

CONTEXTUALISING INNOVATION IN CONSTRUCTION FIRMS IN REGIONAL AREAS

Graham Brewer, Thayaparan Gajendran and Raichel Le Goff

School of Architecture and Built Environment, University of Newcastle, Australia

Construction firms based in regional contexts face different challenges to their metropolitan counterparts in terms of access to markets and resources, scale of operations, and the nature of their competition. This potentially provides both business opportunities and challenges particularly in relation to innovation activities. A large scale research project investigating innovation processes in an Australian regional construction industry is being contemplated and a research mechanism has been piloted. Accordingly the case of a successful regional New South Wales small-medium-sized enterprise's (SME) quest for sustainable competitive advantage is presented through the lens of a dynamic capabilities framework. It reveals four capabilities that deliver innovation, one of which is regional in flavour, indicating that a regional location need be no impediment to innovation and indeed may hold some advantages

Keywords: construction firm, dynamic capabilities, innovation, SME.

INTRODUCTION

It is overwhelmingly the case that construction firms in regional areas of Australia will be small or medium-sized enterprises (SMEs). Regional SMEs may be compelled to innovate in order to generate sustainable competitive (though not necessarily monopolistic) advantage (Todtling & Kaufmann, 2002), developing responsive internal processes and networking with trading partners (Dosi, 1988). Whilst much of the innovation literature concentrates on technology-driven initiatives leading to substantive products, innovation has also been identified in relation to service-based products (Gallouj & Weinstein, 1997). Most construction-based enterprises can be thought of in a hybrid way, delivering physical artifacts using non-physical services (procurement and management), where innovations are found at their interface: this is where a firm's "dynamic capabilities" reside.

The dynamic capabilities literature is congruent with such a technological/non-technological view of innovation. It seeks to understand a firm's tangible and intangible assets, history and path dependency (Teece, Pisano & Shuen, 1997). On this basis a qualitative dynamic capabilities research mechanism has been designed for use in a large scale study of innovation capacity in the construction sector when located in regional Australia. Three pilot case studies of firms with known innovation capability have been planned; one is now presented. Thematic analysis of five interviews and supporting evidential material reveals both the dynamic capabilities that have delivered the firm's success, and the influence of its regionality on its response to

competitive challenge. By doing so it provides preliminary support for the suitability of a dynamic capabilities perspective to investigate the innovation performance of SMEs in a regional context.

LITERATURE REVIEW

Innovation in small firms within the construction sector has been reviewed in the past in terms of both the market-based and resource-based perspectives (Sexton & Barrett, 2003). The highly project-centric and fragmented nature of the construction industry, together with its "precipitating events" triggering or hindering innovation activities are identified as presenting a unique context within which innovation has to occur.

Conversely both the market-based and resource-based perspectives have been criticised for providing an inadequate framework within which to explain the complex interplay between internalities and externalities (Teece, Pisano & Shuen, 1997; p 509).

Lundvall (1992) conceptualised the integration of internal and external processes undertaken with the intention of innovating as "innovation systems", defining them as being "constituted by a number of elements and by the relationships between these which interact in the production, diffusion and use of new, and economically useful, knowledge."

Gallouj & Weinstein (1997) highlight the emphasis innovation literature places on the development of technological innovation in manufacturing activities, suggesting that service industries have largely escaped the gaze of researchers. Where innovation in service industries has been analysed they suggest that two bodies of literature exist.

The first deals with the adoption of ICT for a service activity, leading to incremental process innovations that result in efficiency gains, process redesign, and ultimately new service products: in construction the adoption of web-based project document repositories or Building Information Modelling are contemporary examples. The second body of studies acknowledges the existence of non-technological forms of innovation e.g. new and novel consultancy services. These are frequently ad hoc forms of innovation that defy easy imitation or reproduction, and are not suited to widespread formalisation (Gallouj, 1991 in Gallouj & Weinstein, 1997; p 539).

Collaborative approaches to building design, project procurement or project supply chain management are examples of this form of innovation. In order to understand both technological product and service innovation in the same terms it is necessary to characterise both in terms of a set of interrelated product/service characteristics (i.e. specifications) and competencies (provided by the innovating firm), which deliver the final characteristics of either the product or service (Gallouj & Weinstein, 1997; p 544). Conceivably it may involve a combination of both.

