

Procurement of non-incremental sustainable technology innovations - entrepreneurial firms supplying the New Zealand construction industry.

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Abstract

Traditionally construction industries in New Zealand and abroad have a low track record for successful sustainable innovations. This has a negative impact on private and government spending, and on quality, society and the environment. This conceptual paper posits that the construction industry needs non-incremental (i.e. architectural, system, radical, modular) sustainable technology innovations to make drastic improvements. Such innovations often come from entrepreneurial (small) firms from other industries or at the beginning of supply chains and must be procured and adopted further into such chains. However, after an extensive literature review it remains unclear how entrepreneurial firms procure non-incremental sustainable technology innovations for the construction industry. The paper focuses on procurement activities of entrepreneurial firms in the New Zealand context. These activities interact with (internal and external) innovation activities for an optimal firm performance. They are affected by clusters of internal and external variables. The paper discusses extant literature, a conceptual framework, main propositions, research aims and the choice for a focus group method. It is part of a doctoral project.

Key words

Construction & building industry; entrepreneurs / small firms; New Zealand; non-incremental technology innovations; procurement; sustainability.

Introduction

Traditionally the construction industry in New Zealand and abroad has a low productivity and a low track record for successful innovations (Fairweather, 2010). The industry also lags in sustainability performance (e.g. NZGBC, 2013; BRANZ 2014, p. 20) when seen from a broader or lifecycle perspective. This has a negative impact on private and government spending, on quality and health/wellbeing, and on the environment. Nevertheless the industry is an important contributor to the New Zealand economy (Page, 2013).

In line with Kibert & Grosskopf (2005), Schaltegger & Wagner (2008) and Van den Dobbelsteen (2004) this proposal posits that the construction industry needs non-incremental (disruptive or discontinuous, i.e. modular, architectural, system or radical) sustainable technology innovations to make drastic improvements in sustainability. Such innovations are often procured and (co-) developed by entrepreneurial firms thus introducing such innovations to the innovation superstructure (e.g. Winch, 1998; Hardie, 2011) and hence further into the construction industry. *However it is unclear how entrepreneurial firms procure non-incremental sustainable technology innovations for the construction industry.*

Figure 1 shows a construction supply chain (Pryke, 2009, p. 2). The smaller dashed oval indicates the primary research area; the larger dashed oval the wider research area. The 2nd

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tier suppliers which are the focus of this research often have no direct client contacts. These include *trade contractors* (e.g. plumbers, carpenters); *component suppliers* (supplying systems as window facades or other off-site manufactured structures); *material or trade suppliers* (supplying commodities as bricks, nails, cladding material); and *specialist services or others* (supplying secondary material as machineries, tools, or a range of specialist services).

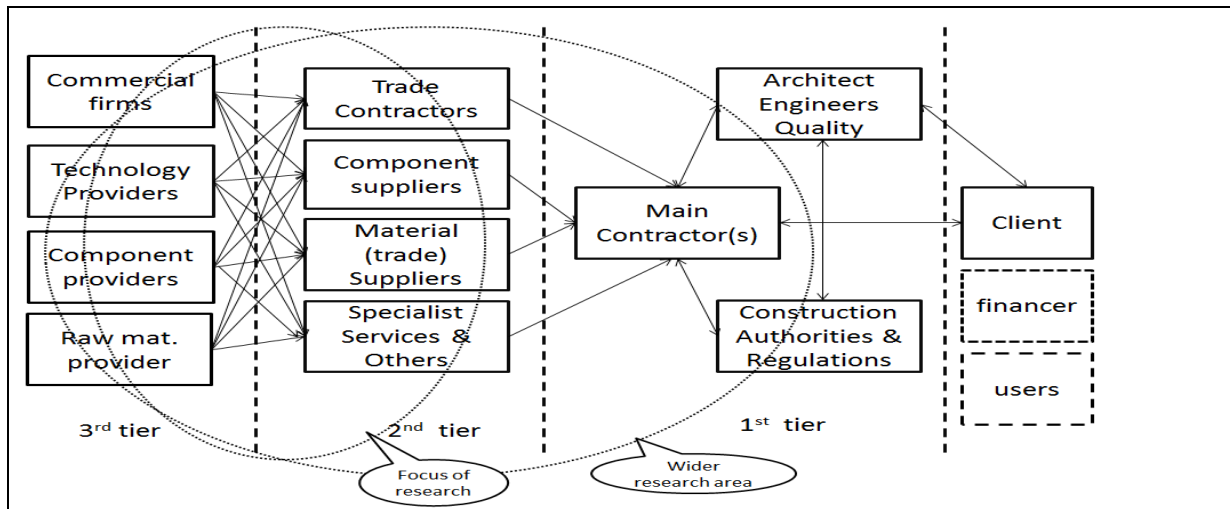


Figure 1: Actors in a construction supply chain (based on Pryke, 2009 and Van Weele, 2010)

The 3rd tier suppliers can offer a variety of goods and services (Van Weele, 2010, p. 15). This research distinguishes *commercial firms* supplying ready-to-sell tangible innovative products (e.g. machinery or materials) with know-how; *technology providers* supplying intangible products (competencies/skills or technology know-how); *component providers* supplying tangible innovative (semi-manufactured) products and know-how that must be transformed (processed or built) into a product offering; and *raw material providers*. The financier and users are considered less important for this research.

