The impact of formal and informal network linkages on firm innovation

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Abstract

This study explore the linkages or partnerships that companies across the EU and a defend set of emerging market economies have in either a formal or informal manner. The research aims to understand the correlation of these linkages and a firm's ability in innovate. Empirically this research is set out to determine if there are differences in a firm's ability to innovate based on the structure of the linkage, i.e. formal or informal. The study extends to understand the impact that the economic downturn had had on these linkages and what impact, if any has filtered through to the firm's ability to innovate.

The central argument is that firms with linkages benefit but being more nimble innovators and therefore both formal and informal linkages are very good for business and an organizations ability to innovate.

Chi squared and t-tests were run on the responses of the firms belonging to the export or domestic categories. The results overwhelmingly suggest that in respect of innovativeness, the domestic suppliers do not differ from those that opt to export into the developed world. However the firms belonging to the domestic group differ considerably with regards to who they collaborate with for their innovations when compared to the export group.

Key Words

- Innovation
- Collaboration
- Networks
- Linkages

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

_____ 4th November 2012

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Contents

1 Introduction

Business linkages are of interest to business and academic researchers because they provide access relationships. Alliances are important to cross-organisational endorsements – “they build public confidence in the value of an organisation’s products and services and thereby facilitate the firm’s efforts to attract risk adverse customers” (Stuart, 2000).

Linkages not only matter, they also seem to become increasingly relevant. Firms are increasingly finding value in strategic partnerships and inter-firm networks (Aris, 1995). These networks and relationships have a lower cost and are more responsive and flexible, while simultaneously offering a greater degree of operational efficiency.

Linkages can be formal or informal. Extensive research has been conducted on the value formal linkages, but limited research exists on the benefits of informal linkages. This raises the question whether informal linkages are valuable too.

Informal linkages often become topical when organisations are subjected to restructuring. The “flattening” or reduction of hierarchical structures often creates an environment where informal relationships flourish (Cross, Borgatti & Parker, 2002). Under these circumstances, informal networks are not only functional but also provide the foundation for improved innovation, product development and overall efficiency within the organisation. This results in a

more flexible organisation that is better positioned to compete in the knowledge economy.

Therefore this research aims to understand the impact of these informal relationships at a company to company level, and how they impact the firm's ability to innovate.

2 Literature Review

This review of literature will start off by focusing on the linkages firms have, both formal and informal. It will then continue to review the benefits of these linkages, the cost of these linkages and how they may impact the firm's ability to innovate.

The review is based on the premise that informal linkages are less expensive than formal (Aris, 1995) and that both forms of linkages return value to an organisation (Cross *et al*., 2002).

2.1 Benefits of linkages

Firms that foster partnerships often achieve better results than those that operate in an environment where no partnerships exist (Stuart, 2000). Alliances (or informal linkages) play a secondary role to partnerships (or formal linkages), but can be responsible for improving the reputation of the firm in the eyes of external institutions (for example financial institutions) and customers.

Companies with formal collaborative agreements with their suppliers tend to score higher innovation rankings than those that do not. In a study conducted by Freel (2000), innovation was found to be directly linked to increased profits through the circular stream of income. As the world continually evolves and innovative firms dominate the headlines, those firms that focus on developing collaborative agreements have a distinct advantage (Cantwell, 2001).

Collaboration also seems to have reputational benefits - a firm's reputation is not only dependant its past deliverables and product quality but also on that of its partners and known associates (Podolny, 1994). This further highlights the importance of the innovation linkages, as well as the on-going management of the relationships that make up the linkage.

If a firm forms a partnership with a company that has a good reputation the firm may benefit from that linkage, formal or informal (Podolny, 1994). The converse also holds - if that associated firm conducts itself in a way that is not perceived to be proper it could have an impact on the partner firm's reputation. Examples exist of firms distancing themselves rapidly from linkages they are concerned could tarnish their reputation. Nike, Trek and Budweiser all radically distanced themselves from disgraced cyclist, Lance Armstrong, as soon as it was discovered that he had competed in and won the Tour de France with the aid of performance enhancing drugs.

The reputational impact of relationships and linkages is present at a country and government level too. The use of Iranian oil in 2011/2012 has come under the spot light and countries have received direct (in the form of sanctions) and indirect pressure to stop purchasing and consuming Iranian oil.

Examples that prove exceptions to this premise also exist. South African cellular network service provider MTN has demonstrated resilience and determination to maintain its ties with Iran despite the possible negative impact of this linkage. It does so under enormous difficulty as it has to find many workarounds to

conduct business in Iran. Due to many embargoes the business models MTN deploys in other countries do not apply in Iran. This would suggest that at a point a company would be willing to risk a reputational linkage for return and revenue.

Reputation is also underpinned by the firm's adherence to compliance regulations and legislation (Rao, 1994). From a competitive strategy point of view, this is not seen as an advantage as it can also be achieved by the firm's competitors. Even so, it remains positive for the reputation of the firm and is viewed in a good light by key external stakeholders including rating agencies and governments. The outcome of this approach is a better reputation for the company, albeit an approach that can be copied by others. The adherence to these requirements does however build positive relationships with external stakeholders. When this complex network of positive relationships is combined with innovation, it does create a distinct competitive advantage (Lengnick-Hall, 1992).

Inter-firm linkages provide three distinct categories of benefits: financial benefits, capability benefits and people benefits.

2.1.1 Financial benefits

There is a direct correlation between loyalty and the firm's ability to generate value (Riechheld *et al.* (2000). Considering this the concept of linkages can be extended to the relationships a firm has with customers and that these linkages

lead to an element of customer loyalty. This loyalty as gained through the linkage is critical as even small changes in customer retention rates can significantly affect a company's profits and therefore maintaining and investing time in building linkages with customers is a positive exercise for companies (Riechheld, Markey & Hopton, 2000).

It is in a supplier's interest to invest in building long term relationship with customers (Kalwani & Narayandas, 1995). These linkages directly translate into repeat customer acquisitions and improve the firm's ability to cross-sell and potentially up-sell to a specific client or group of clients, thereby improving turnover.

2.1.2 Capability benefits

One of the key advantages of network linkages is the increased opportunity to share risk between firms. This allows the following:

- improved ability to get access to new markets and technologies;
- reduced time to take products to market;
- the joining of complementary skills;
- the protection of property rights even when contracts are not in place; and
- the provision of a platform for obtaining knowledge from external parties.

These connections are driven through people, directly affecting the firm's organisational capabilities and therefore its competitiveness (Pittaway, 2004).

As competitive advantage shifts over time, the benefit of having people and relationships as a competitive advantage can distinguish a company from its competitors. This advantage is hard to replicate and therefore ultimately contributes to the overall success of the firm (Pfeffer, 1994). Some of the key reasons for these relationships being complex to copy are because relationships by their nature are "…socially embedded, complex and idiosyncratic, path-dependent" (Jifeng, Mu & Love, 2008).

Many large multinationals like Google and eBay can attribute a level of their success to the network effect. Toyota and P&G are using networks to access innovation across the world. In his 2008 presidential campaign, Barak Obama leveraged his network of volunteers and contributors to be successful in his election bid (Kleindorfer, Wind, & Gunther, 2009).

The encouragement of network creation is vital for firms as it is a key pillar in building institutional learning and retaining knowledge within the firm. Ultimately this results in an improvement in the firm's ability to defend against competition (Jifeng, Mu & Love, 2008).

2.1.3 People benefits to formal and informal linkages

Network linkages provide a clear benefit to individuals within firms, as well as the firms themselves. The deeper the connection, the stronger it's possibility to form the base for an organisation to grow its competitive advantage from. Firms who leverage this competitive advantage and exploit this internal capability

benefit significantly and in most cases improve their overall performance (Zaheer & Bell, 2005).

Although connections may be formalised in systems and processes, they are largely formed and maintained by people. People use their networks to assist them in their work and personal lives as they search for information and make daily decisions to solve problems. Cross *et al*. (2002) discuss and formalise the common saying “it’s not what you know but who you know” through research and literature review to draw a direct correlation between the information a person has access to and their linkages to other people. This implies that people rely heavily on their network of relationships to find information and solve problems.

