Evidenced based decision making in public policy for innovating firms

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Abstract

Firms require policies that are supportive to their operating environment and competiveness. Few firms, however, interact with policy makers and it is suggested in the literature that they do so in a self-interested manner. Policy makers are faced with the challenge of ensuring positive sum outcomes in a highly politicised process. Innovative firms could possible request more value creating policies with non-innovative firms requesting value capturing policies. A firm that is more networked is more innovative, but this also increases the management complexity of the firm. The purpose of this study was to enable policy makers to make more informed political decisions in the public policy process. A secondary dataset focused on firms in the innovation context. Groups of firms were categorised by their innovativeness, involvement with policy and network richness through Chi-square tests, Exploratory Factor Analysis and Cluster Analysis. The policy requests of these firms were analysed through the Kruskal-Wallis test, with post hoc analyses using Mann-Whitney U tests. The study found that firms could be categorised based on their innovativeness and involvement, but that network richness played an important role in increasing both. Innovative and non-innovative firms had similar needs in policies. It is suggested that richly networked firms are not independently rent seeking as they request policies that are to the benefit of the broader innovation network in order to sustain and grow the collaborative relationships. Policy makers are advised to ensure the inclusion of network rich firms in the policy process.

Keywords

Evidenced Based Policy; Network; Public Policy; Innovation; Corporate Political Activity

Declarations

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 examinations in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Marnie Miny   Date

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1 Chapter 1: Introduction to the Research Problem

1.1 Research Title

Evidenced Based Decision Making in Public Policy for Innovating Firms

1.2 Background to the Problem

Country competitiveness is influenced by the innovativeness of its firms. Innovation enables firms to be at the leading edge of market demand, facilitating a more sustainable competitive advantage for the country. Public policy is a factor that enables firms to be more innovative. The public policy process is highly politicised with many stakeholders vying for their interests. Non-innovative firms may request value capture policies in contrast with innovative firms, which might request policies focused on value creation. Evidence based policies could therefore lead to more informed political decisions.

Value creation policies will enable firms to be more innovative, thereby increasing the competiveness of the country. Value capture policies could result in lock in on ineffective capabilities and practices which are decreasing the competitiveness of both firms and the country in an increasingly complex, dynamic and turbulent environment.

1.2.1 Background to Public Policy

Ring, Bigley, D'Aunno and Khanna (2005) stated that governments can have a major impact on organisations and how they are managed. Hillman and Keim (1995) defined public policy as any form of government action or inaction that expresses the intent of government actors. Public policy is the process of choosing goals, values and practices to improve social and economic welfare.

Public policy decision making is a politicised process with many stakeholders competing for the attention of the public policy decision maker (Baumgartner, Breunig, Green-Pedersen, Jones, Mortensen, Nuytemans & Walgrave 2009; Colebatch, 1998). Parties act in their own self-interest and lobby for policies that will be to their own advantage. In addition, public policy makers are inherently self-interested, increasing the challenge of having an effective outcome and process in public policy decision making.

Evidence based policy making is an emerging trend within the public policy field. Although the debate within the field focuses on the type of evidence that qualifies and the methodology used to obtain the evidence, the concept is not debated (Hansen & Rieper, 2010). The question raised, however, is whether the result of evidenced based policies will be better informed political decisions, or if decisions will become de-

democratised and technocratic (Hansen & Rieper, 2010). Davies (2012) and Strydom, Funke, Nienaber, Nortje and Steyn (2010) stated that public policy decision making based on evidence is better informed, more effective and less expensive than a process that is rife with political involvement. The public policy process is inherently political and a tool that enables better informed political decisions will be to the benefit of the policy makers and the stakeholders.

Based on corporate political activity, firms will either be involved in the policy process or not involved in the policy process. As public policy influences the competitive and economic environment of firms (Hillman & Keim, 1995), political action is a business priority (Hillman & Hitt, 1999; Lux, Crook & Woehr, 2011; Yoffie, 1988). Involvement in public policy thus creates or conserves value for a firm and ensures a better competitive positioning in the future. Being involved in public policy is however a cost versus benefit decision and some firms will want to reap the benefits without paying the cost for a collective good (Getz, 1997; Lux et al., 2011). Oliver and Holzinger (2008) argued, however, that free riding is not a viable option as firms are forced to meet the demands of a dynamic or unpredictable environment, but if firms are unaware of how policy can benefit them and are uninformed of their external environment, they are less likely to be involved in policy and if given the opportunity would give an undifferentiated response to public policy decision makers.

1.2.2   Background to Innovation

Innovation is the commercial benefit obtained from ideas (Neely, Filippini, Forza, Vinelli & Hii, 2001) and presents the opportunity to grow, survive and significantly influence the industry for any firm (Davila, Epstein & Shelton, 2006). Innovation is understood differently between contexts and a continuum of innovation, from not innovative to new to the firm/industry/world, exists (Chaminade, Lundvall, Vang-Lauridsen & Joseph 2010; Plechero & Chaminade, 2010). Innovation can therefore range between imitations to genuinely new innovations.

Pittaway, Robertson, Munir, Denyer and Neely (2004) stated that business networking is important for a firm's innovation and therefore its competitiveness. Herstad, Bloch, Ebersberger and van de Velde (2010) argued that interorganisational linkages are critical to the innovative capabilities of firms. Powel, Koput and Smith-Doerr (1996) found that there is an increasing requirement for firms to collaborate with other actors as the source of innovation is increasingly not in the individual firm, but within the network of the firm. Network richness is therefore an important factor for the innovativeness of firms.

1.2.3 Background on Involvement with Policy and Innovativeness

Firms could benefit from positive, negative and zero sum policies and are prepared to use resources to adopt or deter such policies depending on their self-interest (Hillman & Hitt, 1999). Political participation can be on an individual or collective level, with firms that have more resources choosing individual actions that can obtain the most benefit for the firms (Hillman, Keim & Schuler, 2004; Lux et al., 2011; Schuler, 1996). These benefits are firm specific and might not benefit the overall economic and social welfare of a country. If, however, these firms are innovative, they are more likely to seek value creating policies that could benefit the uninvolved innovative firms in addition to themselves. This will facilitate firm and country competitiveness through enabling firms to be at the leading edge of the market.

Firms that are not innovative and involved are expected to request value capturing policies that will lock in capabilities on uncompetitive practices, negatively affecting innovation.

Firms that are not involved in public policy perceive the cost of involvement to be higher than the benefit of involvement. As public policy influences the competitive and economic environment of firms (Hillman & Keim, 1995), firms that choose to be uninvolved possibly do not understand how policy could be to the detriment or benefit of their operations and do not know how to interact with policy makers or what to request. The other alternative is that they know what is required, but the cost of interaction exceeds their expected benefits.

1.2.4 Problem Statement

Public policy makers are challenged to take into account divergent views of interested parties. If firms lobby for public policy there is a need to determine whether it is based on specialist capabilities that need lock in policies to stay competitive or whether it is leading market firms asking for public policy that will benefit a wider constituency than those present in the public policy process. Innovative firms are expected to lobby for value creation policies that could benefit the innovative uninvolved firms in addition to themselves. Identifying firms that request policies that are to the benefit of a wider range of constituents could possibly lead to better informed decision making within the public policy process and enable the firms of a country to be on the leading edge of market demand. This will enable a country to obtain a sustainable competitive advantage.

1.2.5 Significance of the Research/Business Relevance

This study aims to enable policy makers to make more positive sum policies that will facilitate the firms in their economy to be on the leading edge of market demand, thereby increasing innovation and competitiveness within the country.

The Motor Industry Development Programme (MIDP) is a targeted, supply side industrial policy focussed exclusively on the local automotive sector (Altman & Mayer, 2003). The MIDP was created through a consultation process with the South African government, labour representatives, the automotive industry and civil society and promulgated in 1995 (Barnes, 2009). The automotive players used an industry association to lobby collectively for its interests. The MIDP was scheduled to end in June 2000 but was extended twice, and is currently due to end in December 2012. The World Trade Organisation (WTO) found, however, that the MIDP did not meet the subsidies and countervailing measures that are required, resulting in the design of a new policy (Republic of South Africa, Department of Trade and Industry- DTI, 2011). The Automotive Production and Development Programme (APDP) is therefore scheduled to come into effect for the period 2013 to 2020 (DTI, 2011).

The MIDP repositioned the uncompetitive motor industry to compete globally as it was faced with declining tariff protection, trade liberalisation and lack of economies of scale (Altman & Mayer, 2003). The MIDP aimed to enhance the exporting possibilities of the vehicle manufacturers and component producers through government support mechanisms and the reduction of import duty liabilities (Damoense & Simon, 2004). Damoense and Simon (2004) found that these mechanisms however tended to provide protection for the local industry, increasing the cost of domestic production and automotive employment, as strong export growth of automobiles and auto components was experienced with a contraction of the domestic market.

The future success of the automotive industry in South Africa is uncertain as international competition has increased, the MIDP benefits are slowly being reduced, the APDP has to comply with WTO standards and there is a perceived lack of firm level competitiveness. South African based firms have increased their competitiveness but not sufficiently to enable them to compete without the benefit of the MIDP (Barnes, 2009). Barnes (2009) suggested that the underlying reason for lack of competitiveness are part legacy based - diseconomies of scale, high cost base - and part industry based - underinvestment in people, equipment, manufacturing processes and new products. Although the industry has undoubtedly improved, not enough investment was made in operations. Employment in the automotive industry had been declining in

recent years, partly driven by the internationalisation of the component sector (Damoense & Simon, 2004). Alfaro, Bizuneh, Moore, Porter, Ueno and Wang (2012) suggested that labour rigidity, unrest, lack of skilled technicians, low levels of R&D and insufficient supplier depth must be addressed for the automotive industry to regain its competitiveness.

Alfaro et al. (2012) and Barnes (2009) stated that the increased competition from countries with lower costs and better proximity to major export markets is a threat to the South African industry. The South African policy is in line with international automotive policy developments, driving substantial inflows of foreign direct investment, higher productivity, improvement in quality and growth in exports with increased importation of more low volume vehicles, nevertheless the sustainability of the sector is uncertain (Alfaro et al., 2012; Barnes, 2009; Damoense & Simon, 2004).

This raises the question of what would have happened if a different path was followed. If there had been more focus on value creation, could the cost of operating have been less? Would the industry have been more sustainable without protection measures even being required? For unrelated industries, had the focus and investment been on building a skill that does not require market proximity such as ITC, or an industry in which South Africa should have a comparative advantage such as agro-processing, would the economy have been better off? Would policy makers have made better informed political decisions if they had a mechanism of knowing which firms suggest more positive sum policies? Given that this industry is dominated by a few large players that are effective in lobbying through an industry association, would it have been possible to design policies that would not adversely affect related or unrelated industries that were not present in the discussions? Many questions are raised from this example, highlighting the need to move towards more evidenced based policy making.