Literature review

Small firms are not miniature versions of large firms (e.g. Torrès & Julien, 2005) and small firm innovation and procurement processes will differ from those of larger firms. Processes are likely to be more informal, simplistic and holistic, and centred round the firm-owner, although Meijaard *et al.* (2005) suggested a wider variety of organisational small firm structures including formal and complex structures.

There is a wealth of literature on how large organisations procure goods and services but it remains unclear how small firms procure these (e.g. Hagelaar *et al.*, 2014; Paik, 2009). Often (small) entrepreneurial firms from outside the industry or at the beginning of supply chains play an important role in introducing innovations to the industry (e.g. Baumol, 2002; Farschi, 2011; Johnsen & Philips, 2011; Gambatese & Hallowell, 2011; OECD, 2005, 2010; Pries, 1995, 2005). There is literature on how small firms successfully diffuse non-incremental sustainable innovations in the construction industry (e.g. Hardie, 2011, 2013; Sheffer & Levitt, 2010, 2013), but this literature does not reveal (e.g. Hardie 2011, p. 260) supplier relationships of such firms. Likewise, there is a growing body of literature (e.g. Johnsen *et al.*, 2011; Philips *et al.*, 2004) on how large organisations procure non-incremental innovations.

The concept of open innovation “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation,

respectively” (Chesbrough, 2004) is increasingly being used in small firms (Pullen, 2010; Van de Vrande 2009), but its use in construction is unknown. There is research on innovation types in the construction industry (Slaughter, 2000 Hardie, *ibid*). Literature also suggests (e.g. Hardie, 2011, Sheffer & Levitt, 2010) several barriers to adoption of such innovations on a meso (industry) level and on a macro (systemic) level in the construction industry. But as Utterback (1994) concluded, these (in-frequent) non-incremental innovations will trigger (more frequent) process and incremental innovations, and hence will deliver large benefits to stakeholders.

Entrepreneurial (small) firms are a subset of small firms but realize substantial growth and renewal (OECD, 2010). Owners will have a pivotal role (Burns, 2011) and often act as gatekeepers or ambassadors (North & Smallbone, 2000). Their innovation and procurement activities are determined by their experience and attitude to innovation (Chandler, *et al.*, 2000; Songip *et al.*, 2013) by their holistic approach to procurement (Quayle, 2002; Pressey *et al.*, 2009) and hence by their perceptions on risks, strategies and objectives. Altruistic (social and environmental) motives of firm owners could play a role in the choice of wanting to offer sustainable innovations. However it is expected that entrepreneurs are pursuing opportunities (Zortea *et al.*, 2013) and that business objectives (growth, profits, or even continuity) are more important drivers. This is in line with research of Hardy *et al.* (2013, p. 186) on environmental innovative small firms who found that the drivers regulatory climate, industry networks, project-based conditions and client and user influence all ranked substantially higher than the owners’ personal motivation.

Definition on procurement

Managing the firm’s external resources in such a way that the supply of goods, services, capabilities and knowledge (including acquiring or getting access to innovations) *in exchange for financial means* is secured at the most favourable conditions. (Based on Van Weele, 2010).

Definitions on innovation

For this research four definitions on innovations are relevant:

1. A *technological product innovation* is the implementation and commercialisation of a product with improved characteristics such as to deliver objectively new or improved services to the customer (OECD, 2005).
2. Innovation is the process through which firms seek to *acquire* and *build upon* their distinctive technological competence, understood as the set of resources a firm possesses and the way in which these are transformed by innovative capabilities (Tidd & Bessant, 2009).
3. Innovation is the *tool of entrepreneurs*, the means by which they exploit change as an opportunity for a different business or service (Drucker, 1985).
4. Innovation is the actual use of *nontrivial change and improvement* in a process, product or system that is *novel to the developing organisation[s]*, [...] and can be *associated with market growth* [...] and *reductions in the cost* of production (Slaughter, 2000).