One of the most consistent findings in social science research is that the knowledge one gains through life has a great deal to do with who you know or have known (Cross *et al*., 2002). Linkages allow people the flexibility and advantage of gathering information from various sources. This level of flexibility ultimately benefits the individual in various ways.

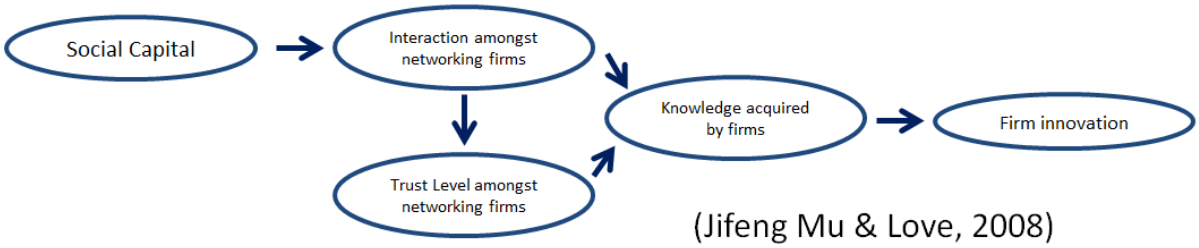
People gather knowledge through social interaction, an important way through which people formulate their knowledge base. Social capital is based on who we know and who we are as individuals. This is extended into the business world where companies tend to interact in a similar manner. Firms conduct business with other firms that are perceived to be in the ‘right group’ or may have the ‘right relationships’ (Jifeng, Mu & Love, 2008).

CEO's perceive a direct link between the bottom-line (as presented by company profits) and levels of employee and customer loyalty. This has bearing on the linkage the employee has with the company (Frederick & Reichheld, 1996). Thomas & Malone (2003) reviewed the benefit to the company from an employee's perspective and drew a correlation between an employee with a better work life balance contributing more positively to an organisation. One can therefore conclude that loyal employees should be more loyal to the firm, ultimately benefitting the firm's profit.

An individual with a solid network will ultimately benefit the firm, assuming their connection to the firm is strong and they are willing to link their network knowledge to a firm activity (Jifeng, Mu & Love, 2008). **Diagram 2.1.3** depicts a visual presentation of the link between social capital and knowledge acquired by firms, often through employees, leading to innovation.

DIAGRAM 2.1.3.1

THE RELATIONSHIP BETWEEN SOCIAL CAPITAL, FIRM KNOWLEDGE AND INNOVATION



(Jifeng Mu & Love, 2008)

An employee's activity on various social networks could potentially have an adverse effect on companies and therefore it is critical that the company

understands the depths of the employee's network in detail before leveraging it (Heene, 2003).

2.2 Costs of linkages

2.2.1 General overview

Linkages have a cost. Companies with more "capital stock" are more likely to have valuable linkages. Companies with limited "capital stock" can still build linkages, but they will require another form of benefit, for example a technological breakthrough (Ahuja, 2000). That implies that there is a correlation between a company's previous investments in building capital stock and how willing the market (in the form of other firms), is to engage with them and develop relationships.

Trust is a common thread in literature on linkages, whether formal or informal. Companies with high levels of trust between them ultimately reduce the overall transaction cost of doing business and present evidence that highlights the transaction costs for firms with low levels of trust being as much as five times higher than those with high trust levels (Dyer and Chu, 2003). Therefore firms with linkages and high trust have some cost advantages.

2.2.2 Cost of formal linkages

In a study conducted on multi-national companies operating from the United States, it was found that many of these firms have adjusted their approach with

regards to joint ventures (as a proxy for formal partnerships) (Hennart, 1988). Historically the approach was for a firm to own a company outright, but the trend is moving towards relationship-based transactions. These transactions are reliant on trust to ensure that this form of formal linkage can have a beneficial effect on the firm's cost structure.

Investments in relationship-specific spending do not necessarily increase the overall transaction cost between firms. Improved relationships can assist in enabling the firm to become more specific in its requests of partners while reducing the cost of the business transaction (Dyer, 1997). This is something that could be unique to the specific inter-firm relationship and therefore provide it with an advantage over its competitors. This finding demonstrates that investing in building linkages is a cost-effective way of building competitive advantage.

2.2.3 Cost of informal linkages

The shift from on-premise trading to e-trading allows firms to reduce costs and simultaneously increase efficiencies and profitability (Garicano & Kapan, 2000). This is a shift from a more formal to a less formal trading mechanism while still providing firm profits. Assuming that linkages extend to relationships between customer and suppliers, one can observe that the nature of the linkage can change over time. So too can the benefits.

In a more risky trading environment with large amounts of uncertainty, trust becomes an even more important ingredient to successful linkages. Levels of trust are difficult to gauge in the online world and therefore the informal linkages between company and people become even more crucial than before (Dryer & Chu, 2003).

Based on the evidence presented above, it would seem that informal relationships, or linkages, impact on firm performance. Word of mouth plays a significant role in a consumer's adoption of new products. Word of mouth from both weak and strong ties is powerful and impactful on a person's buying decisions. Therefore, firms that focus on both weak and strong ties within an informal network benefit. There could be a significant cost, from a lost opportunity perspective, should a company not focus on the informal linkages (Goldenberg & Barak Libai, 2001).

Linkages are effectively relationships and relationships come in different forms. They are all important to business success and are often interlinked or underpinned by the people relationship that underscores them. People relationships are critical to the success of a brand (Fournier, 2000). In addition, interpersonal relationships within an organisation are important to the overall success of the organisation (Sveiby, 2001). This value extends to inter-organisational connections, as people are at the core of this relationship (Cousins, 2002).

Social capital is an important aspect to consider in analysing the value of informal relationships. 'Social capital' in the form of informal relationships between different social groups is one of the key elements to business success (Ashman, Brown, & Zwick, 1998). Innovation in firms is impacted by a great number of factors. Users, suppliers and manufacturers are all sources of innovation. Not only does innovation come from multiple sources but it is difficult for this innovation uplift to be transferred to others in the relationship network (Hippel, 1988).

2.3 Innovation, research and development and linkages

Research and development (R&D) combined with external knowledge collection (i.e. through network linkages) is complementary to the process of innovation creation (Cassiman & Veugelers, 2006). Research and development combined with scientific breathroughs also contribute to in the drive for innovation (Hall & Bagch-Sen, 2002)

A direct link was found between R&D and innovation, operationalised through the link between the adoption of "offshoring" as a practice in the United States, shifting R&D to countries such as China and India (Bardhan & Jaffee, 2005). As a result, innovation in these "off-shored" countries is on the increase. Even though these countries may have participated in innovation activities before, there seems to be a correlation between the increase in R&D "offshoring" hubs and the increase in innovation appearing in countries such as India, China, Russia and others.

Knowledge spill-overs from innovation activities have an impact on a firm's ability to innovate through R&D activities. This argument can be expanded to country-level analysis, extending to the ability of a developed country (such as the US) to translate R&D into innovation if "offshoring" continues to take place. The concept of knowledge spill-over could shift traditional hubs of innovation from developed countries to the "offshoring" destinations due to local firms benefiting from the knowledge spill over (Audretsch & Feldman, 1996). This would be achieved through their linkage with the firm that is innovating and generating R&D and could culminate in the recipient of the spill over becoming more innovative and in doing produce more from an R&D perspective.

The concept of "spill-over" of knowledge, through linkages with the innovating firms is important for the purposes of this research. Knowledge spill-over has a greater impact on firms closer to the source than firms that are more distant. This leads to the creation of hubs of innovation knowledge and possibly leading to the geographical shift of these hubs as companies offshore (Audretsch & Feldman, 1996)

Linking what we know about knowledge spill-overs to the earlier argument that innovation is partly dependant on linkages and that linkages are largely reliant on relationships, leads to a conclusion on innovation markets. Spill-overs present a threat to those markets who currently lead in the innovation and R&D race. The offshoring could have the knock on effect of growing innovation and R&D hubs in the countries that are commonly used as off shoring destinations due to the lower cost of labour (Audretsch & Feldman, 1996).