Dynamic capabilities (Teece, 2009) provides an appropriate lens through which to examine the complex interplay between the technical characteristics of a product or service, the competencies of the firm providing it, and the multitude of environmental factors influencing the firm's behaviour. It was initially conceived to explain innovation in private enterprise firms operating in dynamic technological environments, and sought to explain competitive advantage as arising from a firm's specific inventory of assets, knowledge, and history. However it has since been extended to include non-technological products, and services (e.g. Zahra *et al.* 2006).

In essence project management and construction capabilities, which can be valuable to firms at one point in time, do not necessarily remain valuable when technology conditions change: often firms must reconfigure their capabilities to survive. The

capacity to do so is linked to their dynamic capabilities that represent a “set of ... [managerial and organizational] processes” (Eisenhardt and Martin 2003, p. 342). They are different from substantive capabilities (e.g. the capacity to construct a building) in that they modify resources and substantive capabilities (e.g. a dynamic capability can represent a capacity to change the way the organization builds bridges) (Zahra *et al.* 2006).

Key processes that are embedded in an organization’s dynamic capabilities concern the identification of opportunities and reconfiguration of substantive capabilities (Eisenhardt and Martin 2000; Teece 2009; Zahra *et al.* 2006).

- Opportunity identification involves scanning, search and exploration across technologies and markets (Teece 2009).
- Opportunity identification provides the firm with insights such as technological information (Damanpour 1991). In order to seize identified opportunities, new business models, processes, complementary resources and methods are needed and require evaluation. Thus, once opportunities have been identified and new business models have been evaluated and selected, the organization’s capacity to reconfigure its resource base becomes crucial if it is to align with changed conditions (Teece 2009).
- Reconfiguring, as the third process, reflects extending, modifying and/or changing the resource base and substantive capabilities (Teece 2009).

Further, a construction company’s decision to expand into international markets must be based on a good understanding of the opportunities and threats associated with international business, as well as the development of company strengths relative to international activities (Teece, 2009). Ultimately "dynamic capabilities should be laid at the core of strategic management processes" (Shera and Lee 2004: p 935), wherein dynamic capabilities are tangible and intangible capabilities using resources effectively to deliver products and services.

METHODOLOGY

Philosophically the nature of innovation processes at play in a firm are influenced by the perceptions of its members – particularly senior members making critical decisions – of its product or service offerings, its capabilities and its technological/corporate knowledge gained during its history. The consequent estimation and quantification of the risks and benefits of innovating will have a considerable impact on its commercial decisions. Such decisions are made on the basis of both rational and boundedly rational criteria (Simon, 1991), which embody formal and informal dimensions (Bresnen and Marshall, 2002). The phenomenon of decision-making in such an environment is best revealed using qualitative post-positivist approaches (Gajendran *et al.* 2011).

Methodologically this research was thus designed from a constructivist perspective that addressed multiple stakeholder realities (Creswell & Clark, 2007). This was actioned through a detailed single case study utilising ethnographic research methods, so as to capture both phenomenon and context (Yin, 2009), allowing context-specific generalisation. The choice of a single case was considered both methodologically appropriate as an "instrumental" case (Stake, 1995) and opportunistic given the researchers' access to key stakeholder organisations in an innovative regional Australian SME. In the event five interviews were conducted with the managing director/proprietor, design manager, general manager (Australia), general manager (UAE) and engineering manager.

CASE STUDY FIRM

The focal company for this case study was founded in 1990 specifically to develop and construct property. Through its development and construction arm the group has undertaken property development throughout the Newcastle and Hunter region in New South Wales, Australia. Projects have included Commercial, Industrial and Land Subdivisions. Soon after the firm was set up its proprietor (an engineer by profession) established an architectural facade engineering division, which now forms the major part of its business. Whilst it is headquartered in Newcastle it has expanded to have an international branch office in Dubai. The firm claims to have completed projects worth in excess of A\$0.5B during its life.