Mlecnik (2013, p. 106) adopted the Slaughter (2000) taxonomy in his research on 2nd tier suppliers on construction innovation. His research found that innovative suppliers have a broader vision on innovation and use a wide network in the construction chain. They can e.g. start with what seems an incremental innovation but through collaboration with other players this can become a non-incremental innovation (Mlecnik, 2013, p. 109). Slaughter

(ibid) saw a relationship between the types of innovation and supplier involvement. This was also found by Wynstra & Pierick (2000).

New Zealand entrepreneurial firms – the unit of analysis

This research focuses on entrepreneurial firms (probably between 6 – 150 employees) in which separated innovation and procurement activities can be discerned. These firms supply goods and services into the construction industry. In New Zealand only 10% of all firms (MBIE, 2014) and 8% of construction firms (Page, 2013, p. 16) have more than 5 employees. Moreover only a minority of such firms will have a sustained entrepreneurial orientation *and* create substantial growth. From a quantitative international comparison of entrepreneurship and performance Frederik & Monsen (2011; p. 202) concluded that “current Kiwi *entrepreneurial disequilibrium* of high entrepreneurial activity but lower economic development comes from a singular constellations of events that disfavour *creative destruction* in the Schumpeterian sense” (original italics from the authors). They found that that several macro factors (e.g. lack of adequate governmental interventions) hindered the creation of wealth from entrepreneurial activities. Deakins cited a 2008 New Zealand treasury report stating that competitive forces are generally relatively low due to the size of the domestic market (Deakins, 2013, p. 3). Following the reasoning of Schumpeter (1942) this would imply low innovation or improvement rates. This apparently low level of competitive forces however would contradict general opinion that at least 2nd tier construction firms experience fierce competition on lowest-price contracts (e.g. Hinton, 2012, Bemelmans, 2012). When analysing 2010 New Zealand Statistics data Deakins concluded that a lack of investment in business R&D hindered adoption of innovations. Rinne & Fairweather (2011, p. 77) concluded that cultural attitudes like the tally-poppy-syndrome, individualism and a focus on lifestyle can limit implementation of innovations. An international OECD study (2010 p. 24) found that *high-growth enterprises* account for 2 to 8% of the total firm population. Considering the above this percentage will be lower in the New Zealand construction context.

For defining entrepreneurs the OECD (2010, p. 33) proposed the following definition: “Entrepreneurs are those persons (business owners) who seek to generate value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets.” Shane (2003, as cited in Hardie, 2011, p. 29) linked entrepreneurship to innovation and defined this as an activity that “involves the discovery, evaluation and exploitation of opportunities to introduce new goods and services as not previously achieved”. Entrepreneurship will include characteristics of *pro-active to innovation and risk, competitive aggressiveness, autonomy opportunity recognition, growth ambitions, and organisational learning* (based on Zortea, 2012, p. 147-148) to which this research adds *a longer-term vision on how to achieve growth* (e.g. Burns, 2001). Entrepreneurial orientation can be measured on a scale as e.g. developed by Covin & Slevin (1989, cited in Verreyne *et al.*, 2014).

This research excludes firms with less than 6 employees as such firms probably have too simplistic structures (Meijaard *et al.*, 2005). In their research on small firm strategy among New Zealand firms Verreyne *et al.* (2014, p. 8) excluded firms with less than 10 employees “in order to allow for meaningful [employee] participation”. This research also excludes firms with more than 150 employees as (a) in the New Zealand context they will probably behave as mature and large firms, and (b) the theory of innovation and procurement activities for such firms has already been developed. In their research Verreyne *et al.* (2014, p. 8) excluded firms with more than 100 employees. Although Koebel & Cavell (2006) concluded otherwise it is expected that such larger firms have a less distinct entrepreneurial

and innovative approach (see also Verreyne & Meyer, 2010). This is supported by an OECD report (2010, p. 16) that found that small firms are more active than large firms in “breakthrough innovations [...] not just as knowledge exploiters but also as knowledge sources”.

Technology

A well-established means to protect technology innovations is using patents and other forms of intellectual property such as trade secrets, copyrights, brands, trademarks or database protection (Jell, 2011). Holgersson (2012) found that small entrepreneurial firms use patents to attract financial means and customers and less for protection. In the New Zealand context Deakins (2013) found that patenting can be a good albeit expensive and imperfect strategy for small innovative firms. In their research Manley (2008) and Hardie (2011) found that a large part of innovative construction small firms (subcontractors and manufacturers) use patents as a means of protecting their technology innovations. (In a survey among innovative small firms Hardie (2011) found that 67% of innovations had been patented). Koebel (2008, p. 47) saw patenting relevant for (3rd and 2nd tier) manufacturing and supplying firms but not for innovative home builders as they could not extract value from their suppliers’ patents. Brochner (2013) concluded that patents are relevant for small construction service firms in industry-university R&D interactions and for their intellectual property strategies.