This argument is demonstrated in the Indian pharmaceutical industry where progress has been made from manufacture and designing the process for production, into designing the drug itself. A downstream effect of this innovation progression is that Indian pharmaceutical companies have become a significant force in the production of generic medicine too (Chaudhuri, 2007). This was found to be due to the linkage with the patent holding firm.

2.4 Conclusion

Linkages matter because they are the basis of relationships and alliances. These alliances are important to firms and impact components of a firm's reputation and ability to operate (Stuart, 2000).

Not only are these linkages important but in many cases they prove to be a cost effective mechanism to be responsive and flexible to the needs of the market while reducing the overall cost of the operations (Aris, 1995). Linkages further add to the success of a company – people networks are enablers from a financial, capability and people perspective.

Linkages and their benefits are therefore much wider than just being the bedrock of innovation as innovation is one of the leading contributors to a firms research and development output. This is not just restricted to product but extends to include processes and solutions too (Bardhan & Jaffee, 2005). Networks or linkages can add significant value to organisations while impacting on a firm's ability to innovate through R&D.

3 Research Hypotheses

With the literature review pointing to the fact that linkages, both formal and informal impact a firm's ability to innovate and that R&D impacts a firm's ability to generate innovation, this research project aimed to investigate the differences in impact between formal and informal linkages and how they impact R&D.

The independent variables used to test the hypotheses tried to capture the nature of business networks between firm actors (clients, suppliers and competitors) and non-firm actors (consultancy companies, government, universities and research institutions). These business networks were conceptualised as channels that facilitate innovation (and information and knowledge) transfer, and may assist firms in developing new products and processes through collaboration.

The focus of this research was therefore to describe the impact of linkages on innovation and the impact that innovation has on a firm's ability to innovate.

Two main hypotheses have been formulated with respect to this research question.

3.1 Hypothesis 1

H_1: Firms with network linkages have higher levels of innovation than firms which do not.

H_{1A}: Firms with FORMAL network linkages have higher levels of innovation than firms which do not

H_{1B}: Firms with INFORMAL network linkages have higher levels of innovation than firms which do not

3.2 Hypothesis 2

H_2: Firms that have significant spend on research and development (R&D) have higher levels of innovation than those that do not.

The next chapter discusses the research methodology used to test the above propositions.

4 Research Methodology

4.1 Research Design

The choice of methodology for this research is quantitative and descriptive in nature.

Descriptive research describes the characteristics associated with a population or a phenomenon (Bloomberg, Cooper, & Schindler 2005). Descriptive research can be based on the estimation of a populations proportion and will focus on questions like, how, who, when, what (Bloomberg *et al.,* 2005).

The intention of this research is to establish what proportion of the population has high levels of innovation due to the fact that this group of firms has chosen to cultivate formal linkages. It will then further investigate the specific impact of innovation and linkages during an economic downturn.

4.2 Unit of Analysis

The unit of analysis is the firm.

4.3 Population of Relevance

In this research from the EU or emerging market firms operating in the ICT, Automotive or Agro-processing sectors is considered target population. The

target population is an explicit population elements of an entire group pertaining to a research project (Zikmund, 2003).

4.4 Sampling Frame and sample

The sampling frame lists the elements from which the actual sample is taken. It is ideal that the list of population members is complete and correct with no additions that do not meet the criteria (Blumberg *et al*., 2005).

The survey used for this study was developed to investigate a concept called the “technology frontier”. This was achieved by studying the trend of emerging economies outside of the European Union (EU) increasingly becoming a source for knowledge generation and the inception of ideas for the development of knowledge (INGINEUS methodology report, 2010). Therefore, the following selection parameters could be identified:

Organizations had to be in countries that form part of the EU, as well as countries that do not, in order to be able to test the perceived contrast in development. The countries selected from the EU where, Denmark, Estonia, Germany, Norway and Sweden. The emerging market countries selected included Brazil, China, India and South Africa.

The organizations where categorized, by industry, into 3 different levels, low, medium and high. The categorization was based on the level of knowledge

creation with in the industry and therefore knowledge creation was an underpinning factor for all of the surveyed organizations.

A representative sector had to be identified for each level of technological ability. Based on the foregoing desktop research, the sectors were identified as agro-processing (low), automobile (medium) and ICT (high).

The complete group of specific population elements relevant to the research project is defined by Zikmund (2003) as the target population. In this research, any firm that operates in one of the following industries:

- Agro-processing
- Automobile
- ICT

in countries that are part of the EU and those that are not, are considered as the target population.

4.5 Sampling Method and size

The sampling method used is a probability based simple random survey of all the potentially innovative firms across the three sectors identified in participating countries. Blumberg et al. (2005) defined probability based sampling as a controlled procedure which ensures that each population element is given a known non-zero chance of selection. He went further to describe the simple

random sample as a case in which each population element has a known and equal chance of selection.

4.6 Data Collection Instrument – Design

The questionnaire developed as part of an international project – the Impact of Networks, Globalization and their Interaction with EU strategies (INGINEUS) was used as the base for the data collection process. This project focuses on the extent to which innovation is taking place across globally diverse networks in both developed and emerging markets.

The outcome of this input was a list of 14 questions, some with sub questions:

Question 1 was designed to understand the responding firm's main product, either goods or services. The respondent was required to briefly describe this and was then asked a menu based question requesting the respondents to select which option best described their forms main area of focus;

Questions 2 to 4 focused on gaining insight into the size of the responding firm, their market, research and development activities and some sales information.

Questions 5 and 6 focused around the topic of innovation;

Questions 7 and 8 asked questions designed to uncover information about the way the firm collaborated with various stake holders including customers, suppliers, authorities and education/research;

Questions 9 and 10 examined the firm's views on how attractive the region of operation was and their views on offshoring components of the organisations activities;

Questions 11, 12 and 13 were questions focused on policy; and

Question 14 examined the impact that the global economic crisis had had on the organisation.

4.7 Data Collection

Databases where identified after researching which databases where most relevant and which had the best possible chance of containing the latest contact information of the individuals and firms. These where then procured. In some cases additional databases where procured to ensure enough responses were received.

Potential respondents where contacted telephonically and provided with information about the survey and the type of questions that where going to be asked. If they agreed to complete the survey they were then sent a link to an online survey tool. During the first two weeks, following the mail being sent,

responses where tracked. Any individual that had agreed to participate and had not completed the survey was contacted again and asked to do so. If there was still no response a final reminded was sent.

The online survey tool used was Survey Monkey. All respondents where requested to complete the survey via this channel. However, in the case of China, Brazil and India the decision was taken to rather conduct face to face and/or telephonic interview as past experience had revealed extremely low response rates from emailed surveys. This decision was taken as one may not receive an increased response rate by just increasing the number of surveys sent out (Krosnick, 1999). Scalm & Kelloway (2001) note that the value of the research results can be heavily influenced by the number of results. Therefore opting to make telephonic and face to face contact was a necessary step. Once collected telephonically or through face-to-face interviews this data was inputted by the research entity into the on line tool.

Once all the data had been captured the data was cleaned up and sent to a central statistician for assimilation into a single spread sheet. A final dataset has been assembled with a set of reports and pivot tables based on the various levels of analysis.

Below is a table depicting the response rates by country and categorized into industry:

Table 1: INGINEUS survey results by sector and by country

COUNTRIES	ICT	AUTO	AGRO	TOTAL
Brazil		69 (25.9%)		
China	243 (2.7%)			
India	324 (25.2%)			
South Africa			84 (16.9%)	
TOTAL emerging markets	**567**	**69**	**84**	**720**
Denmark			49 (23.3%)	
Estonia	17 (14%)			
Germany		53 (4.7%)		
Norway	181 (11.9%)			
Sweden	171 (10.3%)	24 (14.3%)		
TOTAL developed countries	**369**	**77**	**49**	**495**
Total	**936**	**146**	**133**	**1215**

Source: INGINEUS methodology report (2011)

The response rates vary between country and sector with the most responses coming from the ICT sector and India and China contributing the most number of responses at a country level.