RESULTS

Operationally, interviews were conducted using a semi-structured script intended to probe the issues of innovation, regionality, and the firm's dynamic capabilities. These were recorded, transcribed, and subjected to a rigorous multi-round process of open and axial thematic coding. Each transcript was coded independently by two researchers, the results of which were compared at coding meetings, where similarities and differences in coding were discussed and consensus on coding achieved. Figure 1 is an extract from the consolidated code table, which was constructed from the coding summaries for all five interviews. In total 27 open codes were generated, each developing between 0-5 axial codes.

These codes were subjected to a process of abstraction to derive synthesised themes. These themes were then cross-referenced back to the literature, enabling the researchers to provide detailed explanations of the relationships between the six generic capabilities found in the firm, and how they combined to form its dynamic capabilities.

Main code	Axial code 1	Axial code 2	Axial code 3	Axial code 4	Axial code 5
Product (facade)	Evolutionary design	Cable stayed	Materials reduction	Added value to clients	Competitive advantage
	Quirky design	Cost efficiency	Reduced manufacturing costs	Added value to clients	Competitive advantage
	High reputation	With consultants	Relationship-based	Long-term/strategic	Competitive advantage
Product (property)	Investment	With major clients	Consultant recommendation	Relationship-based	
	In-house design	Infrequent	Opportunistic		
Proprietor	Strong leader	Eclectic engineer	Quirky design		
		Strategic direction	Sustainable growth	Stability not profit maximisation	
		Hands-on	Problem-solving	Intervention	
Service (contracting)	Contract management	Transactional relationship			
	Project management	Transactional relationship			
Site visits	Facilitation	Increased understanding			
		Better design			
Practical skills	Trade background	Good understanding			
	Non-trade background	Lack of understanding			

Figure 1. Extract from coding summary: quirky engineering perspective

ANALYSIS

Zahra *et al.* (2006; figs 1 & 2) describe and elaborate an appropriate framework of capabilities within which to situate and thereafter explain the synthesised themes obtained from Figure 1, using a dynamic capabilities lens. Table 1 summarises the themes, assigning them to one or more of the generic capabilities held to contribute towards dynamic capability formation. By way of example it can be seen that the thematic attribute "quirky engineering perspective" was synthesised in part from the open code "proprietor" (Figure 1: cells 61C and 61D) and open code "product

(facade)" (Figure 1: cells 56B-F). This thematic attribute was then in turn coded to the generic dynamic capabilities "entrepreneurial", "internal resources", and "internal culture". Lastly, the thematic attributes of the firm were synthetically distilled to derive dynamic capabilities specific to the case study firm. It can be seen that four dynamic capabilities were identified (A-D) and that each was derived from a combination of the attributes of the firm that had been identified thematically. On occasion these attributes were used more than once. There follows a detailed explanation of each dynamic capability.

Capability A is cultural in nature, reflecting the ability of the firm and its employees to exercise local sensitivity in its dealings with clients and supply chain partners: "Our supply chain relationships, I mean, that's 80 per cent of what we do. The other 20 per cent being the actual design and the project management." (Proprietor)

In essence the firm is able to tailor its appearance to its trading partners in ways that suit its own objectives: " A lot of supply chain relationships are very brief [...]you don't have that ongoing relationship [but when you do] over several projects, you can end up with what we literally call, what the Japanese certainly think of as a lifetime relationship." (General Manager, Australia).

This causes it to engage in relational transactions where local trading conditions dictate that this is desirable or normal, or where the trading relationship with a particular supplier is particularly valued " There's a concept called lifetime value of a client [...] that becomes the value of the goodwill on a balance sheet." (Proprietor), switching to a strictly contractually transactional mode in domestic markets "[...] we don't really pretend to put up a nice as nice, mothering, nurturing approach with our [trade] sub-contractors (General Manager, Australia).

Capability B also has an organisational culture dimension but finds its roots in the personality and leadership of the firm's proprietor and his technical perspective. It is derived from his particular approach to engineering design: "It started with my own personal experience in light-weight structures [...] design engineers had a very impractical way of addressing the nuts and bolts of the design [...] they were astounded when [our redesign] had perimeter failure rather than [component] failure, at three or four times the design load." (Proprietor)

It has found its expression in a succession of major projects where his innovations and those of his design team have evolved to deliver successful outcomes: "We've done a lot of things that aren't standard, we've been recognised for that [...] We look outside the box a lot." (Design Manager).

