is needed on the combination of business models by integration and collaboration, on how business models evolve over time and on how value creation emerges from dynamics and evolution of business models in the value network.

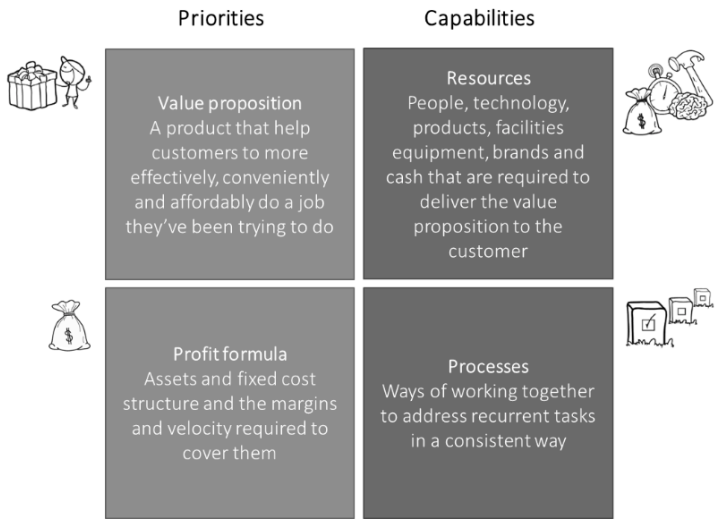
THEORETICAL FRAMING

Business models are a potential source for companies to obtain a competitive advantage. New, effective business models can result in superior value creation and replace the old ways of doing things (Zott *et al.,* 2011). Much research has been done on business models and business model components (e.g. Magretta, 2002; Johnson *et al.,* 2008; Osterwalder and Pigneur, 2010; Zott *et al.,* 2011) and numerous definitions exist. The two models, which formed the bases of the data collection in this paper is the business model canvas from Osterwalder and Pigneur (2010) and the model created by Johnson *et al.,* (2008) and reworked by Christensen *et al.,* (2016).

Christensen *et al.,* (2016) adopted and refined Johnson et al.'s (2008) framework to contain the four elements: Value proposition, resources, profit formula and processes. They further identified the importance of interdependencies describing the integration required between individual elements of the business model. They suggest an internal logic of the business model, where components of the model are congruent with other components. Congruency in this context means that elements have to support each other. As an example; the value proposition has to be supported by the available resources. If this is not the case, either more or different resources should be acquired, or the value proposition should change. Figure 1 shows the four elements are grouped into priorities and capabilities.

In this paper, we adopt an understanding of business model in line with Christensen *et al.,* (2016), who states that business models by their very nature are designed not to change, and they become less flexible and more resistant to change as they develop over time.

Figure 1: Analytical framework adapted from Christensen et al., (2016)



METHODOLOGY

The paper presents the findings from a series of workshops and interviews with companies representing the construction value chain. This research was conducted as part of an innovation partnership, REBUS, which consists of Danish research institutions, building clients and construction companies representing the entire value chain. The research work presented in part in this paper, has two major themes; Strategic collaboration and business models

We organised three workshops in 2018 to explore the participants' perspectives on business models in construction. In the first workshop representatives from all companies were asked to present their value proposition using the business model canvas methodology (Osterwalder and Pigneur 2010). The second workshop sought to inspire the participant by reflecting on how disruptive technologies could challenge existing business models of construction, and the third workshop focused on mapping typical business models based on the participants' experiences from working in the industry. Originally, we planned to use Osterwalder and Pigneur's business model canvas as the main framework throughout the research process. However, the first workshop showed that this framework was too comprehensive to explain and

understand to the participants. Subsequently, we decided to use Christensen et al.'s framework (Figure 1) for workshop 3.

Building on this framework, we explored archetypical characteristics of different business models found in the construction industry. This included identifying priorities (value proposition and profit formula) and capabilities (resources and processes) of construction companies representing different institutional roles.

The workshops included participants representing clients, architects, engineers, contractors and material suppliers. The third workshop represents the primary empirical material for this paper and had three high level representatives; a construction materials manufacturer, a large contractor and an experienced building client. The workshop had a duration of two hours and the findings were supplemented by follow-up interviews with a professional service provider, a large consultant company, and literature studies. In the third workshop, the participants were asked to brainstorm on the capabilities (resources and processes) and priorities (value proposition and profit formula) of each of the institutional roles of construction (i.e. architect, engineer, contractor and supplier). Subsequently, the participants presented the findings from this brainstorm to each other. To emphasise that the participants had divergent understandings of each role, we asked the participants to listen to other participants' view on their own role, before presenting their own view.