4.8 Data Analysis

4.8.1 Dependent variable

The dependent variable for this study was *Level of innovation* and it was operationalised using Question 6 from the questionnaire. This question prompted respondents to provide information regarding product and/ or process innovation experienced in the firm between 2006 and 2008. The sub-questions (6.1 – 6.5) covered different types of innovation, being:

i. New products
ii. New services
iii. New or significantly improved methods of manufacturing or producing
iv. New or significantly improved logistics, distribution or delivery methods for inputs, goods and services
v. New or significantly improved supporting activities for processes (e.g. purchasing, accounting, maintenance systems etc.)

The four options available for each of the sub-questions indicated level of innovation, being new to the world, new to the industry, new to the firm or none. New to the world indicated the highest level of innovation.

A scoring system was devised to operationalise the dependent variable. Each case in the data set could have a score of 0 (= No) or 1 (= Yes), depending on whether a respondent selected that case or not. An aggregate index was created using the summation of all incidences. Each firm could therefore score

a maximum of 15 points for *Level of innovation* (continuous variable). Based on this, each case could then be compared to each other case in the data set.

TABLE 4.8.1a

QUESTION CODE TABLE: LEVEL OF INNVOVATION

Question 6/6.1	
Code	New Product
1	New to the firm
2	New to the industry
3	New to the world

Question 6/6.3	
Code	Improved Maufactoring
1	New to the firm
2	New to the industry
3	New to the world

Question 6/6.1	
Code	New Service
1	New to the firm
2	New to the industry
3	New to the world

Question 6/6.4	
Code	Improve Logistics
1	New to the firm
2	New to the industry
3	New to the world

Agrregated Index
Q6/6.1-6.2 Product Innovativness
0-6

Question 6/6.5	
Code	Improved Support
1	New to the firm
2	New to the industry
3	New to the world

Total Level of innovation = 15

Agrregated Index
Q6/6.3-6.5 Product Innovativness
0-9

Of the firms included in the original data set (n = 1,215), only 85 (0.07%) reported *Level of innovation* ≥ 6 on the scale of 1 to 15. Approximately a quarter (23.6%) reported no innovation.

TABLE 4.8.1b

DESCRIPTIVE STATISTICS: DEPENDENT VARIABLE

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Level of Innovaton	1 215	0	15	2.75	2.341	0.943	0.07	1.905	0.14
Valid N (listwise)	1 215								

The descriptive statistics supported the frequency statistics, with a positive skewness value indicating scores clustered to the left towards the low values. The distribution is relatively peaked with long thin tails. Kurtosis can result in an underestimate of the variance, but this risk is reduced by the large sample size (>200 cases) (Pallant, 2010, p.57).

4.8.2 Control variables

Several variables were introduced that accounted for firm characteristics as thoroughly as possible, within the limitations of the questionnaire.

The primary purpose of control variables is to rule out potential alternative explanations. In this study, these variables also represent those commonly used to describe the demographics of firms in strategic research at firm level and are presented in **Table 4.8.2**.

TABLE 4.8.2

CONTROL VARIABLE DESCRIPTIONS

Control variable	Type	Descriptions	Question
Country	Categorical	Country of origin headquarters of the firm	
Country type	Categorical	Emerging or developed country	
Industry	Categorical	Industry for which the firm produces its main product (goods or services)	1.1
Company structure	Categorical	Relationship in terms of headquarters and subsidiaries	2
Company size	Categorical	Number of full-time employees at firm	3.1
Sales	Categorical	Does the firm have a significant share of sales activity abroad	3.2
R&D activity	Categorical	Does the firm have significant R&D activity	3.3
Geographical market	Categorical	The firm's largest market in geographical terms	4.1

4.8.3 Independent variables

The hypotheses (1a, 1b and 2) were tested through variables that captured the nature of business networks between firm actors (clients, suppliers and competitors) and non-firm actors (consultancy companies, government, universities and research institutions). These business networks were conceptualised as channels that facilitate innovation (and information and knowledge) transfer, and may assist firms in developing new products and processes through collaboration.

Measures were constructed by analysing the responses collected through the questionnaire from firms about their interactions with other firm and non-firm actors. This captured the ability of the respondent firms to receive a wide range of information through the other actors through these ties and linkages. A focal firm's tie to an actor was conceptualised as being formal or informal.

The data from the questionnaire was characterised into four independent variables representing the sub-elements of the various hypotheses. Only some of the relevant

questions from the questionnaire were used for this purpose. These variables are identified in **Table 4.8.3a**.

TABLE 4.8.3a

INDEPENDENT VARIABLE DESCRIPTIONS

Independent variable	Type	Descriptions	Question
Linkage type		Has the firm developed formal/ informal linkages with other organisations to develop innovation?	8
1a Formal linkages	Categorical		
1b Informal linkages	Categorical		
Investment spend		Did the firm have significant R&D activity during the time period 2004 - 2008 (during the financial crisis)?	3.3
2a Significant R&D activity	Categorical		
2b Significant R&D activity	Categorical		

The responses to the questions needed to be statistically analysed. In order to do this, a code was developed to translate the responses into numeric format.

The data was coded as follows:

TABLE 4.8.3b

QUESTION CODE TABLES

QUESTION 3.3: R&D SPEND

Yes	2*	**No**	1*	**No info**	0*

* Coded value

QUESTION 8: LINKAGE TYPE

		Yes, formal	Aggregated index: **Firm actors: Formal**
8.1	Clients	0* = No 1* = Yes	0 - 3
8.2	Suppliers		
8.3	Competitors		

		Yes, informal	Aggregated index: **Firm actors: Informal**
8.1	Clients	0* = No 1* = Yes	0 - 3
8.2	Suppliers		
8.3	Competitors		

		Yes, formal	Aggregated index: **Non-firm actors: Formal**
8.4	Consultancy companies	0* = No 1* = Yes	0 - 4
8.5	Government		
8.6	Foreign Universities/ Research Institutions/ Labs		
8.7	Other		

		Yes, informal	Aggregated index: **Non-firm actors: Informal**
8.4	Consultancy companies	0* = No 1* = Yes	0 - 4
8.5	Government		
8.6	Foreign Universities/ Research Institutions/ Labs		
8.7	Other		

* Coded value

The elements from Table 4.8.3b that are worth noting are as follows:

- An aggregate index for Linkage Type was created by adding the codes from the responses to the type of collaboration (formal or informal) within the firm actor collaboration activities (clients, suppliers, competitors) a firm was engaged with. Therefore, if firms did not collaborate with any actor it would have an aggregated index value of 0, while if a firm engaged with all firm actors in a formal way it would have a value of 7

(1+1+1+1+1+1+1). For any other combination it would have a value between and including 1 and 5.

- Formal linkages and Informal linkages were coded as separate variables based on the methodology outlined above.

4.8.4 Tests of difference

When considering level of innovation, this study focuses on a number of different groups:

- Hypothesis 1: Those firms that utilise business networks (formal or informal) and those that do not
- Hypothesis 2: Those firms that have significant R&D expenditure and those that do not

The objective of this research is to decide if there is a difference between the two groups in each hypothesis in terms of innovativeness. In order to achieve this, interval scale variables in the form of aggregated indices are calculated by combining the answers of the sub questions (see **Table 4.8.1a** and **Table 4.8.3b** for details). The comparison of the means of the aggregated indices between the groups will give the overall difference between the groups with respect to the sources and types of innovation.