These have embodied successive reductions in the quantities of materials used, a reduction in the level of skill required to assemble the facades on-site, and other "lean" principles: "Yes, lean and mean, but this requires designing the skill out of on-site assembly [...] and low or zero defects in product." (Design Manager).

Table 1. Thematic analysis/dynamic capabilities results

Capabilities	Capabilities							Performance
	Entrepreneurial	Internal resources/skills	Internal culture	Organisational learning	Organisational knowledge	Substantive capabilities	Dynamic capabilities	
Thematic attributes of firm								
Ability to adapt to cultural mores of local markets			x				A	x
Ability to conceptualise and then action new manufacturing processes		x			x		B	x
Ability to work in new markets irrespective of geographical location		x			x		A	x
Advanced document sharing between offices		x					BCD	x
Attractive lifestyle in Hunter region		x					D	x
"Australian" lean perspective on procurement and manufacturing		x			x		B	x
Evolutionary engineering perspective				x			B	x
Flexible, highly skilled workforce		x				x	D	x
"Hard to imitate" designs and products		x		x	x	x	B	x
High-level computational analysis		x					BC	x
Investment in supply chain relationships				x			E	x
Investment in workforce				x	x		D	x
Low "churn" of staff		x			x		D	x
Connecting design, manufacture and construction site practice				x			B	x
Product conceptualised in terms of information rather than artefacts	x	x		x	x		C	x
Quirky engineering perspective	x	x	x				B	x
Reconceptualising design problems	x	x	x		x		B	x
Strong organisational culture			x				A-D	x
Supply chain relationship management		x	x	x	x		AC	x

This has also required an ongoing process of staff development intended to sensitise everyone connected with the design process to the consequences of their decisions, through manufacture and onward in the construction phase, with the intention of continually improving product outcomes: "Guys don't come from a trade background these days [...] so we try to send them to our suppliers factories and on sites, so they see the consequences of their designs [...] knowing how difficult they are to build." (General Manager, Australia).

Capability C is an abiding recognition that the firm's product is first and foremost a flow of information: "These days, with all of our major clients all using web-based document control systems, it doesn't really matter where we are. With a good supply chain, no one cares whether a purchase order comes from Sydney, Melbourne or Beijing." (Design Manager).

To be profitable it must optimise that information flow both in terms of accuracy and speed, internally and with its trading partners: "I can liaise with the General Manager in Dubai, find out what spare capacity exists and send them an FTP work package at 2.30pm. With the time difference it is waiting for me the next morning and it works the other way round as well [...] We can do Revit compatible stuff but our AutoCAD drawings contain more detail, so we ensure that our stuff can match the client's BIM requirements." (Design Manager).

Major investment has been made both in infrastructure (hardware/software/ extranet) and in relationship management of key supply chain trading partners: "We regularly embed staff in our suppliers to make sure they can match our ISO9001 requirements

[...] we worked hard to get this and we aren't going to let anyone jeopardise it through bad documentation or information [transfer]." (Engineering Manager).

Capability D is its workforce, which it recognises is highly skilled, flexible, and committed; "...it either works well for you in [firm's name] or it doesn't work at all. We're quite hard on ourselves from the point of view of performance and quality." (Proprietor).

This capability is founded upon the firm's remoteness from major markets for the specialised, skilled labour it employs: "People I think are a lot less transient when they find their roots in Newcastle [...] they love the lifestyle, they like the job, competition for them is less [...] so it takes a big iron lever to move them." (Engineering Manager).

A combination of distance and the attractiveness of the lifestyle in the Hunter region have reduced poaching by competitors, and the desire amongst its workforce to move, leading to both a high level of corporate memory and a low level of intellectual property seepage: "Most of our guys wouldn't move to a competitor for twice the money - it's a lifestyle thing and they are [firm's name] people.

The commitment of the workforce to the firm is mirrored: the establishment of a Dubai branch has allowed the transfer of staff from there to the Newcastle office and vice versa according to workload, thereby minimising staff layoffs during slack periods: " All the guys that run the office there [Dubai] have been in that office [Newcastle] or long term JML people who are in the JML mode." (General Manager, Dubai).