A search in the online database Espacenet² revealed 300 international construction patents from New Zealand organisations, and 700 New Zealand construction patents from foreign organisations. Circa 10% were related to systems and processes and not to discrete devices on a product level. Espacenet indicated that at least 45 of these patents were related to climate change. Not all patents will be legally valid or commercially relevant but all will need complementary assets (e.g. Burgelman *et al.*, 2009, p. 33). An analysis in advanced databases will reveal relevant trends and also potential case study firms.

Networks and collaboration

It must be noted that technology protection is not the only strategy that entrepreneurial firms use (see e.g. James *et al.*, 2013) although the above discussion shows it can be an important one. Entrepreneurial firms will also use their networks in industry and downstream with (potential) customers to create a sustainable value proposition (Gambatese, 2011, p. 508; Treacy & Wiersema, 1997). Similarly, firms can use marketing strategies such as early-time-to-market or joint innovation strategies with customers (Fairweather, 2010) to gain a competitive advantage. In all these instances upstream and downstream networking and collaboration capacities are often crucial (e.g. Chesbrough, 2004; Gronum *et al.*, 2012; De Jong, 2005).

Gap in extant research

The literature reveals *a lack of knowledge on how entrepreneurial firms procure non-incremental sustainable technology innovations for the construction industry*. In more detail it is unclear:

1. How such firms procure non-incremental sustainable technology innovations.
2. How procurement and innovation activities interact within such firms when procuring said innovations.

² www.espacenet.com. Preliminary patent search in IPC-class E04, with NZ priorities or Non-NZ priorities. (Data extracted 20 May 2013). A detailed search will be conducted in advanced databases. See Brochner (2013 p. 415, p. 417) for IP classes and US classes. Espacenet uses classes Y02 and Y04 for ‘climate change’ patents.

3. How such firms use their internal variables (characteristics) in managing these interactions.
4. How such firms react (deal with) or use external variables in managing these interactions.
5. What the procurement performance is as a result of these interactions.
6. What the innovation performance is as a result of these interactions.
7. What the ultimate firm performance is as a result of these interactions.

Conceptual framework

The paper now continues with describing a conceptual framework (Figure 2). The framework shows two (dependant) constructs of interacting procurement activities (1a) and (internal and external) innovation activities (1b) of the entrepreneurial New Zealand firm. These procurement activities and innovation activities will lead to (interdependent) procurement performance (5a) and innovation performance (5b). The resulting entrepreneurial firm performance (6) is the dependant construct. These constructs are affected by five (extraneous) constructs which describe the firm's macro (2a) and meso (2b) environment, the characteristics of the innovation (3), the characteristics of the owner and the entrepreneurial firm (4a), and the firm's strategy and business model (4b). The dotted squares around some constructs indicate possible relationships that will be tested early in the empirical research. These relationships follow reasoning of the holistic and integrated nature of the firm and thinking of the entrepreneur (Hagelaar *et al.*, 2014). However, as this research wants to examine the interaction between procurement (1a) and innovation (1b) activities and the effects of several extraneous variables, it *à priori* wants to separate them. Furthermore, as this research wants to determine value-adding procurement activities, it also wants to distinguish the performance types (5a, 5a, 6). Related variables and propositions are described later-on).

For classifying the procurement activities (1a) this research proposes the validated procurement process framework of Van Weele (2010) as e.g. Pressey *et al.* (2009) also used in his SME research. For classifying the innovation activities (1b) this research analysed several classification methods (Slaughter, 2000; Rogers, 1970; Gambatese & Hallowell and Cooper & Kleinschmidt, 2001; p. 40). It proposes the validated framework stage-gate process of Cooper & Kleinschmidt (*ibid*). In his later work Cooper (2013, p. 3-4) emphasised that his stage-gate process need not only focus on financial estimates but also on qualitative (subjective) measures. Especially with non-incremental innovations and also within small firms the innovation and procurement activities will not follow a linear or sequential pattern but may be "iterative and messy" (Sexton & Barrett, 2003, p. 630; compare also Bocken *et al.*, 2014).

Both frameworks are on a sufficiently high level to account for these informal and iterating procurement and innovation activities interacting within entrepreneurial firms. During the empirical research the phases within both frameworks can be modified or subdivided into several sub-phases. Koen *et al.* (2001) for example developed an innovation process model for the "fuzzy" (i.e. unstructured and with high-uncertainties) ideation phase into five sub-phases. (See also Philips *et al.*, 2006). In Hagelaar & Staal (2015) the four procurement process phases were subdivided into eight phases for a better apprehension of procurement in small firms. Hence this research starts with high-level process phases and in the empery will adjust accordingly.