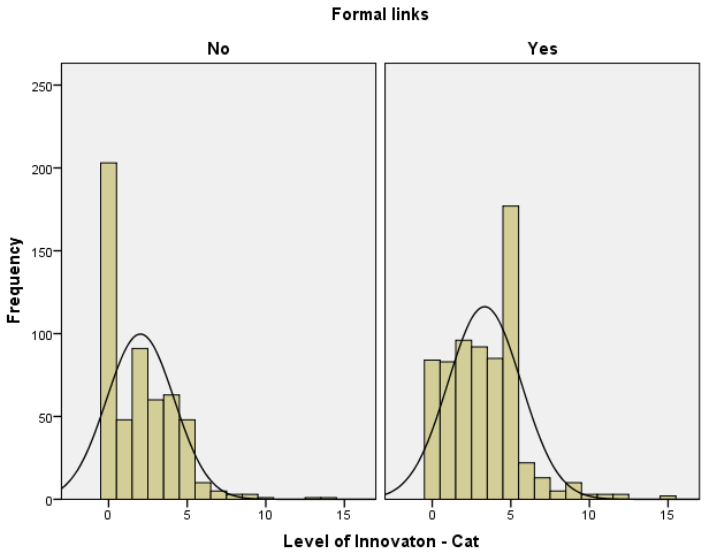
When trying to answer a research question on whether there is a statistically significant difference between two groups, it is appropriate to use independent

samples t-tests. Albright, Winston & Zappe (2006) suggest the t-test as a technique to measure that the mean scores on interval scaled variables are different for two independent groups. The t-value specifically indicates the number of standard errors by which a sample mean differs from a population mean.

In terms of the characteristics of the sample data, the total sample size for this study was 1,215. This sample population is greater than the recommended 30 in order for the central limit theorem to apply therefore allowing the study to assume that the samples were drawn from a normal distribution.

DIAGRAM 4.8.4a

DISTRIBUTIONS OF AGGREGATED INDICES FOR HYPOTHESIS 1



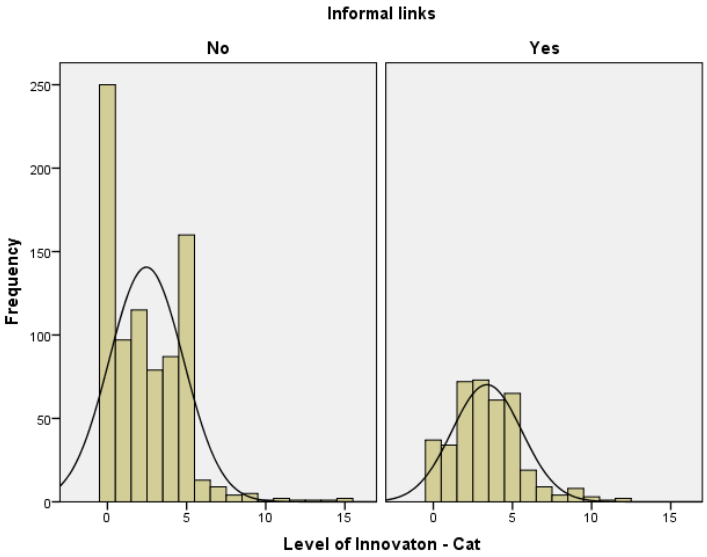
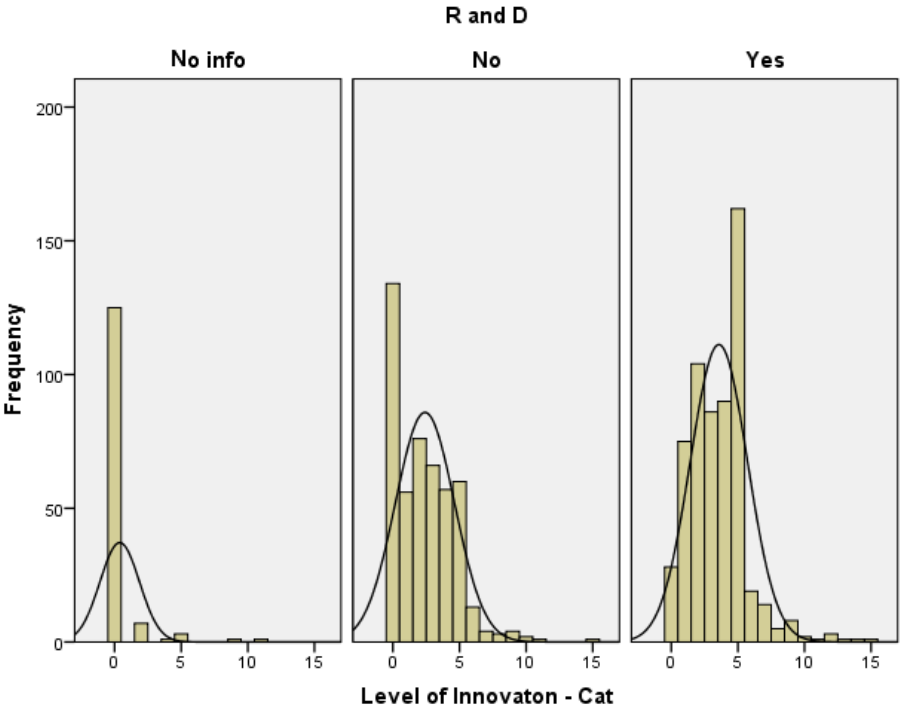


DIAGRAM 4.8.4b

DISTRIBUTIONS OF AGGREGATED INDICES FOR HYPOTHESIS 2



Tests were run to contrast the variances among the two groups. If the variances are equal between the two groups then an Equal Variance t-test will be run,

otherwise Aspen-Welch Unequal-Variance t-test will be run to find the disparity between the means of the various groups for each instance.

The results of these tests will confirm whether or not we must reject or accept the null hypothesis and thereby support in deducting whether or not the two groups tested in each hypothesis differ significantly with regards to their innovative activities.

4.9 Research Limitations

Limitations are acknowledged as follows, these are based on the intended structure and design of the research:

- Although the survey is statistically relevant with a total of 1,215 responses being reported, it is important to note that 77% of the responses received where from companies that identified themselves as ICT organisations. As a main theme of the survey revolves around innovation there is potential that the high percentage of ICT firms that responded could have skewed the overall results.
- Secondly one needs to highlight that 46% of the total responses where received from India and China and that emerging market responses outweighed developed markets by 60% to 40% respectively. Once again the high percentage contribution by countries on a higher economic growth trajectory than others may have an impact of the relevant of the results for countries with significantly small growth rates.
- The survey requested that the respondents answer questions based on the state of their business in 2008. This could have led to some answers being potentially inaccurate as respondents may have incorrectly judged the exact state of their organisation in the past.
- Finally, at the time of completing this research, the data is 5 years old and therefore runs the risk of being less relevant than more recent data. This may be amplified by the timing of the 5 years where the economic

crisis may have impacted the way firms approach linkages and innovation in order to survive the downturn.

In the next chapter, the statistical evaluation of the two hypotheses will be reported on. Descriptive statistics will provide a summary overview of the data set. This will be done by analysing the frequency tables constructed from the responses of respondents to the various relevant questions in the questionnaire. The outcome of this step will be used to establish if there was any existent pattern of differences in terms of the various characteristics of innovative organisations, specifically as pertains to their linkages.

5 Results

This section firstly describes participant responses, followed by some salient findings on the business network types and R&D activity firms engage in. These characteristics were discovered from the responses of the firms to the various questions from the questionnaire. Finally the factors impacting on innovation were linked to the hypotheses of this research.

In order to describe these factors, the data was analysed in the following broad steps:

i. The first step was the descriptive analysis of the data. This was done by analysing the frequency tables constructed from the responses of the firms to the various questions in the questionnaire. The outcome of this step was to establish if there was any existent pattern of differences in terms of the characteristics of various firms in the data set.
ii. The second step was to run the parametric tests per characteristic or factor of innovativeness. The associated crosstabulations and histograms assisted in visualizing the probability distribution and the percentile distribution of the data respectively, while the chi-square values and the associated probability in the t-tests confirmed if the pattern observed in step 1 was statistically significant.

5.1. Participant response and background

5.1.1 Participant response

Responses of 1,215 firms operating in emerging and developed markets were gathered through the INGINEUS questionnaire. The response rate within countries was relatively low, especially in China where the research team decided on a less labour-intensive strategy to gather data.