1.2.6   Research Motivation

The purpose of public policy is to provide the greatest benefit to the economy and society, but there are many forces that aim to only benefit the few at the expense of the economic whole. Challenges such as self-interested parties (Baysinger, Keim & Zeithaml, 1985; Hillman & Hitt, 1999; Lux et al., 2011) and path dependency (Kay, 2005) increase the difficulty of decision making in public policy. Evidenced based frameworks are required to structure the public policy debate to ensure a benefit for the economy and society. Enabling more positive sum policies that are focussed on innovation will put firms at the cutting edge of market demand and will facilitate a country to achieve a sustainable competitive advantage.

1.3   Research Objectives

This study aims to categorise firms based on whether they are innovative or not, and whether they are involved in policy or not. The proposed framework for the study is outlined in Figure 1. Based on this categorisation, policies that were requested by companies are evaluated. It is expected that the involved group has a better understanding of their external environment and will know what policies are to their benefit or detriment. Based on this, firms that are innovative are expected to request more positive sum policies that focus on value creation, while non-innovative firms are expected to lobby for policies that seek value capturing. The positive effect of collaboration within a network on innovation is noted and is measured through network richness. For the uninvolved group, it is expected that firms that are innovative are more aware of their external environment as they see the need to innovate. These firms have some idea of the policies that could possibly benefit them. The firms that are not innovative are expected to be unaware of what policies to request as they are not as informed of their external environment.

Figure 1- Proposed Framework
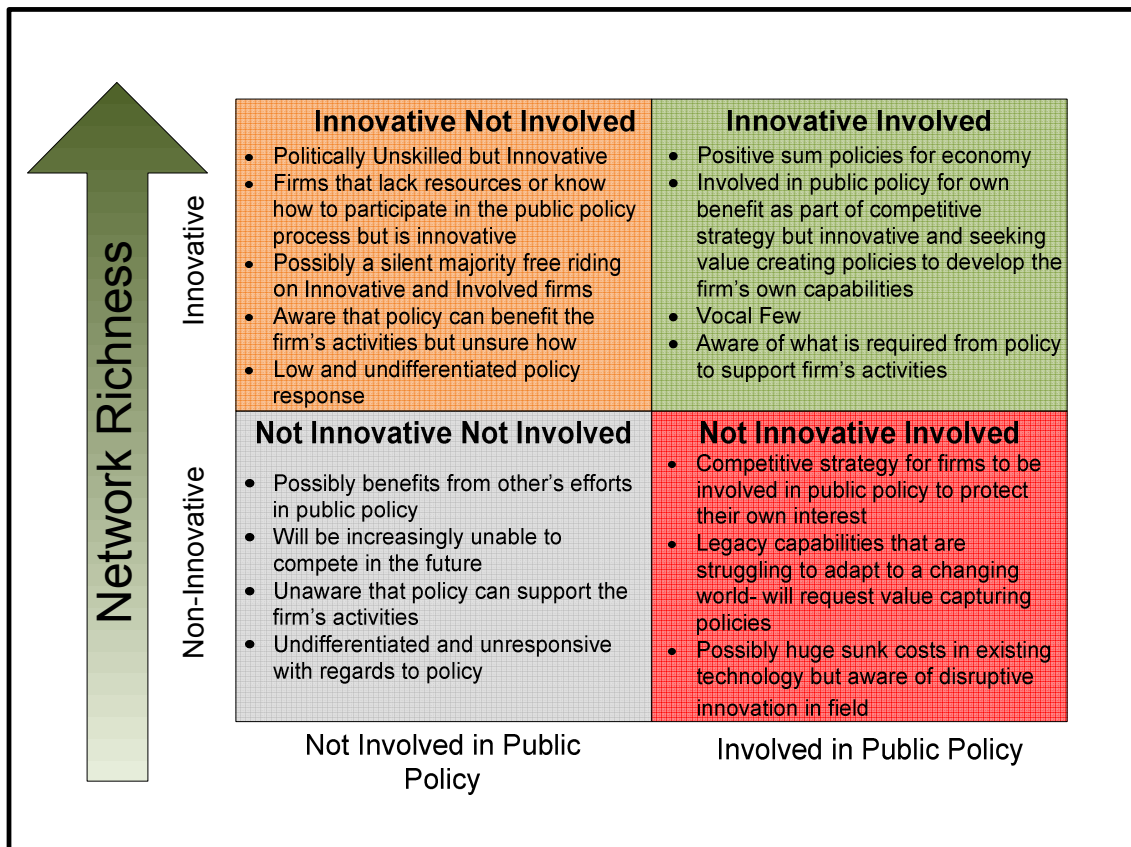
1.4   Research Scope

The study looks at firms' public policy involvement in the context of innovation. It evaluates the policies that are requested from the categories of firms outlined in Figure 1, taking note of the importance of network richness in innovation.

1.5   Report Layout

The report examines the relevant literature in Chapter 2. First public policy is discussed, highlighting the purpose, process and challenges that are experienced. The case for more evidenced based policy being utilised is argued. Firm actions as they relate to public policy are examined. Innovation is explored briefly through discussing its benefits, the types of innovation and the positive impact of network richness through collaborative relationships. The two dimensions of innovation and policy are then joined to discuss the impact of policy on innovation and vice versa.

Chapter 3 outlines the research hypotheses as it relates to the framework proposed in Figure 1. In Chapter 4, the chosen research methodology is defended based on the literature in Chapter 2. Chapter 5 examines the results from the proposed research methodology in the order of the hypotheses. Chapter 6 relates the findings in Chapter 5 with the literature in Chapter 2. The study found that firms could be categorised based on their innovativeness and involvement in public policy, but that network richness played an important role in increasing both. It is suggested that richly networked firms request policies that are to the benefit of the broader innovation network in order to sustain and grow the beneficial collaborative relationships and that these requests are not individually rent seeking. Chapter 7 concludes this study by highlighting the implications for public policy and firms. It is suggested that policy makers aim to engage richly networked firms in the policy process. The contribution to theory is discussed after which the limitations and areas for future research are stated.

1.5.1   Problem Statement

The question that is raised is whether firms can be categorised as outlined in Figure 1. If so, what are the policy requests that are raised by the different groups of firms? Is it as expected that the involved firms have more clarity on what they wish to request from public policy makers, with the uninvolved group having an undifferentiated response? Can policy makers, through listening to the innovative and involved group in the public policy process, make more informed political decisions that benefit the overall economy and specifically the innovative and uninvolved firms? Do the innovative firms seek value creating policies with the non-innovative firms seeking value capturing policies?

These questions are further supported and explored by the literature review in Chapter 2.

2 Chapter 2: Literature Review

Public policy influences the operating environment of a firm. Firms that are innovative have a more sustainable competitive advantage by being ahead of the demand curve. A country that is comprised of more innovative firms has a more sustainable economy and could achieve higher levels of competitiveness.

The literature review aims to cover the pertinent research in the fields of public policy, corporate political activity and innovation. The purpose is to move towards more evidenced based policy decisions. The purpose, process and challenges in public policy are examined and the growing need for evidenced based policy is highlighted. Challenges in public policy decisions are also examined given the motivation of the stakeholders in the public policy process.

Next, the motivation behind corporate political activity is considered. It is highlighted that firms could engage in the public policy process on an individual or collective level. The need for industry associations to attain a high density of membership is examined. The associations therefore act in the interest of their members, regardless of the impact on other stakeholders in the process.

Innovation is discussed in terms of the benefits for a firm and a country and the different types of innovation are explored. It is argued that collaboration with actors outside of the firm has a positive effect on innovation. The complex, dynamic and turbulent environment of firms is highlighted, touching on the emerging trend of global production networks. Finally, the impact of innovative firms on public policy and the benefits for the wider economy are explored. The chapter concludes by presenting a framework for analysis based on the dimensions of public policy involvement and innovation, taking note of the importance of network richness for innovation. The salient points of the literature review are discussed in light of the suggested framework.

2.1 Public Policy

This section describes the purpose of public policy as gaining the most economic and social welfare benefit. Next, the process of public policy is discussed, highlighting the different dimensions of public policy involvement and interaction that has to be taken into account. The challenges of public policy are discussed in terms of four broad themes, namely: diverse participant involvement, path dependency, maintaining order in the process and globalisation. Finally, collaboration with government to influence public policy is briefly discussed as a form of company political behaviour.

2.1.1 The Purpose of Public Policy

Public policy is defined as any form of government action or inaction that expresses the intent of government actors (Hillman & Keim, 1995). The dominant view of public policy is an exercise of authority to achieve collective purposes that are based on utilitarian principles (Colebatch, 1998). Public policy therefore aims to make everyone better off and no one worse off through an action or lack of action. Policy makers who are given authority by governments should therefore pursue goals, values and practices that aim to improve the welfare of the system as a whole (Colebatch, 1998). The process however is inherently politicised, with the majority of the stakeholders acting in their own interest. There is thus a need for evidenced based public policy making to limit rent seeking among the stakeholders to ensure the achievement of collective purposes.

Government enacts public policy with the purpose of economic and social benefits and is thus a regulator of the broader system it acts in. Ring et al., (2005) stated that governments can have a major impact on organisations and how they are managed. Ring et al. (2005) further suggested that firms need to analyse the structure or patterns of relationships between the actors in these bureaucracies and how the observed relationships among these actors can affect organisational fields and the behaviour within them. A firm that is cognisant of these effects will possibly attempt to influence the direction of the regulation. Policy makers therefore have to ensure that the broader purpose of public policy is still enforced, without benefiting the individual firm to the detriment of the rest of the system.

2.1.2 The Process of Public Policy

Public policy is the process of choosing the goals, values and practices to improve social and economic welfare. The process has both a vertical dimension of interaction - representing the decision makers - and a horizontal dimension of interaction - representing the stakeholders that are involved in public policy. The interests of these dimensions and the underlying participants are in a constant balancing act. Within the vertical dimension there is further interaction between government and policy makers, while within the horizontal dimension there is further interaction between all other stakeholders that try to influence the public policy process. A high level model that presents the process was developed from the literature (Baumgartner et al., 2009; Colebatch, 1998) by the researcher and is presented in Figure 2.