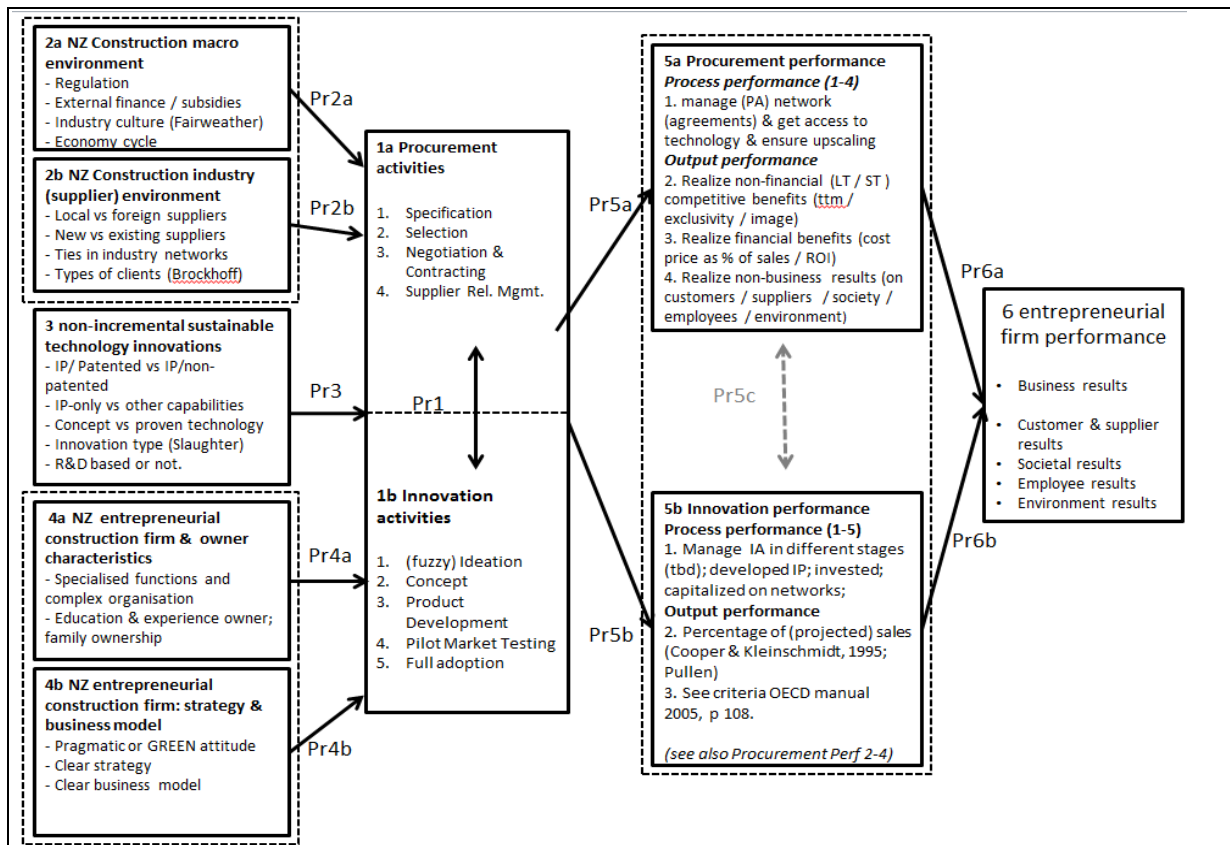


Figure 2: Conceptual framework of this research with dominant variables

Research question and aims of this research

The overarching research question is: *How do entrepreneurial New Zealand firms procure non-incremental sustainable technology innovations for the construction industry?* The related research aims are:

1. Determine how procurement activities and innovation activities (i.e. related to non-incremental sustainable technology innovations) interact within entrepreneurial New Zealand firms.
2. Determine the effect of dominant (internal and external) variables on said interaction.
3. Determine value-adding procurement activities of said firms in economic, social and environmental terms when these activities are interacting with innovation activities.
4. Operationalize such value-adding procurement activities into best-practices.
5. Develop and communicate new insights to firms and other participants involved in this research, and via academic journals and conferences.
6. Provide recommendations for further research.

The theoretical social sciences perspective

This paper follows the Resource-Based View and the Resource-Dependency Theory in combination with the Stakeholder theory (Chicksand *et al.*, 2012):

- The *Resource-Based View* (Barney, 2012) holds that procurement can generate competitive advantage when acquiring resources that are value adding, rare, costly to imitate and have no substitutes. Hence procurement can bring important advantages when it can identify and manage value-adding innovative suppliers. This makes this theory relevant for this research.
- The *Resource-Dependency Theory* works similarly and posits that suppliers and effective relationships with suppliers are important sources of competitive advantage. However

this theory is more aware of power plays and power differences (Pfeffer & Salancik, 1978). Hence it relates well with the uncertainties and risks of innovating partners in this research.