Table 1: INGINEUS survey results by sector and by country

COUNTRIES	ICT	AUTO	AGRO	TOTAL
Brazil		69 (25.9%)		
China	243 (2.7%)			
India	324 (25.2%)			
South Africa			84 (16.9%)	
TOTAL emerging markets	**567**	**69**	**84**	**720**
Denmark			49 (23.3%)	
Estonia	17 (14%)			
Germany		53 (4.7%)		
Norway	181 (11.9%)			
Sweden	171 (10.3%)	24 (14.3%)		
TOTAL developed countries	**369**	**77**	**49**	**495**
Total	**936**	**146**	**133**	**1215**

Source: INGINEUS methodology report (2011)

The total number of responses was considered satisfactory for the purposes of conducting quantitative research. In terms of number of responses, India had the highest number being 324. Of country types, 720 (59.3%) responses from emerging market firms were included as well as 495 (40.3%) from firms in developed markets.

With an increase of the sample size (*n*), sampling error and uncertainty decrease. "…if *n* is reasonably large, there is about 95% chance that the magnitude of the sampling error will be no more than 2 standard errors" (Albright, Winston & Zappe, 2009, p.417). With increasing *n* which implies greater degrees of freedom (larger than 30), the sample distribution is expected to adequately approximate the population distribution (Albright et al., 2009, p.435).

5.1.2 Background of the firms in the data set

As described in section 5.1.1 above, just over a quarter of the respondents were firms in India (26.7%). Across the board, most of the responding firms were in the ICT sector (77%) with 12.2% in the automotive sector and 10% in the agro-processing sector respectively. Most firms were standalone (57%), with about a quarter of respondents being the subsidiaries of multinational corporations (MNC's) (20.2%) and the remainder indicating that they were the headquarters of an emerging market multinational (11.1%). Most of the firms were operating in the SMME sector with less than 10 full-time employees (32.8%).

The share of location of sales activity indicated a level of insularity, with 37.2% of firms indicating a significant number of their sales that can be attributed to foreign markets, while 54.5% indicated no significant sales activity abroad. Of the total sample, 62% of the market for these firms was internal to the

enterprise, regional or national, with 26.7% of firms saw exports as the key market for their product.

Table 5.1.2 is the summary of demographics of the sample:

TABLE 5.1.2

SUMMARY OF DEMOGRAPHICS

COUNTRY OF ORIGIN

	Frequency	Percent	Valid Percent	Cumulative Percent
Brazil	69	5.7	5.7	5.7
China	243	20	20	25.7
Denmark	49	4	4	29.7
Estonia	17	1.4	1.4	31.1
Germany	53	4.4	4.4	35.5
India	324	26.7	26.7	62.1
Norway	181	14.9	14.9	77
South Africa	84	6.9	6.9	84
Sweden	195	16	16	100
Total	**1 215**	**100**	**100**	

COUNTRY TYPE

	Frequency	Percent	Valid Percent	Cumulative Percent
Developed	495	40.7	40.7	40.7
Emerging	720	59.3	59.3	100
Total	**1 215**	**100**	**100**	

INDUSTRY TYPE

	Frequency	Percent	Valid Percent	Cumulative Percent
No info	10	0.8	0.8	0.8
Agro-processing	122	10	10	10.9
ICT	935	77	77	87.8
Automotive	148	12.2	12.2	100
Total	**1 215**	**100**	**100**	

COMPANY TYPE

	Frequency	Percent	Valid Percent	Cumulative Percent
No info	141	11.6	11.6	11.6
Standalone	693	57	57	68.6
Subsidiary	246	20.2	20.2	88.9
Headquarters	135	11.1	11.1	100
Total	**1 215**	**100**	**100**	

COMPANY SIZE

	Frequency	Percent	Valid Percent	Cumulative Percent
No info	154	12.7	12.7	12.7
<10 FTE	398	32.8	32.8	45.4
10 - 49 FTE	310	25.5	25.5	70.9
50 - 249 FTE	189	15.6	15.6	86.5
250 - 999 FTE	99	8.1	8.1	94.7
>1000 FTE	65	5.3	5.3	100
Total	**1 215**	**100**	**100**	

MARKET GEOGRAPHY

	Frequency	Percent	Valid Percent	Cumulative Percent
No info	135	11.1	11.1	11.1
Internal to entity	20	1.6	1.6	12.8
Regional market	212	17.4	17.4	30.2
Domestic market	523	43	43	73.3
Export market	325	26.7	26.7	100
Total	**1 215**	**100**	**100**	

5.2 Linkage type of business networks

The main objective of this research was to find how the characteristics of a firm's business network contribute to its levels of innovation. This section provides an overview of the results of the different statistical tests run on the responses of firms to the relevant questions (as described in **Section 4**).

5.2.1 Source of technology for the enterprise

Firms may develop formal or informal linkages with other organisations, which may assist in gaining access to, developing and transferring innovation. While formal linkages presuppose the existence of a formalised agreement, informal linkages would imply that no written contract or financial obligation existed.

As described in Section 4, these variables were combined to better understand their interaction and the impact on level of innovation. Accordingly, the following variables were operationalized as follows:

- Variable 1a : Formal linkages with other actors
- Variable 1b : Informal linkages with other actors

For the purposes of brevity and to conform to non-parametric test requirements, the scales used for the original operationalization of these variables were compacted to dichotomous indicators (0 = No; 1 = Yes) and analysed using independent t-tests with level of innovation.

Analysis of the statistical tests on these responses of the firms pointed to the fact that there were significant differences in the level of innovation of firms that employed networks, both formal and informal.

For the purposes of this study the following significance levels/ p-values were used, this is consistent with those commonly used in most statistical interpretations:

- $p > 0.1$ not significant
- $0.05 < p < 0.1$: moderately significant
- $0.01 < p < 0.05$: significant
- $P < 0.01$: highly significant

5.2.1.1 Hypothesis 1a: The level of innovation in firms with formal linkages

The t-test results for formal linkages and level of innovation indicates that the mean value for the group with formal linkages (0.04) is higher than that of the group without formal linkages (0.02). This suggests, although only fractional, that the group with formal linkages group could have a slightly higher level of innovativeness for both products and processes when compared to the group without formal linkages.

TABLE 5.2.1.1

INDEPENDENT T-TEST FOR HYPOTHESIS 1a

	Formal links	N	Mean	Std. Deviation	Std. Error Mean
Level of innovation	No	537	0.02	0.128	0.006
	Yes	678	0.04	0.192	0.007

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Level of innovation	Equal variances assumed	20.452	0	-2.237	1213	0.025	-0.022	0.01	-0.041	-0.003
	Equal variances not assumed			**-2.339**	**1181.49**	**0.02**	**-0.022**	**0.009**	**-0.04**	**-0.003**

There was a significant difference in innovation scores for firms with formal linkages (*M* = 0.04, *SD* = 0.192) and those without (*M* = 0.02, *SD* = 0.128; *t*(1181.490) = -2.339, *p* = 0.020, two-tailed) . Therefore the null hypothesis is accepted.

5.2.1.2 Hypothesis 1b: The level of innovation in firms with informal linkages

The t-test results for informal linkages and level of innovation indicates that the mean value for the group with informal linkages (0.05) is higher than that of the group without informal linkages (0.02). This suggests, although only fractional, that the group with informal linkages group could have a slightly higher level of innovativeness for both products and processes when compared to the group without informal linkages.

TABLE 5.2.1.2

INDEPENDENT T-TEST FOR HYPOTHESIS 1b

	Informal links	N	Mean	Std. Deviation	Std. Error Mean
Level of innovation	No	827	0.02	0.142	0.005
	Yes	388	0.05	0.211	0.011

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Level of innovation	Equal variances assumed	25.295	0	-2.515	1213	0.012	-0.026	0.01	-0.046	-0.006
	Equal variances not assumed			**-2.194**	**557.752**	**0.029**	**-0.026**	**0.012**	**-0.049**	**-0.003**

There was a significant difference in innovation scores for firms with informal linkages (*M* = 0.05, *SD* = 0.211) and those without (*M* = 0.02, *SD* = 0.142; *t*(557.752) = -2.194, *p* = 0.029, two-tailed) . Therefore the null hypothesis is accepted.

5.2.2 The significance of research and development activity

Many firms have significant budget and other resource allocations focused on research and development activity. This may assist in gaining access to and developing higher levels of organizational innovation.

As described in Section 4, the operational variable describing research and development (R&D) activity was a dichotomous variable (1 = No significant R&D activity; 2 = Significant R&D activity). This variable was analysed using independent t-tests with level of innovation.