Figure 2- Horizontal and Vertical Dimensions of Policy
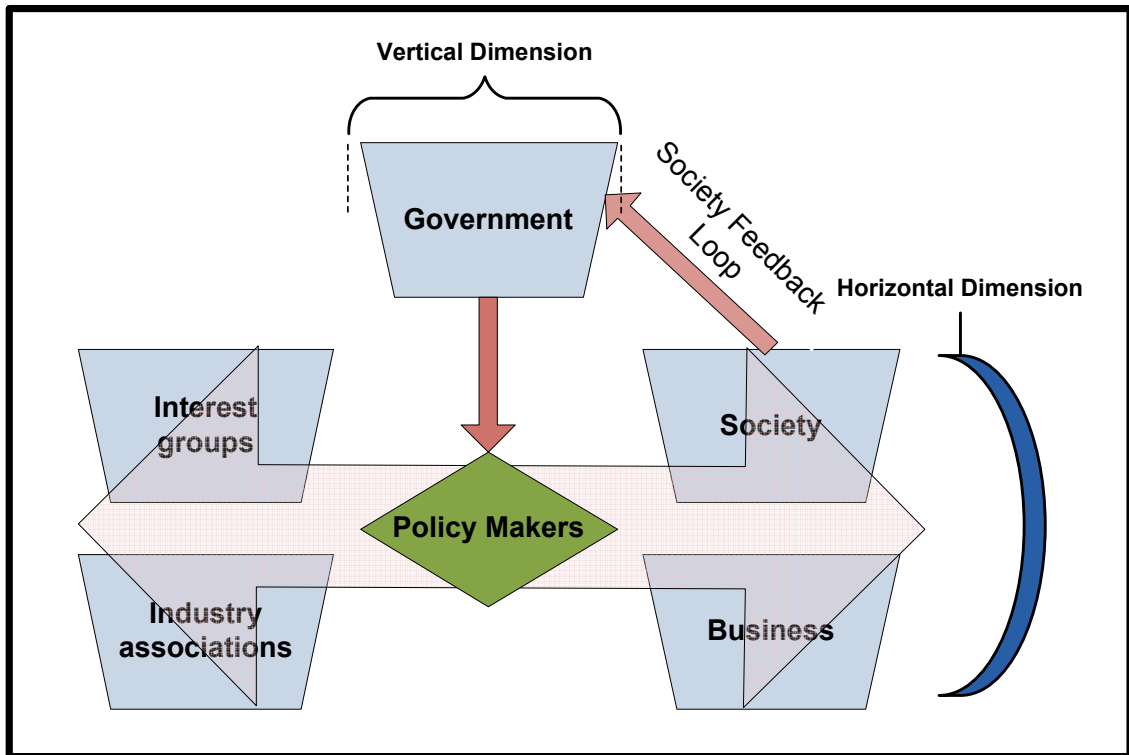
The involvement of the participants depends on the context of the public policy debate, the relevant expertise of the participant and whether the participant is potentially impacted by the policy. Policy makers need to balance the horizontal and vertical dimensions of policy and is therefore represented at the centre of the process in Figure 2. Public policy is therefore a pattern of policy making decisions between a connected set of actors that have a shared language, with the policy maker having to balance the perspectives and needs of these actors without acting in a self-interested way (Colebatch, 1998).

2.1.3 Challenges in Formulating Public Policy

There are four broad themes of challenges in public policy that are relevant to this study. These are: diverse participant involvement, path dependency, maintaining order in the process and globalisation. The challenges are illustrated in Figure 3 and examined individually below.

Figure 3- Challenges in Public Policy Decision Making
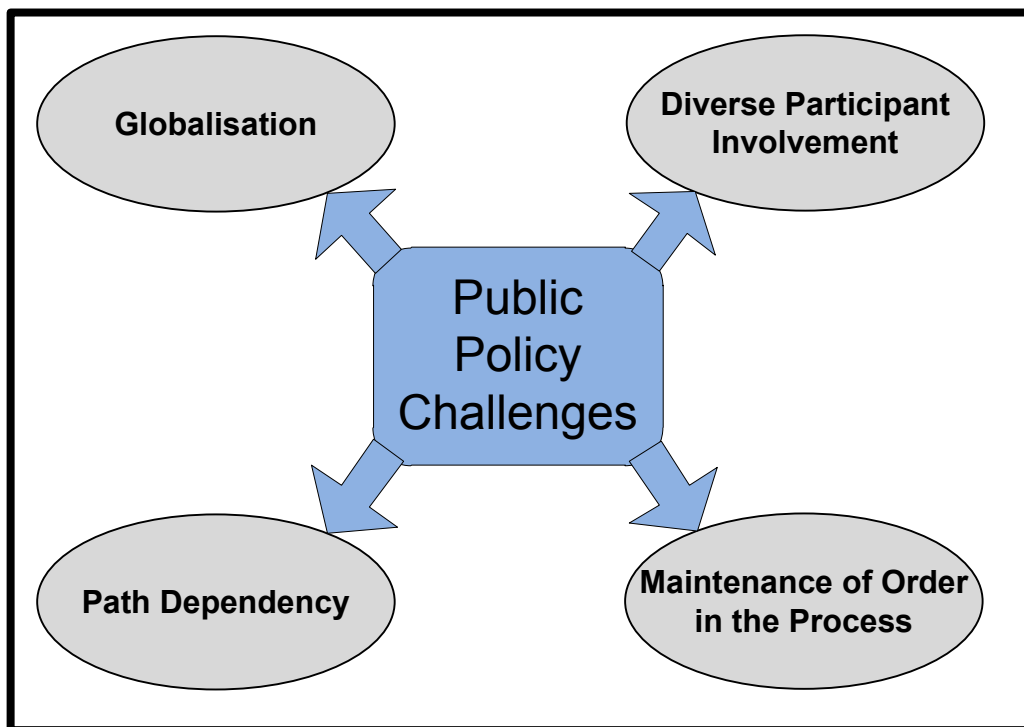
2.1.3.1   Diverse Participant Involvement

Given the diverse range of participants within the horizontal and vertical dimension, policy makers are challenged to determine the actions that are beneficial to the largest groups of constituents, both in the short and long term. Not all the affected constituents are involved in the process but their needs should still be taken into account by the policy maker. Governments act as master jugglers to allocate agenda space for the increasingly complex issues and diverse participants that contend for the policy maker's attention (Baumgartner et al., 2009). Based on punctuated equilibrium theory, the agendas are stable until an external shock leads to renewed focus, followed by a frenzy of political activity (Baumgartner et al., 2009; Pump, 2011) which further complicates the process.

2.1.3.2   Path Dependency

The policy maker's actions and choices are often dependent on, or limited by, the actions or commitments taken before. A process is path dependent if initial choices in one direction elicit further choices in that same direction (Kay, 2005). There is thus a tension between the choice of a new action and the existing structure created by previous decisions (Colebatch, 1998). Policy making agendas are stable over time with previous actions limiting current choices and therefore the policy process is subject to path dependency.

Kay (2005) further elaborated that path dependency is a form of context bound rationality among policy actors. Individuals and organisations have limited cognitive and organisational abilities to see all sides of a problem, they lack perfect information about their choices and they might not have access to the complete knowledge of their own preferences (Pump, 2011). These restrictions make it easier to follow the historical structure of a policy and increases resistance to change. The bureaucracy found in government institutions adds to this resistance (Colebatch, 1998).

Previous policy decisions could have constrained or enabled some interest groups, invested or divested in infrastructure pertinent to the policy, or involved the establishment of formal or informal contracts with participants (Kay, 2005). Thus previous policy decisions limit current policy decisions in deep-rooted ways and are unlikely to change unless the agenda suffers an external shock, invoking the punctuated equilibrium theory (Pump, 2011). The system in general only becomes aware of these external shocks once they are reported through political inputs such as mass media, lobbyists, information from social movements, systematic data collection, and so forth (Baumgartner et al., 2009). Path dependency often results in sub-optimal outcomes when change is required and more so if no rational decision framework constrains the current policy making.

2.1.3.3 Maintaining Order in the Public Policy Process

Public policy is also faced with the challenge of creating and maintaining order among a diverse set of participants and perspectives, ensuring that the necessary expertise and legitimate players are involved in the process (Colebatch, 1998). Policy making is a complex process with complicated negotiations between actors (Baumgartner et al., 2009), which has far reaching effects on uninvolved but impacted constituents.

2.1.3.4 Globalisation

Globalisation is characterised by increasing and widespread trade liberalisation and economic integration (Desai, 2000; Preble, 2010). A key concern around globalisation is the decreasing national sovereignty of a nation state and the increasing power of supranational management structures. A supranational structure's purpose is similar to that of public policy and will attempt to serve the interest of its member states (Preble, 2010), however increased transparency and equal participation rights are required for this to be effective. There is thus a need to protect a country's own interests. Policy makers have to balance the increased pressure of globalisation and the competition that accompanies it with their purpose of economic and social welfare.

Additionally, there is the emergence of global production networks (Ernst & Kim, 2002; Hildrum, Ernst, & Fagerberg, 2010). This is the combination of concentrated dispersion of the value chains across firm and country boundaries with a parallel process of integration between the hierarchical layers of the networks (Ernst & Kim, 2002). It involves the intricate division of labour, extensive use of the internet to facilitate interactions, and formal and informal mechanisms of knowledge transfer that take place between firms to enable effective production. This is evident in the example of the automotive industry stated in Chapter 1 where the internationalisation of the component sector is being experienced. This emerging trend with its novel effects on firm interaction is not yet fully understood and further increases the complexity of the policy decision making process.

In a globalising, complex world that is increasingly characterised by rapid change, policy makers need to be aware of which participant inputs to listen to, the extent to which uninvolved constituents can be affected, the dangers of path dependency and the structure required in the process. Public policy actions have far reaching effects and policy makers need evidence based guiding frameworks to enable more effective and informed decision making.

This section discussed the main challenges in public policy through focussing on the following four broad themes:

- Diverse participant involvement
- Path dependency
- Maintaining order in the public policy process
- Globalisation

The next section details the collaboration or involvement with government as a medium to influence public policy from a firm perspective.

2.1.4   Collaboration with Government on Public Policy Vehicle as a Form of Business Political Behaviour

This section describes collaboration or involvement with government as a medium to influence public policy outside of normal business resources. Boddewyn and Brewer (1994) listed compliance, evasion, negotiation, cooperation, coalition building and co-optation as business political actions and broadly categorised this behaviour as compliance, avoidance, circumvention, conflict and cooperation.

As government is within the vertical dimension of the public policy process (see Figure 2), stakeholders that collaborate with government will have a legitimate position of interaction within their relevant area of expertise. This collaboration is a channel of communication through which stakeholders can voice their opinions. The policy makers however still determine the order of the process and decide on whether the opinion is relevant.

This section highlighted that the purpose of public policy is to benefit the economic and social welfare of a country. The process of public policy decision making was examined through the vertical and horizontal dimensions of interaction and involvement. The challenges of public policy were discussed in terms of four broad themes: diverse participant involvement, path dependency, maintaining order in the process and globalisation. Collaboration with government on public policy was highlighted as a method to interact with the public policy process.

2.2   Evidence Based Policy

This section highlights the need for evidenced based policy making. It is argued that using forms of evidence in the policy decision making process is more effective, informed and less expensive. In conclusion, the challenges of evidenced based policy making are examined.