- The *Stakeholder Theory* takes a more holistic view and acknowledges the existence of different stakeholders related to the focal firm. These stakeholders have different values and want varying financial and non-financial results from firm activities. Firms who can meet such demands will better deal with their industry and macro environment, will be able to satisfy all stakeholders, and can also achieve good business performance (e.g. Kibbeling, 2010, p. 24). This theory is also relevant for this research.

Dominant variables and propositions

When using the above perspectives and the units of analysis, extant literature provided a number of dominant variables on the two independent constructs and also provided performance measures (Figure 2). The dominant variables have been used to describe main working propositions (from sets of related hypotheses) related to the procurement and innovation activities (Table 1). These will be explored (and modified) during the empirical research.

Table 1: Main working propositions

1	The coordinated interaction of (classified) procurement and innovation activities will lead to increased procurement (5a) and innovation (5b) performance.
2a	The procurement activities will vary with building regulation, industry culture and the economic cycle.
2b	The procurement activities will vary with the focal firm's clients and procurement system, the types of suppliers (foreign, domestic, new, existing), and types of (ties in) networks.
3	The procurement activities will vary with the amount of external development, whether it relates to non-product related or product related, with the Slaughter innovation typology and other innovation variables (notably IP, proof of concept, complementary assets) and will require different types of supplier relationships.
4a	The procurement activities will vary with the firm's age, experience and the organisational structure.
4b	The procurement activities will vary with the owner's entrepreneurial attitudes on risk, suppliers/networking and objectives/strategies.
5c	Procurement & innovation performance are interdependent and result in firm performance (6)

On the design of the future study

The overarching research question wants to know *what* is happening in innovation practice of the small entrepreneurial firms. More in particular it wants to know *how* the procurement and innovation activities interact within the subject firms and hence *how* certain phenomena relate to each other. This understanding of *how*, also needs some explanation of *why*. The type of research objective hence varies during the research. This makes this research theory building, theory testing and to a certain extent theory validating. On a more philosophical level this research adheres to the phenomenological / realism position as this researcher sees the researched phenomena as social constructs i.e. subjective and individual perceptions and social interactions (e.g. Zou *et al.*, 2014, p. 318). The interpretation of these individual perceptions and interactions will develop meaning and knowledge which in part are subjective by nature.

Constructs in social science and hence in business research are context-based and must be interpreted, which Weber (1865-1920) coined as "Verstehen". This entails an approach which needs a close interaction of the researcher and the research objects (Delnooz, 2008; p. 68). Close interaction can entail action research (Lewin, 1948) where the researcher is participating (intervening) in the business practices in order to suggest or bring change. Research can go one step further with collaborative research (see e.g. Chen *et al.*, 2013)

when business practitioners discuss and build theory together with the researcher. This increases business relevance and the researcher can draw better conclusions on the state of the research. Potential risks are that the researcher does not manage the process of collecting reliable data or does not reflect (take an academic position) on findings from research. This must be neutralised in the research design.

Related to the above is the issue whether qualitative or quantitative research can offer the best method to deliver the objectives of this research. In an analysis on 101 construction research papers Dainty (2008, p. 6) found that 75% used quantitative methods. Only 25 % used qualitative methods of which 3 used focus groups or workshops. He critiqued the quantitative papers in their relevance to practice and questioned the ability “to provide a rich and nuanced understanding of industry practice” (Dainty, 2008, p. 7). On the other hand he also critiqued the qualitative papers to only rely on semi-structured interviews. Yin (2004), Saunders (2009) and others mentioned valid reasons for using one of both approaches, or combining the two. Considering this research needs rich data it will use a qualitative approach (Neuman, 2014). Irrespective of the chosen research method(s) this research must have adequate rigor, notably confirmability (repeatability), reliability and validity (e.g. Huberman & Miles, 1994).

Research methods

This research needs a flexible design. However at this stage it plans the three following empirical methods:

1. *Exploring interviews*: This study will have exploring semi-structured interviews for identifying participants and discussing and refining research design and outcomes.
2. *Focus research*: This study will in part use a collaborative focus method (Latham, 2008) based on Tan & Brown (2005) called *research world café* (Schiele, 2012). This focus group method differs from traditional focus group methods in that academics and practitioners both have the role of co-researchers and both generate, refine and test knowledge (Schiele, 2014).
3. *Case studies*: This study will use two rounds of multiple case studies (Eisenhardt, 1989). The first round is explorative by nature (i.e. try to understand) and will use classic case study methodology. The second round is theory building (perhaps also testing) by nature and could see more action research (Mueller, 2005).