DISCUSSION

It is seductive to explain the performance of SMEs in terms of the heroic actions of a small number of individuals, and undoubtedly the influence of this firm's proprietor is writ large across all of the data collected. His particular view of engineering design pervades all levels of the firm, as to his beliefs in connection with trading partner relationships: "Yes, a particular perspective on materials reduction and on short production runs – our guys have to understand manufacturing constraints – and on procuring just what we need for the job." (Proprietor). However this firm demonstrably has a learning culture (Sapienza, DeClerq and Snadberg, 2005) that was established from the outset (Autio, Sapienza & Almeida, 2000): "Michael and John have been around from the start, but new staff have to be brought up to speed with the kit of bits that we typically use, and think about better ways they can be made and used." (Engineering manager).

The firm's history begins with a "quirky" approach to engineering, minimal research effort, but a strong record of evolutionary development, which appears to be at odds with much of the innovation literature that indicates a firm's propensity to atrophy if substantive capabilities are not exercised and renewed (e.g. Zahra *et al.* 2006; p 20). On the other hand it is evident that design agility, which reuses and refines concepts used on previous projects is quite normal practice. Nevertheless, this approach is indicative of a high level of path dependency, where current activity is substantially dictated by the firm's history.

Theory indicates that a firm's drive for competitive advantage through innovation may be achieved delivering substantive or service products (Gallouj & Weinstein, 1997; p 538), however the case study firm conceptualises its product in terms of information flows, which subsequently find physical form through manufacturing and construction

activities. Moreover the firm's designers are happy to act in a consultative role for a fee during the early stages of the project, indicating that their competitive advantage is derived from both substantive and service product offerings, blurring the boundary between each.

Their awareness of opportunities presented by the environment is acute (Eisenhardt & Martin, 2000) neither being confined to business leads or technological advances alone. However consideration of expansion into new products such as curtain walls have traditionally been regarded as high-risk ventures in the absence of high-quality components available in Southeast Asia or Australasia: this perception is changing with the advent of cost-effective alternatives becoming available in Europe.

The perception of risk and the way in which it has been accommodated by the firm's leadership is undoubtedly risk-averse, often choosing not to utilise its dynamic capabilities in pursuit of business opportunities. This could be characterised as non-rational economic decision-making, ignoring maximisation of economic return (Zahra *et al.* 2006; p 21). Such boundedly rational behaviour (Simon, 1991) has been exercised in pursuit of business survival over the long-term, and has nevertheless resulted in significant business growth over a protracted period.

Ultimately the case study firm produces a hard-to-imitate substantive product (Teece, 2009) and service offering (Gallouj & Weinstein, 2007) through consultancy that is offered by few firms globally. The extent to which a) the market for its product continues to exist and b) it retains the ability to be competitive will depend upon its continued innovative activity. This in turn will depend upon the mix and development of tangible and intangible competences that define its dynamic capabilities.

CONCLUSIONS

The research presented in this paper was the preliminary findings from part of a study that was exploratory in nature. It was intended to determine the extent to which a dynamic capabilities lens would be an appropriate mechanism for revealing the innovation practices of construction firms operating in regional areas of Australia. As such it revealed the approach to be a useful, integrative mechanism: issues of regional influence had to be specifically prompted, since they did not appear to figure highly in the conscious decision making of those interviewed.

The case study firm clearly displayed a number of dynamic capabilities which made it globally competitive in a niche market. However the perils of path dependency could be detected, triggering the need to consider alternative products in order to continue this success into the future. Further, this firm could be considered atypical of regional SMEs in the construction industry and thus their point of departure, and the dynamic capabilities developed over more than two decades could be considered unusual. Certainly both the desire and ability for a regionally based SME to be globally competitive would be a rarity in the construction sector, and this case study must be understood in those terms.

The value of this case study to the researchers was as the initial step towards validating a robust and appropriate research methodology with which to investigate innovation in regionally based construction SMEs. Moreover, as a single case study generalisation of its findings cannot be made beyond the firm's boundaries: however it does raise a number of critical questions for future research:

- To what extent are the regional benefits experienced by the case study firm mirrored by others in the local industry?

- To what extent is the boundedly rational decision to limit growth in favour of stability through risk minimisation mirrored by other SMEs in the local industry?
- How does a strong business proprietor influence the culture of a firm as it matures?

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