2.2.1   The Purpose of Evidenced Based Policy Making

Public policy decision making based on evidence is better informed, more effective and less expensive than a process that is rife with political involvement (Davies, 2012; Strydom et al., 2010). Evidenced Based Policy (EBP) decision making increases the confidence of the policy maker and ensures that a broader area of knowledge is assessed (Strydom et al., 2010). Furthermore, it ensures that the decision is focused on the benefits and outcomes of the policy and not on the process of decision making (Davies, 2012). The concept of EBP has enjoyed increased interest and debate in recent years (Frey & Ledermann, 2010; Head, 2010; Hughes, 2007; Hunter, 2009; Lewin, Bosch-Capblanch, Oliver, Akl, Vist, Lavis, & Haines, 2012). EBP aims to improve decision making though promoting rigorous analysis of policy options (Head, 2010).

EBP as a concept is attributed to the 1997-2010 labour government of the United Kingdom that stated that rigorous scientific analysis would improve policy-making (Frey & Ledermann, 2010). This is a move away from faith based policy making (Head, 2010) based on political ideology and prejudice (Frey & Ledermann, 2010). The aim is to

improve the efficiency and effectiveness of public policy making based on the use of systematic evaluative rationality (Frey & Ledermann, 2010; Howlett, 2009).

2.2.2 The Role of Evidence in the Decision Making Process

Policy decision makers see rigorous research findings as both useful and necessary for policy development and review (Frey & Ledermann, 2010; Head, 2010). "What matters is what works" (Frey & Ledermann, 2010, p. 1) and "What counts is what works" (Head, 2010, p. 80) is the broad mantra of EBP. There are two main categories of research for EBP, firstly, the overall idea of synthesising knowledge and secondly, the more specific ideas around the methodology and organisation of the knowledge producing system (Hansen & Rieper, 2010). There are methodological challenges and analytical uncertainties that give more political leeway to evaluators (Borrás, 2011) and it is vital that these are addressed. Policymakers, however, require evidence that is focused on the end product rather than the methodology (Davies, 2012).

Research and publication into the EBP field has grown considerably (Frey & Ledermann, 2010; James & Jorgensen 2009; Pawson, Wong & Owen, 2011; Tenbensel, 2004). EBP is based on the notion that quality, efficiency and effectiveness of policies can be measured objectively and that policy making can be rationalised (Frey & Ledermann, 2010). The concept of improving public policy has not been fundamentally challenged (Frey & Ledermann, 2010; Hansen & Rieper, 2010; Head, 2010).

The majority of the current debate in EBP as a process is on what constitutes sound and credible evidence (Hansen & Rieper, 2010). Not only is there a lack of consensus on what qualifies as relevant and sound evidence (Head, 2010; Vreugdenhill & Rault, 2010), but also the concepts of 'use', 'influence' and 'learning', as research studies use these term interchangeably (Frey & Ledermann, 2010). The components of evidence as stated by Strydom et al. (2010) are:

- Research
- Surveys
- Quantitative or statistical data
- Qualitative data
- Economic data
- Attitudinal data
- Behavioural data
- Anecdotal data

- Knowledge and expertise of experts
- Knowledge and expertise of lay people
- Propaganda
- Judgements
- Insights/experience from history
- Analogies
- Local knowledge and culture

There are thus multiple components that can be considered as evidence. Good policy making depends on relevant, quality information from a variety of sources but is also deeply influenced by institutional, professional and cultural factors (Head, 2010). Vreugdenhill and Rault (2010) showed that how pilot projects inform policy making depends on the type of project, actor involvement and the type of evidence generated. Therefore the process to decide on what evidence to use could be more useful for policy makers.

Frey and Lederman (2010) argued that it is not necessary to have a single, well-accepted definition of evidence, but rather the overall type of evidence needs to be clearly delineated and the relevance for actors in the policy process identified (Frey & Ledermann, 2010). Thus the research should be investigated from the perspective of potential users.

It is also important to note that the expectation is that EBP on a fundamental level will improve public policy, but this result is hampered by the practical limitation on rational processes in political decision making that is characterised by bargaining, entrenched commitments, balancing of different stakeholder values and interests (Head, 2010), short term political mindset, corporate political activity and path dependency (Kay, 2005).

There is a need to improve and streamline the task of sifting through all the presented evidence by interested parties to deal with the divergent implications of evidence. Although the academic debate within EBP is around the methods, evidence and usefulness of the process, this study circumvents these issues by providing a tool for enhanced decision making given the pressures of the public policy process, focusing on the end user as suggested by Davies (2012), Frey and Ledermann (2010) and Vreugdenhill and Rault (2010).

2.2.3 The Challenges in Evidenced Based Policy Making

Davies (2012) listed the following challenges in using evidence for policy making:

- Role of other factors influencing the policy decision making and how to integrate these factors with evidence.
    - These other factors are: role of values, beliefs, ideology, experience, expertise, judgement of policy makers, availability of resources, bureaucratic culture and the role of lobbyists and pressure groups.
- Mitigating the probalistic nature and uncertainty of evidence through formative and impact evaluation using qualitative and quantitative methods under various conditions.
- The different perspectives between policy makers and researchers of what constitutes evidence and what type of evidence is required for EBP challenges the role evidence plays in decision making (Strydom et al., 2010).
- The time it takes for the research, evaluation and analysis to seep through to policy makers and have an impact (Hansen & Rieper, 2010). In the medical field in which evidence based policy making originates, it takes on average 17 years to convert 14% of research findings into benefits for patients (Mold & Peterson, 2005). In a field with a large sphere of influence that does not have a history of EBP, this period could be much longer or shorter, with path dependency also playing a role.
- The different time cycles between policy making and high quality research require a matching of the best available evidence to base future policy making on.

In certain areas of policy development there is a widening and deepening of public policy (Borrás, 2008) - widening in the sense that the realm for action of government is expanding, and deepening in the sense that there are increasingly sophisticated policy instruments (Borrás, 2008). Given this expansion there is a growing demand from government to have rigorous research to inform the policy process. Researchers are increasingly able to supply government with research on topics of interest (Head, 2010) with systematically synthesised knowledge (Hansen & Rieper, 2010).

The market factors at work drive the growth in EBP. Evidence or research that is produced, however, could be time or location specific (Pawson et al., 2011) and there is thus a need to develop tools that help policy makers to make better decisions. This study aims to provide an evidenced based tool for policy decision making as it relates to firm involvement within the innovation context. Any such decision models do have limitations which should be noted by the stakeholders in the public policy process.

This section highlighted the importance of evidenced based policy making, the role of evidence in the process and the challenges that EBP faces. The next section outlines the political behaviour of firms as it relates to public policy.

2.3   Firms Actions Relating to Public Policy

In this section, companies' actions and inactions in terms of public policy are examined. Firstly the rationale for involvement is explored. Possible business strategies are discussed and reasons for choices are examined, with the literature that supports these arguments being illustrated in Table 1. The choice of firms to not be involved in public policy is examined from a free rider perspective in collective action theory (Getz, 1997; Lux et al., 2011; Olson, 1965; Schuler 1996). Finally, the choice of being involved on an individual or collective level is discussed. Industry associations are highlighted as a vehicle for collective action.

Table 1- Literature on Firm Motivation in the Political Arena

Reason for Engagement	Literature Source
Make interest known to government	Hillman and Hitt, 1999
Gain collective or private benefits	Getz, 1997 & Olson, 1965
Access resources from political institutions	Hillman, Keim and Schuler, 2004
To purchase government policy or secure government inaction	Getz, 1997
Stop unwanted regulation	Yoffie, 1988
Increase firm control and autonomy	Getz, 1997 & Yoffie, 1988

2.3.1   Need for Firms to Interact in Public Policy

Government policies influence the competitive and economic environment of firms (Hillman & Keim, 1995) and many firms are expanding their efforts to affect public policy decisions. Political action is a business priority when a policy influences a firm's competitive future (Hillman & Hitt, 1999; Lux et al., 2011; Yoffie, 1988). These efforts could be for a competitive advantage or survival, but are ultimately to produce a public policy outcome that is favourable to the firm (Baysinger et al., 1985; Hillman & Hitt, 1999; Lux et al., 2011). The influencing of public policy can be to improve the firm's economic position, to hinder both domestic and foreign competitor's ability to compete and to voice an opinion in government affairs (Hillman & Hitt, 1999). Thus involvement in public policy can increase overall market size, give an advantage in industry competition through reducing the threats of substitutes and entry, and improve a firm's bargaining power with suppliers and customers.

Strategic actions that firms plan and enact in order to benefit economically from the political environment are termed strategic political management (Lux et al., 2011), and

are a means of competing on a non-market method (Boddewyn & Brewer, 1994; Oliver & Holzinger, 2008). Strategic political management can be used both to limit costs (Weidenbaum, 1980) and as a method to leverage assets and competencies to earn economic rents (Oliver & Holzinger, 2008). Involvement in public policy thus creates or conserves value for a firm and ensures a better competitive positioning in the future.

2.3.2 Business Strategies in the Interaction with Public Policy

This section describes the possible business strategies in political management. These are:

- Passive reaction, positive anticipation and policy shaping proposed by Weidenbaum (1980).
- A transactional or relational approach proposed by Hillman and Hitt (1990).
- Compliance and influence strategies proposed by Oliver and Holzinger (2008).

These business strategies can be broadly categorised as involved or not involved in public policy. This anchors the first argument of this study. Firms are either involved or not involved in the public policy process. The literature that supports the business strategies in public policy involvement are listed in Table 2.

Table 2- Business Political Management Strategies

Literature Source	Business Political Management Strategies	
	Not Involved in Public Policy	**Involved in Public Policy**
Weidenbaum (1980)	Passive Reaction	Shaping Public Policy
	Positive Anticipation	
Hillman and Hitt (1999)	Transactional Approach	Relational Approach
Oliver and Holzinger (2008)	**Compliance Strategies**	**Influence Strategies**
	Reactive Political Strategy	Proactive Political Strategies
	Anticipatory Political Strategy	Defensive Political Strategies

2.3.2.1 Passive Reaction, Positive Anticipation and Policy Shaping

As long ago as the 1980s, Weidenbaum (1980) discussed the increasing cost to business due to regulations, outlining three basic approaches for a firm to have increased control in regulation. Two of these responses are classified in the category of not actively in collaboration with public policy makers. These are 'Passive Reaction', which is the response of a firm that reacts after the policy is issued and attempts to postpone its effects but eventually will meet the requirements, and 'Positive

Anticipation', which is the adjustment of business activities to business regulations that are likely to be implemented (Hillman & Hitt, 1999; Weidenbaum, 1980). The third response is 'Shaping Public Policy', which is a more collaborative effort with public policy makers that aims to manage both the cost and benefits of the changes with the relevant authorities (Hillman & Hitt, 1999; Weidenbaum, 1980).

Hillman and Hitt (1999) also stated that other interest groups that are shaping public policy are doing so in their own interests which may not coincide with those of a non-involved firm. Furthermore, the interest groups could have conflicting interests, increasing the complexity of the process.