The focus studies and the case studies will be conducted in alternating rounds (Figure 3). It is expected that *two* rounds totalling 6 - 10 case studies and *three* rounds of focus groups with each 10 - 15 participants will suffice to obtain sufficient rich data. However depending

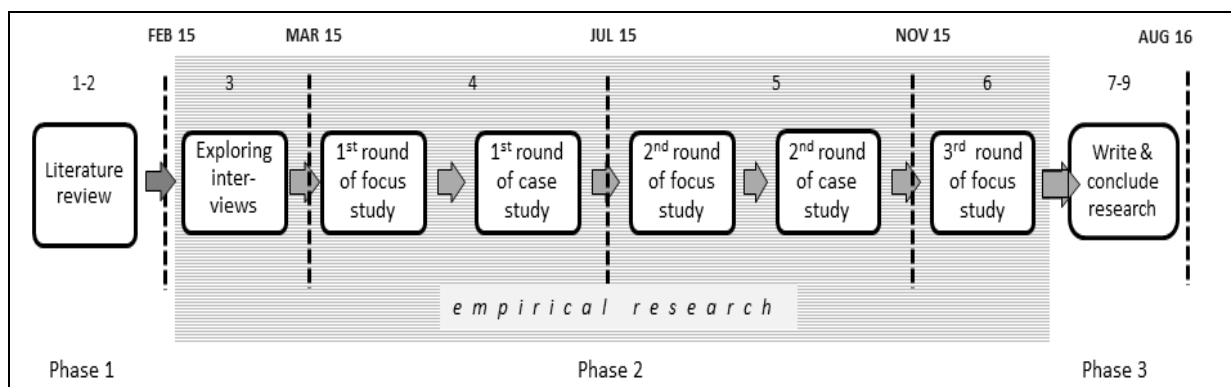


Figure 3: Research planning with the three empirical research methods

on the intermediate research outcomes the 2nd round of case studies could be action research or could be replaced or supplemented by a survey. Likewise the 3rd round of focus study could be designed differently. This design will ensure triangulation (Edwards & Holt, 2010) on several levels. The paper will now discuss the relatively novel focus research in more detail.

Determining an adequate focus group approach

A traditional *focus group* approach (group interview) consists of a number of experts and researcher(s). Experts will be asked questions and can also respond on each others answers. This will help participants and the researcher in obtaining generating knowledge about complex subject matters (Verschuren *et al.*, 2010, p. 232). Disadvantage of this method are the possibility of group-think and bias, and the relatively weak position of the researcher (Van Engeldorp Gastelaars, 1998, p. 308). Such disadvantages could be avoided in a Delphi study.

A conventional *Delphi-study* approach consists of two or more rounds of posing written questions to experts, and analysing their written opinions which should lead to increased knowledge and a convergence of opinions (Verschuren *et al.*, 2010, p. 233). An advantage is that participants can develop their knowledge. The researcher will again take the lead in developing research questions and hypotheses. The absence of face-to-face discussions makes interactions among participants limited and knowledge generation time-consuming. It also requires a steady base of participants. Other disadvantages are the difficulty to verify the precision of the method (that is manipulation by participants or the researcher) and the lack of interaction which for example is needed to clarify questions posed by the researcher (Landeta, 2011, p. 1630).

The *nominal-group-technique* consists of a small number of experts who follow a strict process in producing ideas (proposals or answers) posed to them by the researcher. They first put down their ideas in writing, and only then explain them to the other experts in a discussion. Then experts individually and anonymously prioritize the ideas which are summarised by the researcher. Although the interaction produces good results, according to Landeta (*ibid*) these are still less reliable than Delphi due to group-effects.

To overcome weaknesses of the above methods Landeta (2011, p. 1628) combined the three. Although this approach seems an improvement it still requires considerably time and effort from participants. This approach furthermore has not been validated in other research.

The *world-café approach* consists of a number of structured parallel focus group discussions. It was developed by Tan & Brown (2005) and found a wide application abroad and also in New Zealand (see e.g. Fouché, 2011). The related *research world café* approach was developed by Schiele (2012) and successfully applied in three Dutch procurement-related PhD studies. It compensates for weaknesses found in both the Delphi (i.e. time-consuming for participants) and the traditional focus group setting (i.e. risk of group-think, Hoffmann, 2011). Table 2 summarizes the four group-type methods.