The last workshop was audio recorded and Post-it notes was transcribed to document the findings. After the workshop, the Post-it notes were subsequently organized and analysed to identify contours of the archetypical business models.

FINDINGS

Through the workshop, interviews and analysis, we identified four business model archetypes, which utilise three distinct profit formulas illustrated in Table 1. Each business model is sustained through unique capabilities in the form of resources and processes, which support a specific value proposition.

The Architects and Engineers

The preliminary findings show that professional service providers, like architects and engineering businesses, build on a profit formula concentrating on selling hours to cover high variable costs. It is important to note that the way to classify costs can depend on the boundary conditions that a company has in a given market. Since professional service providers are knowledge firms, the fixed cost (e.g. office space leases, insurance and office equipment) is negligible when compared to the variable cost of wages to highly skilled specialists.

Both architect and engineering businesses have a strong focus on advising the clients as a central part of their value proposition by using e.g. references to previous projects. However, their underlying capabilities differ, and while a typical architect's competences concentrate on integrating aesthetics and functionality, a typical engineer focus on quality assurance and in-depth technical studies. Architects and engineers share a strong emphasis on digital tools and the ability to win competitions. They primarily differ with regards to competencies and, to some extent, the scale of projects. Participation in competitions and bidding processes represent a significant upfront cost, which every competing company must recuperate through overhead on other projects. Consequently, many professional service providers prefer making framework agreements with building clients to avoid the extra cost and risk of competitions. This requires competences in managing long-term relationships with

building clients and creating the trust necessary for the building client to be willing to commit to such an agreement.

Table 1 Overview of archetypical business models in construction

	Architect	Engineer	Contractor	Supplier
Value proposition	• High architectural quality • Art • Prestige (reputation) • Development • Advise the client • Listen to the users	• Advise the client • Prestige (reputation) • Ensure the building's durability • Innovative solutions • Trustworthy solutions	• Convert project material to buildings -> buildability • Give the client what is economical possible in the project	• Products with few flaws and complaints • Sustainability & Comfort • Materials are delivered on time
Profit formula	Selling hours to cover high variable costs	Selling hours to cover high variable costs	Ensure constant cash flow to cover variable costs and contractual risks	Sales of products and systems
Resources	• Creative and competent employees • Strong digital tools • Communication resources • Commercial relations • Project management and control	• Strong professional skills especially on technology • Strong digital tools • Commercial relations and project alliances • Project management and control	• Construction skills specially trained employees • Special equipment • Purchasing Competencies • Project and construction management	• Production facilities • Manufacturing expertise • Good relationship with customers / contractors
Processes	• Integrate aesthetics and function • Set the right teams • Convert ideas / needs into design • Create a basis for construction, • Win competitions • Continuous development	• In-depth technical studies • Keep the balance between unique and standard • Make "good enough" solutions • Quality assurance / review • Secure realizable solutions (buildability, architecture, price)	• Calculate expenses • Read the market (expenses, capacity, etc.) • Adhere to schedule and flexibility • Manage purchasing and logistics	• Understand the market on the short and long term (10, 20, 30 years) • Develop new products / new markets • Optimize production • Advertise products

The Contractor

The profit formula of general contractors builds on a sustained cash-flow model to cover high variable costs and contractual risks. Sustained cash flow is needed to

cover the often-long span of time between an expense being paid by the contractor and the building client reimbursing the contractor. The high variable cost of contractors comes both from wages to employees (in-house production) but also from, building materials and sub-contractors. The sustained cash flow is achieved by carefully following the market and shaping projects in a way that fits the capabilities and capacity of the company. Depending on the contractor, some of the turnover is secured through tendering processes - but in all cases the ability to document the capabilities and capacities is important e.g. through references.

The key value proposition of the contractor is to convert project drawings and other specifications to physical buildings, delivering the project within the economical boundaries of the project. This require contractors to be capable of ensuring buildability of design, calculating for realistic estimates on costs and time, managing purchase and sub-contractors, assessing and handling risk through the project life cycle, monitoring and controlling project progress and handling the various stakeholders in and around the project. The capabilities of the contractor first and foremost consist of human resources and include technical construction skills and project management competences.