2.3.2.2 Transactional or Relational Approach

Hillman and Hitt (1999) stated that there are two approaches to political action - a transactional or a relational approach. In a transactional approach, firms await the development of an important public issue before building a strategy that can affect the issue - this is a non-collaborative approach to involvement in public policy. A relational approach attempts to build relationships over time so that the firm is in a position to influence a policy if it might affect the firm's operations (Hillman & Hitt, 1999).

In the relational approach the public policy process can be described as a market, as there are suppliers and demanders of policy (Hillman & Keim, 1995). The suppliers are the policy makers that shape the government policies and agendas, while those demanding policies are the individuals, individual firms and interest groups. This relates to the vertical and horizontal dimensions discussed in section 2.1.2. The concept of mutual interdependency is critical in the market exchange (Hillman & Hitt, 1999). It is difficult for the suppliers of policy to know the preferences of business and society due to the sheer volume of issues considered, therefore this is not a perfect market as asymmetry of information exists between the demand and supply sides of public policy (Hillman & Hitt, 1999).

2.3.2.3 Compliance and Influence Strategies

Oliver and Holzinger (2008) outlined two types of political management strategies: 'Compliance' and 'Influence' strategies. Compliance strategies use internal capabilities to achieve or anticipate an optimum fit with political strategies. This strategy is further subdivided into reactive political strategy and anticipatory political strategy, both of which are not involved collaboratively with public policy. Reactive political strategy is aligning internal processes to political demands, while anticipatory political strategies

are actions taken to gain a first mover advantage through anticipation of public policy (Oliver & Holzinger, 2008).

Influence strategies are divided into proactive political strategies and defensive political strategies. Proactive political strategies are actions that attempt to shape and control the way in which norms and public policies are defined. Defensive strategies are actions to stop unwanted political changes and protect the status quo. Both of these strategies are actively involved with public policy processes (Oliver & Holzinger, 2008). These strategies are all driven from a dynamic capabilities perspective in which firms are motivated to maintain or increase the value of their strategic assets (Oliver & Holzinger, 2008). Dynamic capabilities refer to the ability of firms to maintain or create value for the firm by developing and deploying internal competencies that maximises fit with a changing environment (Teece, Pisano & Shuen, 1997).

This section discussed the business strategies for being involved or not involved with public policy. It argued that it is a business imperative to be involved given the influence of public policy on a firm's operating environment. The next section highlights possible reasons why firms would choose not to be involved.

2.3.3 Free Riders and Collective Action Theory

This section examines why firms would choose not to interact with public policy based on the concept of free riders in collective action theory and a cost and benefit analysis.

At the heart of collective action theory are the voluntary provisions of public or collective goods by private actors (Getz, 1997). Getz (1997), Lux et al., (2011), Olson (1965) and Schuler (1996) argued that without incentives or sanctions, a large numbers of free riders would try to reap the benefits without paying the cost for a collective good and that few members would value the good so much that they would bear more than their share of the cost to ensure it is provided. Firms that do not expect to benefit from political action or whose benefits would be less than their cost will refrain from being involved in public policy (Getz, 1997).

Oliver and Holzinger (2008) argued, however, that free riding is not a viable option as firms are forced to meet the demands of a dynamic or unpredictable environment. Thus if an industry has more free riders or firms that do not engage in the public policy process, the industry can be seen as more stable. In contrast if there are less free riders it can be assumed that the industry is more dynamic and uncertain. Due to path dependency, more mature industries can be assumed to be more stable than younger industries with less path dependency, as the incumbent firms of older industries are

possibly benefiting from lock-in or protectionist policies that are difficult to change. These firms are therefore in a comfort zone with no immediate need to be actively involved in the process. However, the impact of an increasingly globalised world will continue to challenge all industries, regardless of their maturity or path dependent policies. Thus it is possible that older industries could have more or less free riders than younger industries, due to the complex interaction of multiple factors.

This section outlined the existence of free riders within the context of public policy and their impact on the process. The next section describes public policy involvement in terms of individual or collective actions by firms.

2.3.4   Individual and Collective Action in Public Policy

Political participation can be on an individual or collective level (Getz, 1997; Hillman & Hitt, 1999). Individual action refers to individuals or single firms, while collective action refers to the collaboration and cooperation of two or more individuals or firms in the policy process. An aspect of market strategy is choosing between competitive or cooperative strategies to pursue a certain competitive advantage (Hillman & Hitt, 1999). Firms with more tangible and intangible resources and dominant firms in an industry prefer individual rather than collective actions. These firms have the resources to initiate independent actions that can influence government policy in a way that best favours the firm.

Firms allocate resources to political activities if they are perceived to have more benefits than costs. The most reliable predictor of political activity is firm size (Hillman et al., 2004; Schuler, 1996). Larger firms are more exposed to the overall economic and social environment and the incentive to ensure a healthy operating environment will be sought through market and non-market activity (Boddewyn & Brewer, 1994; Lux et al., 2011). A further possible reason is that large firms often provide essential services to government (Lux et al., 2011; Schuler, 1996) and thus have a vested interest in influencing public policy. Most important is that larger firms possess more resources to engage with public policy (Hillman & Hitt, 1999; Lux et al., 2011; Yoffie, 1988).

Firms with fewer resources thus tend to support collective action, which could be a more forceful voice if there are constrained firm level resources (Hillman & Hitt, 1999). An industry association is a vehicle of collective action used by firms. The impacts of these associations are discussed in the next section.

2.3.4.1 Industry Association Impact on Public Policy

Industry associations are third-party membership organisations that are typically comprised of profit seeking firms that retain a distinct organisational identity (Reveley & Ville, 2010). They can deliver both productive benefits and rent seeking. They serve to mitigate sources of market imperfection, facilitate exchange through reducing transaction costs, mitigate agency problems and promote cooperation through resolving collective action dilemmas (Reveley & Ville, 2010). Doner and Schneider (2002) and Reveley and Ville (2010) suggested that these institutions may transcend individual rent seeking and play a market-complementing role. Hillman and Keim (1995) stated that industry associations have provided broad business benefits to the business sector instead of narrow policy positions that would only benefit a few firms. However the focus is on the broad business sector of the industry without regarding the effect this has on related or unrelated industries.

An industry association strives to attain a high member density to mitigate the effects of free riding and to prevent the emergence of rival associations (Reveley & Ville, 2010). They attract members through providing both tangible and intangible benefits such as shared transacting powers and reputational signals (Doner & Schneider, 2002; Reveley & Ville, 2010). Most of these associations are however seeking benefits specific to their members, representing the interests of similar firms. If these industry associations lobby effectively for their members' needs, other related industries or different industries could be negatively affected. The association is likely to strive to benefit its members' needs to ensure a high density of members.

Firm involvement in public policy is thus dependent on a cost benefit analysis and some firms will choose not to engage in public policy. This section discussed the motivation for firm action or inaction towards public policy involvement. Possible business strategies for policy involvement were explored and the motivations for firms to act as free riders were examined within collective action theory. The choice of firms to follow either an individual or collective approach to involvement in public policy was explored and the impact of industry associations on public policy was examined. The next section explores the benefits of innovation, the types of innovation and the positive impact of networking with actors outside the firm on innovation.

2.4 Innovation

The previous section examined corporate political strategies for firms as they relate to being involved or not involved in public policy. This section outlines the benefits of innovation for the broader economy. The types of innovation that exist within the

continuum of being innovative or not innovative are discussed. The importance of business networks in innovation is highlighted and it is argued that firms that are richly networked could experience a competitive advantage, increase their management capability, lower their relative resource cost and enhance their value proposition in a complex, dynamic and turbulent environment.

2.4.1   Benefits of Innovation

Innovation presents the opportunity to grow, survive and significantly influence the industry for any firm. It provides revenue and profit growth that cost reduction and reengineering cannot provide or sustain (Davila et al., 2006). Innovative firms will therefore lead to wider economic benefits for a country. Consequently policies that benefit innovation within a country will benefit the broader economic and social context.

2.4.2   Type of Innovation

Innovation is the commercialisation of ideas (Neely et al., 2001). Depending on the context of a firm, different types of innovation can be experienced (Chaminade, et al, 2010; Plechero & Chaminade, 2010). Innovation can be imitative of previous innovations in other fields or industries, it can be imported as a new source of commercialisation from other similar firms, or it can be genuinely new. Firms are however classified as either innovative or non-innovative regardless of the type of innovation that the firm has experienced. Figure 4 illustrates the different types of innovation that occur across the continuum of being non-innovative and innovative.

Figure 4- Innovation Continuum
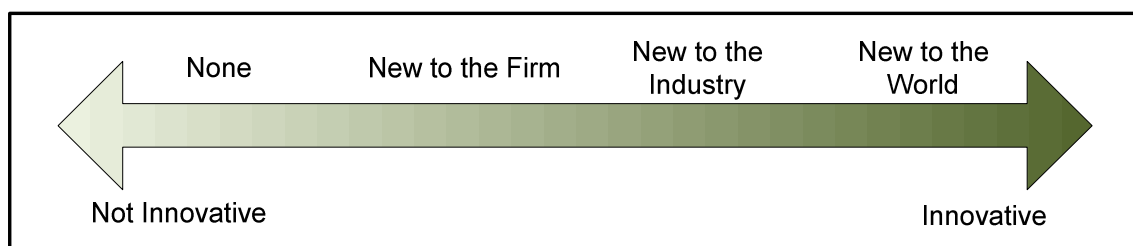
2.4.3   Networking and Innovation

This section highlights the positive impact of networking with other actors on innovation. The reasons for entering into business networks are examined. It is argued that business networks provide a competitive advantage, build the firm's management capability, lower its relative resource cost and enhance its value proposition in a complex, dynamic and turbulent environment.

There is an greater than ever requirement for firms to collaborate with other actors as the source of innovation is increasingly not in the individual firm, but within the network of the firm (Powel et al., 1996). A firm that is networked with several actors is more likely to have successful innovation. Bougrain and Haudeville (2002) found that many breakthroughs occur when actors work together in a network. Cross industry collaboration through networks significantly boosts the innovation output and competitiveness of firms (Ahuja, 2000; Powell et al, 1996). A competitive advantage is obtained through the facilitation of innovation, an increase in the standard of innovation, an increased probability for radical innovation and the improvement of a firm's internal capabilities in managing the complexity of innovation.

The innovation process is increasingly difficult to manage and a firm needs to build its own capacity and competency to deal with the complexity (Bougrain & Haudeville, 2002). A firm has an increased ability to form collaborative relationships if it has a history of collaboration, high technical strength and commercial assets (Ahuja, 2000). Gemünden, Ritter and Heydebreck (1996) noted that it is a strategic task to develop, manage, plan and exploit a firm's network. For a firm to attain a competitive advantage it needs to develop a collaborative competence that is composed of both an absorptive competence, which is the ability to comprehend from the external environment the important trends and know-how, and an adaptive competence, which is the ability of the firm to adapt to changing circumstances (Lusch, Vargo & O'Brien, 2007). Managing, sustaining and growing a network effectively increases the management complexity of a firm.