The focus group studies of this research will be conducted in line with research world-café approach as it (1) is less dependant on a steady base of participants, (2) is less time-consuming for participants, (3) yields results which are less subjected to interviewer-bias or group-think and (4) has multiple discussion rounds which increases (internal and external) validity. Although Pulles & Schiele (2011) stated that this approach can replace case studies,

Table 2: Comparison of group-type research based on Schiele (2014) and Landeta (2011)

	Delphi method	Focus group	Nom. Group Techn.	Research world café
Objective	Obtain reliable data from certified experts through strategically designed surveys. Research consensus.	Understand / interpret theoretical knowledge in a new or different context.	Two or more rounds of brainstorming, open discussion of ideas or problems and voting to refine and prioritize.	Generate or refine and 'test' knowledge relevant to practitioners & researchers.
Setting	Online with 1-3 rounds or enquiry.	Face-to-face discussions of interacting experts.	Physical location (or webbased) for several times with exchange of large amounts of data.	Preparation 'online'; and then moderated discussions in one physical location. (One of two days)
Role of academics	Researchers.	Researchers.	Co-researchers?	Co-researchers.
Role of participants	Experts (co-researchers?)	Experts.	Co-researchers	Co-researchers.
Documentation	Qualitative and quantitative survey results.	Transcripts.	Quantitative data on complex influence / confounding factors.	Transcripts / notes, flip charts; pictures.
Time efforts participants	Long throughput time. Risk of losing participants.	Less time consuming for participants.	Less time consuming for participants.	Less time consuming for participants.
Potential weaknesses	Selection process of experts; communicating the problems; Number of rounds & efforts from experts; measures of consensus; feedback. Limited interaction. Need 10 – 15 participants.	Bias due to potential dominance of group members. Costs & logistics of experts. Complex data analysis. Needs 6 – 10 participants.	Cost and logistics or experts. Need highly qualified panel. Less reliable than Delphi. Needs 5 - 9 participants.	Selection process of experts. Cost and logistics or experts. Need 10 – 15 participants per round.
Validation	Mostly by researchers.	Mostly by researchers.	Joint validation with stickers / voting etc.	Joint validation with stickers / voting etc.
Source	See also Hallowell & Gambatese, 2009 Landeta, 2011	Schiele, 2012 Landeta, 2011	Toole & Hallowell, 2013; Hallowell & Gambatese, 2009 Landeta, 2011	Schiele, 2012
Method described in	Hallowell & Gambatese, 2009 Landeta 2011, with references.	Kruger, 1994 Landeta 2011, with references.	Erffmeyer & Lane, 1984; Gallagher, 1993; Landeta 2011, with references	Hoffmann, 2011 Huttinger, 2013 Schiele, 2014

this PhD research will use case studies and focus studies in alternating combinations. The focus studies will be conducted in three rounds. The first round will be more explorative (inductive); the latter two will be geared towards testing and validating (deductive). The latter two hence help strengthen (and to a certain extent generalize) findings from the case studies. As an option this research planned a parallel (fourth) round in October 2015 during an SME conference in The Netherlands.

On inter-subjective performance measures

This research will identify and conduct research on innovative entrepreneurial firms. The three main selection criteria are:

1. The focal firms either generate *measurable and significant value* while conducting procurement and innovation activities, or have a *clear potential to generate such value*. The term *value* (benefit) is seen here as the difference between the procured value from suppliers versus the (potential) value provided to customers and other stakeholders. Hence this can be a monetary value but also a non-financial value, and can have a short-term horizon or a long-term horizon.
2. The value is related to *sustainable* innovations for the construction industry. The concept of sustainability has many definitions and refers to meeting both economic, and social & environmental requirements (based on Brundtland, 1987).
3. The focal firms exhibit *entrepreneurial characteristics* as described earlier. These criteria are mainly qualitative by nature and hence also have a subjective element.

“Beauty is in the eye of the beholder” (Hungerford, 1855-1897) and so is value. The appreciation (see also Vickers, 2010) whether an improvement is indeed a *non-incremental sustainable innovation* will vary with the position in the construction supply chain and the particular interests of stakeholders. This appreciation will also vary with time and with the geographical place or specific industry. For the stakeholders involved in this research *value* will be related to their perception of *non-trivial change*.

Value can also be a *potential* value which is not yet or ultimately will not be realised. Value can have been realised in other New Zealand industries or in construction industries abroad, but not (yet) within the context of the New Zealand construction industry. This research will comprehend such value from the position of the focal firm, its suppliers, and its customers and other stakeholders, taking into account these aspects of time, industry and geographical position. The perceived added-value within the three performance constructs will hence be measured via qualitative and subjective rating schemes (e.g. Rose & Manley, 2012, 2014) which will be developed further after the exploring interviews.

In conclusion

This research wants to learn what the role of procurement is with non-incremental sustainable technology innovations in entrepreneurial New Zealand firms supplying the construction industry. It established a knowledge gap in extant literature. To bridge this gap this paper developed a conceptual framework with dominant variables and propositions which will be tested in empirical research. The research outcomes will be beneficial to innovating firms and their business partners, to owners and occupants of buildings, and to the wider environment. Hence it has a scientific and business relevance, and a social and environmental relevance.

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