The Supplier

The profit formula of material suppliers is based on selling products and systems. Typically, they strive to optimise the capacity of their production facilities to cover high fixed costs. Compared to the institutional roles, the suppliers usually have large fixed costs based on investments in production facilities. This makes them less agile in terms of scaling the organisation to the market and thus they work with longer time horizons - up to 30 years. The value proposition of the supplier centres around providing products on time with a minimum of flaws. Consequently, material suppliers have capabilities within supply chain logistics and strive to avoid legal responsibilities for erroneous handling of their products during the construction process.

The suppliers focus intensively on developing good relationships to their customers, which typically include large contractors and wholesalers. Although architects are not direct customers, material suppliers tend to prioritise showcasing products to architects to influence purchasing decisions derived from the early design phases. Thus, architectural offices often include a substantial amount of demo products to increase visibility of suppliers' products. To stay competitive, suppliers focus on utilizing their production capacity. This includes sustaining and developing capabilities within automation, lean production and digitalization. In addition, suppliers emphasise the importance of new product development to respond to changing user requirements. However, given the high cost of production facilities, the innovation and variance of products tend to be constrained by the capabilities of the production system. Furthermore, many suppliers struggle to remove products from the market although new products are launched, resulting in a high degree of product variance and high complexity costs.

DISCUSSION

The identification of four archetypical business models raises several questions. One is on the modularity of business model in construction: To what extend does the business models fit one another or are they in conflict? And under what circumstances? Combining the architect's aspiration for unlimited flexibility with the

supplier's high degree of product complexity can result in a toxic environment for contractors in charge of realizing the project within budget.

This further raises a question on how business models can be combined across businesses. Both Zott and Amit (2008) and Wikström *et al.,* (2010) support the observation that business models are not constrained to firm level, but they can also exist between companies. Here it is interesting to follow the development of strategic partnerships, where construction companies collaborate with a certain client or segment on a portfolio of projects over a longer period of time. When these long-term partnerships are established, conflicting business models can create friction. To execute construction projects successfully, strategic partnerships therefor need to identify their conflicting interests and address these.

This paper does not describe the archetypical business model of construction clients. This is a limitation, which will be addressed in our further research that focus on strategic partnerships. The construction client can by the way they formulate tendering conditions promote specific forms of strategic partnerships, which requires new integrated business models, where companies from different parts of the value chain have to engage in long-term collaboration on a project portfolio (Jensen *et al.,* 2017).

Another topic concerns the gradual development of business models. Christensen *et al.,* (2016) suggest that business models remain stable over time, but also that they can be developed through gradual experimentation. The similarity (and compatibility) between the business models of architects and engineering businesses may be one of the reasons, why we are currently witnessing blurring boundaries between engineering and architecture. In Denmark, architects are increasingly hiring engineers to support their design, while engineering companies are buying architectural businesses to improve their service to the clients. In addition, suppliers and contractors also experiment with new business models in Denmark. Contractors strive to become consulting contractors through early involvement in construction projects, and suppliers increase investment in complex system products that require design competencies.

Business models frame how construction companies collaborate, and how trends and digital technologies are implemented in construction practices. By challenging their current business models, construction companies may gain a competitive advantage in a dynamic market, where sustainability and digitalisation are important drivers of change. The identification of business model archetypes thus represents a platform for further research and discussions on how new technologies and changes in boundary conditions influence construction businesses.

CONCLUSION

The construction industry continues to struggle with productivity, profitability and quality. Business models will not directly solve these challenges caused by a multitude of factors, but business models can be a tool to understand and develop the construction industry.

To help in the development of new and innovative business models, this paper has supplied a fundamental ingredient; identified current archetypes of business models in construction. We have identified four business models with three distinct profit formulas. The business model for the architect and engineering firm share a profit formula, "selling hours", but they have distinct features, which sets them apart when it

comes to the other three dimensions in the business model; Value proposition, resources and processes. Suppliers and contractors have their own distinct profit formula; "sales" and "constant cash flow", respectively.

Further research can use these four archetypes as a starting point, e.g. in the alignment of business models in a business network context or a strategic partnership. Knowing the current starting point is paramount in our understanding and development of the construction industry.