Ahuja (2000) and Pittaway et al. (2004) stated that the literature provides two explanations on why business-to-business networks form. Firstly, firms can be induced to form a network to obtain access to technical or commercial resources without a constraint on the opportunities to develop these relationships (Ahuja, 2000). Secondly, firms have access to opportunities because of previous patterns of inter-firm relationships (Ahuja, 2000), therefore a firm has the ability to form relationships based on its existing network and its capability of forming networks (Bougrain & Haudeville, 2002).

Business networking is important for a firm's innovation and therefore for its competitiveness (Pittaway et al., 2004). Firms that do not co-operate and/or exchange knowledge reduce their long-term knowledge base and their ability to enter into exchange relationships (Pittaway et al., 2004). Herstad et al. (2010) argued that interorganisational linkages are critical to the innovative capabilities of firms and are driven by a variety of factors that include the complexity in technological content of

products, services and processes, as well as the patterns of territorial specialisations that follow globalisation.

Collaboration leads to a firm having the ability to lower its relative resource cost and enhance its value proposition in a complex, dynamic and turbulent environment. Firms that therefore utilise resources outside of the traditional firm boundaries are more efficient, cost effective and more likely to produce successful products, processes and services as they are in line with customer demand. Firms are thus enabled to be ahead of the market demand curve.

Firms can be classified in terms of their network richness. As network richness increases, so should innovation. This is illustrated in Figure 5.

Figure 5- The Impact of Network Richness on Innovation
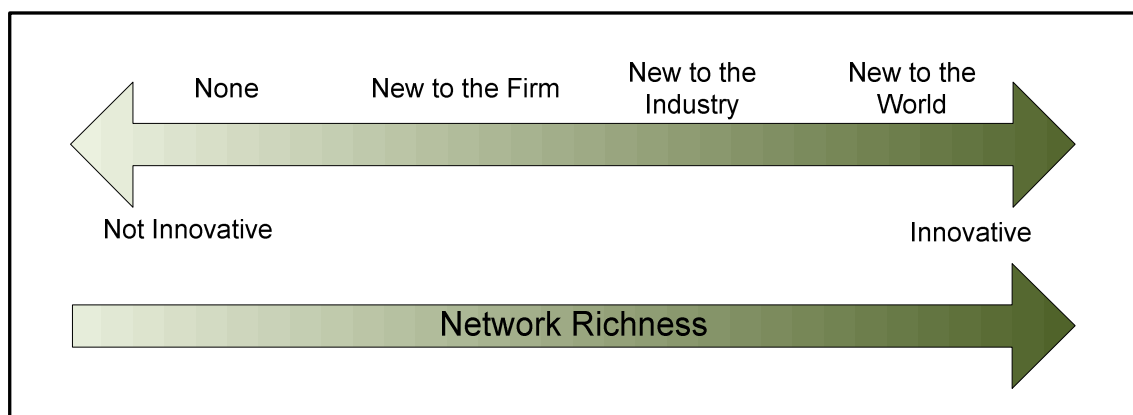
This section highlighted the benefits of innovation for an economy. The types of innovation that lie between a firm being innovative or non-innovative were explored. The positive impact of network richness on innovation for a firm was discussed. It was argued that being network rich for a firm increases its competitive advantage, builds its management capability, lowers its relative resource cost and enhances its value proposition in a complex, dynamic and turbulent environment. In the next section the influence of innovation on public policy is explored.

2.5   Policy and Innovation

The previous section highlighted the importance of network richness in innovation, the types of innovation that are experienced and the benefits of innovation for an economy. This section explores the possible influence of innovative firms on the outcome of public policy. The different types of policies and their influence on the wider economic context are examined.

Chaminade et al. (2010) found that policy makers require tools that facilitate choosing policies that will enable and support innovation. A one-size-fits-all policy for innovation

is also not preferred as innovation systems are unique to the institutional context of a country (Chaminade et al., 2010). There is thus a need to assist the decision making process of policy makers in identifying the best policies for their specific context. Firms within a country are well suited to advise on what is required for the specific context.

There are many stakeholders involved in the public policy process, further complicating the task for the policy maker. Firms that are not innovative are expected to act in a self-interested manner and seek protectionist behaviour focused on value capture. Innovative firms that engage with policy makers might seek platform-enhancing policies focused on value creation. There is however uncertainty on whether innovative firms with the means to engage in the public policy process are seeking the same policies as the innovative firms without the means to engage in the public policy process.

2.5.1 Policy Choices and the Effect on the Wider Economy

This section classifies the policies that firms seek as positive, negative and zero sum and examines the influence of these policies on the wider economy. Firms could benefit from positive, negative and zero sum policies and are prepared to use resources to adopt or deter such policies, depending on their self-interest (Hillman & Hitt, 1999). A positive sum policy is where all groups benefit from the action, a zero sum policy is where no one benefits more than the other, and a negative sum policy is where one group benefits at the expense of another. In the absence of institutional frameworks that prevent self-interested behaviour, the firm would consider private costs and benefits above social or public costs and benefits (Hillman & Hitt, 1999; Hillman & Keim, 1995). However some policies that are sought by firms could benefit the bigger platform of the industry; these are the positive and zero sum policies. Arguably this could be even more so if these are policies to fill institutional voids that all firms suffer from. The challenge from a policy making perspective is being cognisant of whether the policy is more positive than negative sum to the overall economy and social welfare.

Firms that specialise in particular areas will actively seek more protection to preserve the value of past investments (Krueger, 1990; Lazzarini, 2011). This protection could benefit innovation or deter it. A lock-in will promote a tendency to focus on existing knowledge and solutions and can incentivise firms to continue developing and improving what they know best. If the locked-in path of knowledge and solutions cannot serve a competitive and changing environment effectively, it could expose the firm to disruptive innovation and be debilitating to both the firm and the economy in the long run. This form of path dependency could induce lethal reinforced specialisation, where

firms in an economy are locked into inferior and ill-suited capabilities within their industries. The risk of firms influencing policy for private benefits and unjustified protection (Ades & Tella, 1997; Lazzarini, 2011) increases the chances of a country's economic failure in the long run.

Policy is a deliberate intervention by the state that does not necessarily equate to better or worse performance than a market based environment. Rent seeking firms will provide one-sided information to policy makers to secure or prevent policy interventions. Policy makers from a government perspective have an overview of the economy which an individual firm lacks. The combined effects of an overarching view and the capability to plan projects with external linkages puts government in a better position to ascertain policy requirements (Lazzarini, 2011), but the information asymmetry can negatively affect policy makers in identifying and implementing the most effective solution.

In this section the policies that firms seek were classified as positive, negative and zero sum. It highlighted the need for policy makers to identify firms that seek positive and zero sum policies that can benefit the wider economy. Next, the benefits of innovation on the public policy process are discussed. The next section proposes that policy makers identify and engage with firms that are innovative, involved and networked.

2.5.2 Public Policy and the Benefits of Innovation

This section suggests that policy makers should identify and engage innovative, involved and networked firms to ensure better policy outcomes. Firms will interact with public policy if the benefits are greater than the costs, however these benefits are firm specific and might not benefit the overall economic and social welfare of a country. Policy makers are thus challenged to weed out policy requests to determine those that in the short and long term will provide the most benefit to an economy as a whole.

A possible way to determine whether firms are not seeking negative sum policies is to look at whether the firm is innovative or not. More innovative firms are on the leading edge of market development. If firms have the resources to engage in public policy and are on the cutting edge of markets, policy makers can benefit the economy as a whole by developing policies that support these firms. As firms that collaborate with external partners are more innovative, a firm that is network rich could possibly also request more positive sum policies.

This section examined the influence that innovative firms could have on the public policy process. The need for policy makers to ensure positive policy outcomes was

highlighted. It was proposed that innovative, networked firms that are involved could request polices that are to the benefit of a wider range of constituents. The next section merges the concepts discussed thus far.

2.6 Degree of Government Involvement and Innovation and the Significance for Public Policy

In the above sections two important dimensions of firm activity were discussed - innovativeness and the degree of involvement in public policy. From these two dimensions a framework is constructed with four quadrants of firm categorisation. The importance of network richness that was highlighted in the innovation literature was taken into account on the innovation axis of the framework. It is possible that the network richness could indicate the ability of a firm to be involved, therefore this will be investigated. The quadrants are presented in Figure 6.

Figure 6- Firm Categorisation

Innovative Not Involved
- Politically Unskilled but Innovative
- Firms that lack resources or know how to participate in the public policy process but is innovative
- Possibly a silent majority free riding on Innovative and Involved firms
- Aware that policy can benefit the firm's activities but unsure how
- Low and undifferentiated policy response

Innovative Involved
- Positive sum policies for economy
- Involved in public policy for own benefit as part of competitive strategy but innovative and seeking value creating policies to develop the firm's own capabilities
- Vocal Few
- Aware of what is required from policy to support firm's activities

Not Innovative Not Involved
- Possibly benefits from other's efforts in public policy
- Will be increasingly unable to compete in the future
- Unaware that policy can support the firm's activities
- Undifferentiated and unresponsive with regards to policy

Not Innovative Involved
- Competitive strategy for firms to be involved in public policy to protect their own interest
- Legacy capabilities that are struggling to adapt to a changing world- will request value capturing policies
- Possibly huge sunk costs in existing technology but aware of disruptive innovation in field

Network Richness (Innovative / Non-Innovative)

Not Involved in Public Policy   Involved in Public Policy

2.7 Possible Public Policy Implications from Each Quadrant

This section briefly discusses the categories of firms that are represented by each quadrant, with their possible expectations and requirements from public policy.

2.7.1 Not Innovative and Not Involved Firms

If being involved in the public policy process leads to the benefits stated in section 2.3.1, uninvolved and non-innovative firms possibly do not know how public policy can be beneficial to their firm's operations and are unlikely to know what to request from policy makers. Therefore these firms follow one of the 'not involved in business political management strategies' out of ignorance. The other alternative is that they are aware that public policy measures could benefit them, but the perceived cost of being involved outweighs the benefit of being involved. It is expected that the majority of these firms will not request policies and if they do, the requests will be undifferentiated.

These firms however are not innovative and are unlikely to have a sustainable competitive advantage in a globalised and changing environment. Positive sum policies that benefit innovation could help these firms to be more innovative, whereas negative sum policies promote lock-in that could stimulate inferior and ill-suited capabilities within their industries.

2.7.2 Innovative and Not Involved Firms

Firms that are innovative but not involved are better equipped to deal with a changing and globalised environment. These firms are more aware of their context and possibly have a better idea of what policies are required to benefit their operations than the non-innovative and uninvolved firms. These firms will potentially have a low and undifferentiated response in requesting policies. This is due to a lack of clarity on the benefits of being involved and results in the cost of being involved being perceived as excessive.