Analysis of the statistical tests on these responses of the firms pointed to the fact that there were significant differences in the level of innovation of firms that engaged in significant R&D activity.

5.2.2.1 Hypothesis 2: The level of innovation in firms with significant R&D activity

The t-test results for significant R&D activity and level of innovation indicates that the mean value for the group with higher R&D activity (3.57) is significantly higher than that of the group without (2.4). This suggests that the group significant R&D activity could have a higher level of innovativeness for both products and processes when compared to the group without significant expenditure on this function.

TABLE 5.2.2.1

INDEPENDENT T-TEST FOR HYPOTHESIS 2

	R & D	N	Mean	Std. Deviation	Std. Error Mean
Level of Innovaton	No	477	2.4	2.217	0.101
	Yes	600	3.57	2.152	0.088

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Level of Innovaton	**Equal variances assumed**	**2.255**	**0.133**	**-8.751**	**1075**	**0**	**-1.171**	**0.134**	**-1.433**	**-0.908**
	Equal variances not assumed			-8.722	1007.286	0	-1.171	0.134	-1.434	-0.907

There was a significant difference in innovation scores for firms with significant R&D activity (M = 3.57, SD = 2.152) and those without (M = 2.4, SD = 2.217; $t(1075)$ = -8.751, p = 0.000, two-tailed) . Therefore the null hypothesis is accepted.

6 Findings and Interpretations

6.1 General characteristics

Linkages are important to both business and academia as the form the basis of the relationship and access to the relationship (Stuart, 2000). The literature reviewed for the purposes of this research project supports the premise that firm linkages, both formal and informal, support the development of innovation, resulting in benefits to the firm.

In the case of formal linkages the findings of this report supported the literature that firms with linkages have higher levels of innovation than those who do not. This supports other similar research findings that companies with collaborative agreements with their suppliers generally top the rankings with regards to innovation levels (Freel, 2000).

The difference in the levels of innovation for firms with formal linkages as opposed to those without is statistically significant, but not as high as was expected when entering into this research. In addition the data shows that the difference in innovation between firms with formal linkages is less that the difference in innovation between firms with informal linkages. This too is somewhat contradictory to some of the literature that specifically refers to the fact that alliances, or informal linkages, play a secondary role to partnerships, or formal linkages (Stuart, 2000).

In addition to the above, it is clear that firms are finding value in these linkages (Aris, 1995). This value perception is largely based on the fact that firms find these linkages to be a more cost effective than traditional forms of gathering information and formulating strategies. Linkages are not only cost effective but are also more responsive than very formal channels in facilitating innovation.

A limited body of literature exists distinguishing the difference in impact (if any) of formal and informal linkages on innovation. Research indicates that business partnerships render better results than an environment where no partnerships exist (Stuart, 2000). It is posited that informal linkages play a secondary role to formal linkages (operationalized as partnerships), but can be responsible for improving the reputation of the firm in the eyes of financial institutions and customers.

The literature reviewed for this research project defines a contractual relationship as a formal relationship or linkage. There is occasional reference to informal linkages (referred to as “loose relationships”). It would therefore seem that that many of the characteristics of a linkage or relationship between firms are the same whether the relationship is formal or informal, a premise refuted by this research project.

6.1.1 Hypothesis 1a

The data analysis concludes that firms with FORMAL linkages have higher levels of innovation than those who do not. Hypothesis 1a is therefore accepted.

Pittaway *et al.* (2004) discuss how the main advantages of a network:

- sharing of risk between firms in the network;
- mutual improvement of networked firms to gain access to new markets as well as new technologies;
- the reduction of the time it takes a member company to develop and release a new technology to market;
- the combination of complementary skills,
- providing a platform for obtaining knowledge from external parties.

All of the advantages cited can contribute to innovation in one way or another and therefore support the concept that formal linkages benefit firm's innovation and or research and development activities.

The finding that formal linkages do yield higher levels of innovation in firms is important as linkages also have an impact on financial value. The positive linkages a firm has with its customers directly translate into loyalty which in turn directly translates into value for the firm (Riechheld *et al.,* 2000). Likewise innovation has a direct impact on an organisations ability to generate value (Cantwell, 2001).

If one concludes that innovation and research and development require investment it is clear that good customer linkages are critical to a firms success. The retail sector in South Africa provides an example of firms increasingly looking to formalise their linkages with customers. Pick ‘n Pay, Woolworths, the Foschini Group, amongst others, have all launched loyalty programs to formalise their relationship with customers. In the case of Pick ’n Pay it appears that it is not only the retailer that is looking for the relationship with the consumer but also the consumer realising value from a formalised relationship with the retailer. When Pick n Pay released their SmartShopper card they received significantly more customer uptake than they expected (Pick n Pay Annual General Meeting, 2011).

This anecdotal evidence is supported in business research findings. Zaheer and Bell (2005) found a benefit for people connections with firms, citing a direct correlation between the strength of the relationship and the firm’s ability to build and grow its competitive advantage based off the relationship with customers or consumers. One can therefore infer that an individual with a solid network will ultimately benefit the firm, assuming their connection to the firm is strong and they are willing to link their network knowledge to a firm activity.

A firm can further use its formal linkages with the employee (for example the employment contract) to leverage an employee’s informal network, assuming the employee is willing to link their network knowledge to the firms activity (Heene 2003). It is not only important for a company to encourage the formation of social linkages for employees but also to understand those linkages as there

is clear evidence of their benefit. These kinds of expanded linkages could however introduce increased risk to the firm, regardless of the fact that the underpinning linkage is formal.

6.1.2 Hypothesis 1b

Firms with **INFORMAL** network linkages have higher levels of innovation than firms which do not

The literature reviewed for this research project indicated that companies with informal relationships are more innovative than companies without informal relationships. This premise is supported by the data analysis and Hypothesis 1b is therefore accepted.

Zaheer and Bell (2005) discuss the benefit of an individual having strong connections with other individuals and with firms. They discuss how there deep relationships can assist a firm in building competitive advantage. Lengnick-Hall (1992) broadens this discussion and discusses the direct link between competitive advantage and innovation. They tied this link back to a complex network of relationships being the underlying reason for this competitive advantage.

The literature findings are supported by the data analysis in Chapter 5, concluding that firms with informal linkages have higher levels of innovation than those who do not have informal linkages or relationships.

In many industries, consumer relationships are largely informal, with the exception of some firms (mostly in the retail industry) investing heavily in formalising those relationships though a myriad of loyalty programs.

Based on the literature, relationships or informal linkages are incredibly difficult to replicate and can therefore be a true source of innovation (Jifeng, Mu & Love (2008). If considered that innovation contributes to a firm's competitive advantage and that informal linkages impact innovation, it can be concluded that the informal linkages that a firm or its employees have will not only impact competitive advantage and innovation but that it will be incredibly difficult for competitors to copy the innovation and the reason for the competitive advantage.

There are also a number of unforeseen benefits of informal networks, specifically the impact that they have on the protection of property rights even when contracts are not in place (Pittaway *et al*., 2004). This leads to the conclusion that informal networks are a positive contributor to the protection of the output of many research and development or innovation activities.

The process of firm innovation involves solving both simple and complex problems. Cross *et al.* (2002) discuss the common saying "it's not what you know but who you know", drawing direct correlation between the information a person has, being linked to the people that they have linkages with.

They extend this discussion and infer that people rely very heavily on their network of relationships to find information and solve problems. This points to the possible conclusion that firms with informal linkages have higher levels of innovation than those who do not, as supported by the data. If people are able to solve problems more efficiently with a broad set of informal relationships it therefore holds that people with larger informal networks will have higher levels of innovation. As firms are made up of collections of people, the firm would therefore benefit from these informal linkages by being more innovative.

Informal linkages could further have a significant impact on a firm's performance (Goldenberg *et al.,* 2001). Word of mouth plays a significant role in consumer's adoption of new products and their buying decisions. Therefore companies that focus on ensuring they have a positive position within an informal network benefit could potentially benefit from these linkages.