REFERENCES

Abuzeinab, A, Arif, M and Qadri, M A (2017) Barriers to MNEs green business models in the UK construction sector: An ISM analysis, *Journal of Cleaner Production*, 160, 27-37.

Abuzeinab, A, Arif M and Thompson W (2014) Green business models in the UK construction sector: Empirical study, *In*: *Proceedings of the 2014 Industrial and Systems Engineering Research Conference*.

Asmussen M *et al.,* (2018) *Byggeriets Top 100 Copenhagen*, Nordiske Medier A/S, 128.

Bakhtiyari, A, Barros, A and Russell, N (2016) Business models design in business networks, *In*: *24th European Conference Information Systems (ECIS)*, June 12 - June 15, Istanbul, Turkey.

Ballard, G (2012) Should project budgets be based on worth or cost, *In*: *20th Annual Conference of the International Group for Lean Construction*, San Diego, 761-770.

Bos-de Vos, M, Wamelink, J and Volker L (2016) Tradeoffs in the value capture of architectural firms: The significance of professional value, *Construction Management and Economics*, 34(**1**), 21-34.

Bower, D (Ed.) (2003) *Management of Procurement*. London, UK: Thomas Telford.

Brady T, Davies, A and Gann, D (2005) Can integrated solutions business models work in construction? *Build Research and Information*, 33(**6**), 571-579.

Chinowsky, P (2011) Engineering project organization: Defining a line of inquiry and a path forward, *The Engineering Project Organization Journal*, 1(**1**), 3-10.

Christensen, C M, Bartman, T and Van Bever, D (2016) The hard truth about business model innovation, *Mit Sloan Management Review*, 58(**1**), 31.

Dubois, A and Gadde L E (2002), The construction industry as a loosely coupled system: Implications for productivity and innovation, *Construction Management and Economics,* 20(**7**), 621-631.

Egan, J (1998) *Rethinking Construction: Report of the Construction Task Force on the Scope for Improving the Quality and Efficiency of UK Construction*. London: Department of the Environment, Transport and the Regions.

Eriksson, P E (2013) Exploration and exploitation in project-based organizations: Development and diffusion of knowledge at different organizational levels in construction companies, *International Journal of Project Management*, 31(**3**), 333-341.

Jensen, P A, Berg, J B and Thuesen, C (2017), Prerequisites for successful strategic partnerships for sustainable building renovation, *In*: *9th Nordic Conference on Construction Economics and Organisation*, Gothenburg, Sweden.

Johnson, M W, Christensen, C C and Kagermann, H (2008) Reinventing your business model, *Harvard Business Review*, 86(**12**) 50-59.

Kujala, S, Artto, K, Aaltonen, P and Turkulainen, V (2010) Business models in project-based firms - Towards a typology of solution-specific business models, *International Journal of Project Management*, 28(**2**), 96-106.

Magretta, J (2002) *Why Business Models Matter*, Boston, MA: Harvard Business School Publications.

Mokhlesian S and Holmén M (2012) Business model changes and green construction processes Business model changes and green construction processes, *Construction Management and Economics*, 30(**9**), 761-775.

Nielsen J, Steen, E and Haugbølle, K (2010), *Byggeriets Produktivitet Udvikling I Boligbyggeriets Standard Dokumentationsrapport 2*, Hørsholm: SBI-forlag SBi 2010, Nr 8.

Osterwalder, A and Pigneur, Y (2010) *Business Model Generation: A Handbook for Visionaries, Game Changers and Challengers*. Chichester: John Wiley and Sons.

Pekuri A, Pekuri L and Haapasalo H (2013) *The Role of Business Models in Finnish Construction Companies*, *Journal Construction Economics and Building*, 13(**3**), 13-23.

Thomassen, M A (2004) *Fornuft Og Ufornuft I Byggeriets Organisering*. SBI forlag.

Wikström, K, Artto, K, Kujala, J and Söderlund, J (2010) Business models in project business, *International Journal of Project Management*, 28(**8**), 832-841.

Zott, C and Amit, R (2008), The fit between product market strategy and business model: Implications for firm performance, *Strategic Management Journal*, 29(1), 1-26.

Zott, C, Amit, R and Massa, L (2011) The business model: Recent developments and future research, *Journal of Management*, 37(**4**), 1019-1042.