This category of uninvolved firms is however innovative and therefore is beneficial to a country's economy. Policies that stimulate innovation will benefit these firms and therefore the wider economy - these firms could be advantaged or disadvantaged depending on the policy decisions. The uninvolved but innovative firms could possibly benefit from the innovative and involved firms' policy requests. Policies that non-innovative firms request could lock-in the wider context of the firms' operations on inferior and ill-suited capabilities, increasing the complexity of delivering innovation and are to the detriment of these firms and a country's economy.

2.7.3 Not Innovative and Involved Firms

The non-innovative and involved firms follow a more active business political management strategy. This could potentially lead to negative sum policy seeking as these firms might seek to protect their existing knowledge base and solutions against more efficient competitors and innovators. These firms realise what policies are

required to benefit them, whereas the uninvolved firms lack this understanding. Therefore these firms could possibly request policies that would be to the detriment of the country's economy, as they lack the focus on innovation seeking policies that provide lock-in and protection for existing capabilities. These firms therefore possibly request more value capture policies that benefit their existing capabilities.

2.7.4 Innovative and Involved Firms

The study proposes that policies focussed on value creation lead to innovation that benefits a firm's competitive advantage in a sustainable manner and that these policies could improve a country's competitive positioning and economic growth. Although acting in their self-interest, innovative firms that are involved with the public policy process will likely request policies that seek value creation. These policies would possibly benefit innovative but uninvolved firms specifically and stimulate innovation in the broader economy. It is expected that these firms have a higher degree of network richness than the non-innovative firms.

These firms should have a thorough understanding of what policies they require for value creation and know that the cost of being involved is outweighed by the benefits that will be received. The firms in this category need to be identified and engaged with by policy makers.

This section discussed the possible policy requests and expectations of the proposed categories of firms. The impact of network richness on innovation was highlighted. The non-innovative and uninvolved firms are not likely to understand how policies can benefit their operations or see the cost of being involved as too high. The innovative but uninvolved firms might realise that policies could be beneficial to them, but lack clarity on the degree to which this is required, or they see the cost of being involved as too high, resulting in low undifferentiated policy requests from this group. The non-innovative but involved firms are rent seeking and are likely to request negative sum policies that focus on value capture. The innovative and involved firms are expected to seek value creation policies that will benefit the wider economy.

2.8 Rationale for This Study

The theory, as discussed in the literature review of public policy, firm political activity, innovation and network richness, frames the scope of the study. The study looks at firms that do or do not engage in the public policy process and is further subdivided into firms that are innovative or not. The positive effect of a rich network with regards to innovation is noted. The study aims to determine the types of policies that are requested and to examine the factors that determine firm engagement with the public

policy process. The next chapter outlines the proposed hypotheses of this study based on the literature review conducted.

This section covered the pertinent research in the fields of public policy, corporate political activity and innovation. The importance of evidenced based policy making and network richness was highlighted in their respective fields. The purpose, process and challenges in public policy were discussed, highlighting the difficulty of ensuring positive sum policies are enacted. Evidenced based policy making was identified as a means of obtaining more informed political decisions.

It was argued that firms should engage in the public policy process given the influence that it has on their operating environment. The possible strategies for corporate political activity were examined and it was highlighted that firms could choose to engage in the public policy process on an individual level or a collective level, with industry associations being the most common collective engagement method. Industry associations have to ensure density of membership and therefore will lobby for the benefit of its members, regardless of the influence it actions will have on other constituents.

It was argued that a firm's competitiveness and therefore the country's competitiveness are positively influenced by innovation. It was highlighted that the definition of innovation depends on the context of the firm. The importance of collaboration with a network outside of the firms was highlighted as it pertains to innovation. It was argued that firms that are more innovative would request value creating policies, compared to non-innovative firms that will request value capturing policies. It is suggested that the value creating policies are positive sum policies that will benefit the economic and social welfare of a country.

The complex, dynamic and turbulent environment of firms was highlighted, touching on the emerging trend of global production networks, a phenomenon that is not yet well understood. Given this complexity, a framework was suggested that merged the dimensions of policy involvement and innovation, taking note of the effect of network richness. The possible policy implication from each quadrant in the framework was discussed.

The next chapter outlines the proposed hypotheses of the study.

3   Chapter 3: Research Propositions

The previous chapter reviewed the pertinent literature that relates to this study. This chapter suggests the proposed hypotheses of the study. The literature review identified that a firm's public policy involvement is motivated by its corporate political strategy, but that not all firms participate in the process. Policy makers are bombarded with several stakeholders to satisfy and this is a highly politicised process. More evidenced based policy making methods are required to improve the effectiveness of public policy decision making.

Innovation benefits the competitiveness of a firm and a country. Some firms experience innovation and others do not. Policies that are required by innovative firms will focus on value creation to stimulate innovation and should lead to better country competitiveness. Firms that are not innovative will request policies that relate to value capture that aims to protect existing capabilities. This study aims to investigate if there are four distinct groups as outlined in Figure 7, the extent of network richness in each group and the resultant policy behaviour for each category.

Figure 7- Hypotheses
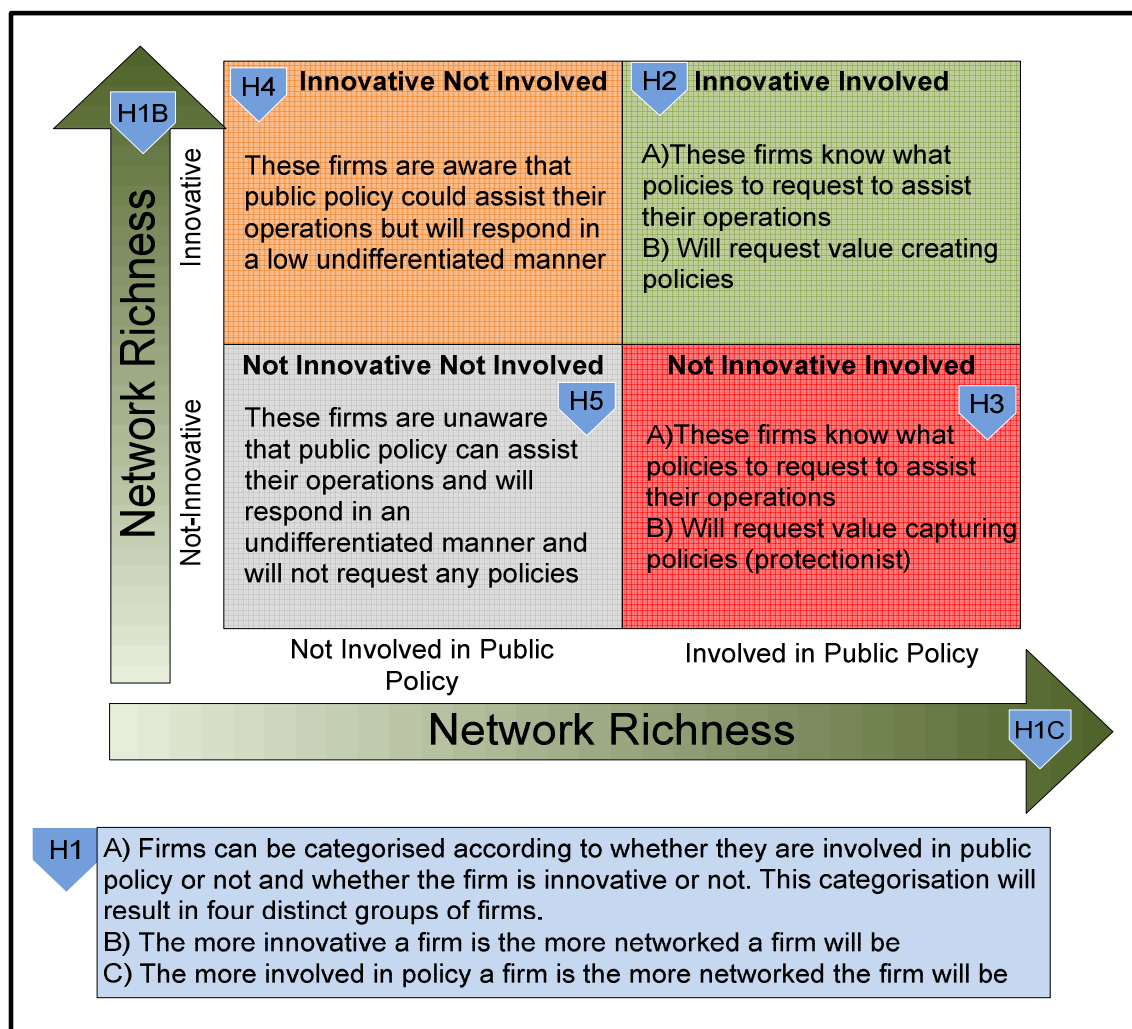
3.1   Hypothesis 1

$H1_A$: There are four independent groups within the sample based on whether a firm is innovative or not innovative, and whether a firm is involved in the policy process or not. A system of categorisation can thus be determined.

$H1_B$: The more innovative a firm is, the more networked the firm will be.

$H1_C$: The more involved in policy a firm is, the more networked a firm will be.

3.2   Hypothesis 2- Innovative and Involved Firms

$H2_A$: Firms that are innovative and involved know which policies to request from public policy makers.

$H2_B$ Firms that are innovative and involved will request policies that relate to value creation in comparison to the non-innovative and involved firms. Hypothesis 3- Not Innovative and Involved Firms

3.3   Hypothesis 3- Non Innovative and Involved Firms

$H3_A$: Firms that are not innovative and involved know which policies to request from public policy makers.

$H3_B$: Firms that are not innovative and involved will request policies relating to value capture in comparison to the innovative and involved firms.

3.4   Hypothesis 4- Innovative and Not Involved Firms

$H4_A$: The firms in the innovative but uninvolved group will request a low and undifferentiated need for policies.

3.5 Hypothesis 5- Non Innovative and Not Involved Firms

$H5_A$: The firms in the non-innovative and uninvolved group will not request policies and are undifferentiated in their response.

This chapter stated the proposed hypotheses of the study. The next chapter defends the research methodology used to test the proposed hypotheses.

4   Chapter 4: Research Methodology

4.1   Introduction

The previous chapter outlined the proposed hypotheses of the study, while this chapter outlines the proposed research methodology. Firstly, the rationale of using secondary data in the form of the INGINEUS survey data is presented. The research methodology follows and why this dataset is best suited to address the hypotheses is defended. The population, unit of analysis and sampling is outlined.

Next the proposed data analysis methods are defended. The dataset in general is analysed through descriptive statistics. To test if there were four independent groups as hypothesised, the Chi-square test of independence with cross tabulations were used. As innovation exists on a continuum and to take into account the network richness of a firm, Exploratory Factor Analysis was used to determine the underlying structure in the dataset, with Cluster Analysis to refine the hypothesised groups. Kruskal-Wallis testing was then conducted on the policy requests of the different groups, but as this only measures the group as a whole the results were further analysed through Mann Whitney U tests using box plots for the results to compare more granular differences. ANOVA testing of the Kruskal-Wallis results was conducted to verify that group differences did exist in order to decrease the probability of type 1 errors. Lastly, the limitations of the research methodology are discussed.