As an example, the shift from on-premise trading to *e*-trading allows a firm to not only reduce cost but also increase efficiencies and profitability (Garicano & Kapan, 2000). If a firm did not have a positive linkage with its "on premise" customers or clients it would be difficult if not impossible for a firm to shift buying patterns to the internet and take advantage of the cost savings and efficiency benefits. This once again is supported by the data findings, indicating that a well formed set of informal linkages across internal and external stakeholder groupings (e.g. employees, consumers and partners) will impact a firm's ability to innovate.

6.1.3 Hypothesis 2

Firms with significant levels of R&D activity have higher levels of innovation than those that do not.

The results of the data analysis indicate a positive relationship between research and development and innovation in firms. Hypothesis 2 is therefore accepted. This finding supports the findings in the literature review for this research study.

Innovation requires some level of investment, whether from a financial or time perspective. Research and development has an impact on innovation (Hall & Bagch-Sen, 2002). Driving this innovation through formal and informal linkages has a cost (Ahuja, 2000). One the main reasons for investing in linkages would be for a firm to get some level of benefit or return. Firms with more “capital stock” would make for a more attractive linkage partner. It is therefore important for companies to understand the cost and get the balance right.

As the current world economic environment continues to shift in the aftermath of the global financial crisis, many firms have experimented with different solutions to improve revenues and reduce costs. Arguably one of the most popular cost saving measures for firms in the developed world has been the practice of offshoring. This is a process of “outsourcing” none core functions or functions that have little or no strategic value to countries that can complete them is less time at less cost.

Through the process of knowledge spill-over in emerging markets, these markets becoming more and more innovative themselves. China and India are good examples of this where they have evolved their pharmaceutical industry from pure production to the development and manufacture of drugs (Bardhan & Jaffee, 2005).

As capital stock is largely built through innovation and or R&D there is an indirect cost to the linkage. This is supported but the literature (Ahuja, 2000) and confirmed by the data analysis, indicating a positive impact on innovation in firms with formal linkages. Even in the case where a company has limited capital stock, the literature reviewed supports the concept that it can become attractive to linkage partners by having a technological breakthrough. In most cases a technological breakthrough would come from some level of innovation, supported by formal and informal linkages.

6.2 Conclusion

This research study set out to investigate:

- The impact of formal and informal linkages on innovation; and
- The impact of investment in R&D on innovation.

In the case of formal linkages the findings of this report supported the literature that firms with formal linkages have higher levels of innovation than those who do not. Companies with collaborative agreements with their suppliers generally top the rankings with regards to innovation levels (Freel, 2000).

In addition, the data analysis showed that while both formal and informal linkages lead to higher levels of innovation, informal linkages seem to lead to higher levels of innovation. This finding was somewhat contradictory to the literature specifically referring to the fact that alliances, or informal linkages, play a secondary role to partnerships, or formal linkages (Stuart, 2000).

With regards to research and development, the data analysis indicated that there is a direct correlation between firms which invests in research and development generate and the levels of innovation than these firms generate.

All of the research hypotheses were accepted and is supported by the findings in the literature reviewed.

7 Conclusions and Recommendations

7.1 Conclusion

The purpose of this study was to identify how innovation is impacted by the linkages (both formal and informal) a firm has with other players in the market. Secondly was to extend our understanding of innovation and look at any possible linkage between innovation and research and development activities that firms conduct.

Both of these are important considerations given that firms increasingly operate in a world where networks (whether social, physical, on-line or in-person) are playing an increasing role in business and how business is conducted. Research and development become an increasingly important focus for firms, whether in developed or emerging markets. Therefore understanding the links that research and development has with subjects such as linkages is important to assist companies in navigating these fast moving and treacherous business times. .

Investment in research and development also showed a positive impact on innovation. This is an important finding, as it possibly points to one of the reasons behind increased levels of innovation. Companies like Apple are investing billions of dollars into research and development and are releasing significant and world changing innovation in both products and services. In

some cases the innovation Apple has released has changed the entire spectrum of an industry:

- iTunes fundamentally changed the music industry and the way people procure new music tracks;
- The iPad franchise introduced a game-changing invention to the market, leading to the development of an entirely new product market.

In summary, linkages are important to companies (Stuart, 2002). Both formal and informal linkages have advantages for a firm's innovation activities. Informal linkages, achieved through the flattening of company's structures, have led to increased innovation levels (Cross *et al.,* (2005). Firms with higher investment in research and development have hiver levels of innovation as concluded through the data analysis and supported but the literature.

7.2 Recommendations to stakeholders

7.2.1 General business recommendations

Based on the findings of this research report, the case for investing time and money in their development has been made. Linkages return value in terms of increased levels of innovation, but also customer retention, company reputation, cost reduction, efficiency improvements and talent attraction.

Building linkages should be considered an activity with many benefits and generally promoted within organisations:

- Linkages can be formal or informal, with contract or without. However, by their very nature, they are largely built, managed and executed on by people – the people within your company.
- Linkages should not just be considered as an intercompany practice. Linkages should be examined and extended to customer, employees and suppliers. There is clear literature evidence that points to benefits of positive linkages across all of these aspects.
- Consider linkage acquisition as a proactive practice to be implemented across the business. There are many tools available to people to build these networks. LinkedIn, Yammer, Facebook and a myriad of other social networking sites that allow the building of networks are available. Many companies have restricted the use of these sites but business leaders should consider how to leverage the networks people have to benefit the organisation and empower them to do so.
- Linkages should not just be considered an external activity. Especially in large firms, the building of cross-divisional linkages is an important organisational development activity. By empowering people to build linkages internally, extensive business benefits could be gained.
- As linkages are largely a people-driven activity, it is important for firms to insider how to retain the linkage even if the individual holding the primary relationship departs the organisation. Many companies have lost clients due to the primary relationship owner moving companies and taking the relationship with them. A firm needs to consider its own brand in the market and the emotional attachment that clients, customers, suppliers

have to the brand. This could assist in the transfer of the linkage should the owner move organisation.

- The advantages of business linkages are clear, but these advantages may come at a rate of diminishing returns. Many employees engaged in business development activities have fallen into the "building-a-relationship-trap" and spent unnecessary time entertaining customers to build a linkage. Although this activity may be necessary, managers and business owners need to understand that there comes a time where the linkage shifts from being built to being maintained. If the former is done correctly the later will require less input and effort going forward.

7.2.2 Recommendations to business-to-business companies

In addition to the general recommendations above, it is key to select you linkages well and ensure you define, understand and execute on these relationships. While a firm should consider investing in both informal and formal linkages, it is important to remain aware that these relationships could have negative implications. Should a linkage partner experience any form of negative impact in the market, this could be transferred onto the partner firm.

7.2.3 Recommendations to business-to-consumer companies

In addition to the general recommendations, investing in linkages with your consumers can be largely positive. There are direct links to customer loyalty and an increase in revenue.

One should also be cognisant of the opportunities of extending this loyalty into the online world as there are significant cost and efficiency gains to be made. That said the customer linkage needs to be at the core of that change and understood deeply as this change in approach could largely change the integration model with the consumer and therefore could impact the overall relationship.

7.3 Recommended for areas of further research

- The concept of a customer as a linkage warrants further investigation, specifically in the area of innovation and how this contributes to the bottom line.
- Although there is some literature that discusses the linkage between research and development and competitive advantage this is largely conducted in the ICT and pharmaceutical sectors. While this remains interesting, the results are somewhat expected as research and development forms a large component of what these firms do and these are large companies with access to significant resources. It would be interesting to see this research extended to smaller firms with historically lower levels of research and development and understand how even small changes in processes or systems could impact a firm's ability to compete.

- In this report, the main consideration was the difference between firms with formal and informal linkages. It would be interesting to extend this research and understand if a firm with formal linkages also has informal linkages and *vice versa*. Further research should consider the link between these different linkages and the benefits, if any, to the firm.
- The personal relationship and the impact it has on the formation of linkages could also be considered, specifically the conclusion of formal agreements. There is a possibility that the failure of these large, complex and very formal linkages between firms is the result of the failure of people to form their linkages as organisational cultures clash in a forced linkage process.

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