4.2   Rationale for Proposed Research Design

The aim of the research was to identify if firms can be categorised into four groups. These four groups are:

- Innovative and Involved
- Not Innovative and Involved
- Innovative and Not Involved
- Not Innovative and Not Involved

Based on this categorisation the researcher hoped to ascertain if network richness influenced a firm's classification and to examine a firm's policy requests. Public policy that is guided by innovative firms is expected to yield greater economic benefits and competiveness as it is focused on value creation. These policies would also benefit the innovative firms that are not involved with policy. In contrast, the self-interested incumbents that are not innovative but are involved were expected to request value capture policies that would only benefit that firm specifically, impacting negatively on

other firms and the country. The firms that are innovative but uninvolved were expected to show a low and undifferentiated response to policies. The non-innovative and uninvolved firms were expected to be unresponsive and undifferentiated with regards to policy requests.

To best answer the hypotheses, a large set of data on firms that report on innovativeness, collaboration outside of the organisational boundaries and policy intentions or requirements was required. The cost and time to conduct such a study was significant. Given these constraints, secondary data based on survey methodology from the European Union (EU) INGINEUS project - Impact of Networks, Globalisations and their Interaction with EU Strategies - was utilised for this analysis (INGINEUS, 2011).

This dataset was funded by the EU and was conducted in nine countries (both developed and developing) over three industry sectors with a sample of 1215 firms, with the aim of determining the extent to which innovation is taking place in globally dispersed networks (INGINEUS, 2011). It was based on the emerging and previous theories of business networks and innovation (INGINEUS, 2011).

The study benefitted tremendously from leveraging off this body of work. Limitations of the original study were that the evidence was self-reported and more accurate information was obtained on local rather than more distant matters, the location of control of subsidiary firms was not known and there were inherent difficulties in having a standardised survey across countries, such as the point of reference, qualifying definitions for industry inclusion and the different context of operations (INGINEUS, 2011). Even with these limitations taken into account, the INGINEUS dataset was best suited to provide insights on the stated hypotheses.

4.3   Population

The population was the complete set of group members (Saunders & Lewis 2012). The dataset of the INGINEUS survey categorised members according to country and a loosely defined industry sector (INGINEUS, 2011). The population of the INGINEUS dataset was firms active in the ICT, automotive or agro-processing industry located in the country of the survey. For a firm to be considered in the population there was a lower limit of five employees and no upper limit (INGINEUS, 2011). The chosen industry sector of each country that participated in the INGINEUS survey was based on the economic importance of that industry within the national or regional context (INGINEUS, 2011). There is a complex link between innovation and research intensity;

therefore industries were chosen to provide insights across the research intensity spectrum as follows (INGINEUS, 2011):

- Low research intensity – agro-processing for human consumption
- Medium research intensity - automotive
- High research intensity – Information Computer Technology (ICT)

The survey measured characteristics of a firm's resource base, innovation levels, involvement of third parties in innovation, involvement in public policy structures and policy requirements (INGINEUS, 2011). The population of relevance to this study therefore, was all the firms in the economy per the relevant industry chosen for each country.

4.4   Sampling

Saunders and Lewis (2012) defined a sample as a subgroup or a subset of the whole population in question. The INGINEUS dataset was a sample of all firms involved in the economy of a country in one of the predefined industry sectors (INGINEUS, 2011). Databases of the chosen industry per country were analysed to identify possible firms that could participate in the INGINEUS survey. The sample of the INGINEUS project was carefully delimited and proved to be a difficult process as there is no international standardised code of defined industry parameters. Key insights from this process were that the increasing complexity of global supply chains complicated the definitions of industry and that it was not useful to have a definitive definition for industry (INGINEUS, 2011). Industry was therefore loosely defined.

The sampling frame was the complete list of all the members of the total population (Saunders & Lewis 2012) and was obtained through the use of the abovementioned databases. Either random or stratified probability sampling techniques were used, depending on the choice of the survey partner (INGINEUS, 2011). Simple random sampling is a sampling technique in which each member of the population has an equal chance to be selected at random, while stratified sampling is the technique where the sampling frame is divided into relevant strata with sample members being chosen at random within each stratum (Saunders & Lewis 2012).

With regards to the current study, the sample frame consisted of all the firms belonging to the agro-processing, automobile and ICT industries within developed and developing countries. The countries, database used and industries are listed in Table 3. The developed countries were Denmark, Germany, Norway and Sweden, with the developing countries being Brazil, China, Estonia, India and South Africa.

Table 3- List of Countries, Databases used, as per Industry

Country	Database	Industry
Denmark	Orbis- a company database offered by Bureau Van Dijk, The Netherlands, which lists 241000 Danish companies.	Agro-Processing
South Africa	Five Databases Experian database, a global information services company, Go Organic Online Directory Tradepage, Online Trade and Business Directory South Africa, Search ZA Directory, The Food World	Agro-Processing
Brazil	Three distinct sources: (a) The Annual Registry of Social Information (RAIS) (b) Auto-parts Union Contact List (SINDIPECAS) (c) Other known suppliers	Automotive
Gemany	Data was bought from Hoppenstedt which processed raw data according to specifications as the automotive industry is a cross-sectoral industry.	Automotive
Sweden	Statistics Sweden database	Automotive and ICT
China	Two databases Beijing database- consisting mainly of a firms list published by the Beijing Administration for Industry and Commerce, as well as the Beijing Taxation Bureau. Shenzhen database- consisting of a firms mainly from several science and technology entrepreneurship service centres in Shenzhen, as well as Shenzhen small and medium enterprises service centre.	ICT
Estonia	Estonian Business Registry	ICT
India	NASSCOM Directory of IT firms	ICT
Norway	The Brønnøysund Register Centre". Data set extracted from a commercial register (Proff Forvalt - Eniro)	ICT

4.5   Unit of Analysis

The firm was the unit of analysis. In the INGINEUS study, the representative of the firm completing the survey was viewed as a proxy for the firm itself and the information

provided was used to extract the views and behaviour of the firm as an entity (INGINEUS, 2011).

4.6   Research Instrument

4.6.1   Design of the Data Collection Instrument

The survey design followed a rigorous design process. It was cognisant of the difficulties of establishing a research instrument across countries, cultures, industry definitions and languages (INGINEUS, 2011). The survey was designed to measure the trend of the globalisation in innovation through business networks (INGINEUS, 2011).

The survey instrument was a questionnaire that was developed through the interaction and collaboration of the nine survey partners involved in the INGINEUS project (INGINEUS, 2011). The goal of the project was to track the globalisation of innovation networks. The structure of the questionnaire was based on a theoretical framework of proposed theoretical propositions on the individual instances of firms that constitute global innovation networks (GINs), the scope of GINs, the determinants of GINs and the impact of GINs (INGINEUS, 2011). The constructs from the INGINEUS study were modified from the literature to reflect the context of this study.

The survey instrument consisted of 14 questions with multiple sub-questions. The questionnaire is detailed in Appendix 1. The questions were structured according to three themes - globalisation (Q3.1, Q4.1, Q4.2, Q7), innovation (Q5, Q6), or degree of networking (Q5, Q8, Q10) - within the defined theoretical framework. The questions that pertained to this study and their area of focus are outlined in Table 4.

Table 4- INGINEUS Questions and Focus Areas Used for this Study

Questions	Area Researched
Q3	Background information on firm size
Q6	Innovation based questions
Q7	Investigated the firms geographic network and collaborative relationships
Q10	Strategic management
Q13	Policy based questions

To best answer the hypotheses outlined in Chapter 3, only specific constructs of the INGINEUS study were used. The constructs for this study were developed out of the relevant theory and the questions that best related to these constructs were identified in the INGINEUS questionnaire.

The questionnaire, although not originally designed for this study, did meet its criteria. The collection and methodology was described in detail, it was recent and it suited the purpose of the study. It would not have been possible to obtain such extensive data within the time and cost constraints of this study.

4.6.2 Reliability and Validity in the Research Design

Validity is the extent to which the data collection method accurately measures that which was intended and if the research findings are what they profess to be about (Saunders & Lewis, 2012). Factors that could threaten the validity of this study (Saunders & Lewis, 2012), as well as the mitigation factors, are outlined in Table 5.

Table 5- Principle Factors in Validity in Research Design

Principal Factors that Threaten Validity	Mitigating Action
Subject Selection	The population of firms used in the INGINEUS study was identified through using the best available nationally representative databases of each country. Care was taken to delimited the sample as no standardised codes or definition for industry existed across the countries used. From these databases stratified or random sampling was used to select the sample of respondents. The respondents should therefore be representative of the research population. This study leverages of these efforts.
History	The survey was conducted in one phase within a limited time period therefore specific events in the history of the project should not have important effects on the findings
Testing	Each survey partner could choose the data collection method that would garner the most reponses. The options were an online tool, telephonic, face to face interviews, or per written mail. The users of the offline methods of data collection were still required to feed the information into the online tool were the data had to be checked and cleaned by the survey partner before sending it for statistical analysis. The off line methods could have had more of an impact on the research subjects than the online method, for example, the respondent could have been keen to impress the interviewer.
Mortality	INGINEUS was not a longitudinal study and loss of research subjects would have less of an impact. For this study the loss of subjects do not have a material impact.
Ambiguity about Causal Direction	The survey instrument was based on a theoretical framework that outlined the direction of cause and effect based on theoretical propositions. The INGINEUS study was the first study to examine the impact of global innovation networks in detail, and although unlikely, the flow of cause an effect could have been challenged by the findings.

Reliability is the extent to which the data collection methods and analysis will produce consistent findings (Saunders & Lewis, 2012). Factors that could threaten the reliability

of this study (Saunders & Lewis, 2012), as well as the mitigation factors, are outlined in Table 6.

Table 6- Principal Factors in Reliability in Research Design

Principal Factors that Threaten Reliability	Mitigating Action
Subject Error	This was mitigated through a time limit on survey partners to distribute and collect information. There was no need to use night shift representatives of firms in the INGINEUS study further decreasing the probability of subject error.
Subject Bias	Research subjects could have been tempted to provide unreliable information in order to present themselves as more innovative or networked. The need for this is minimised however by the data not having a significant impact on the firm's reputation.
Observer Error	Direct contact and indirect contact respondents could have interpreted questions differently. Respondents with direct contact could have clarified questions with the researchers to give them a different understanding than respondents contacted indirectly. This could bias the results.
Observer Bias	The offline researchers had to feed the data into the online reporting tool, clean and check the data. The nature of the study is also international with cross cultural differences and language difficulties. There is thus the possibility of researchers biasing findings and conclusions. This was mitigated however with the in depth research design process that was used involving all nine survey partners.

4.6.3   Data Collection

The data was collected by survey partners in each of the nine countries that participated in the EU INGINEUS project. The survey was conducted through Survey Monkey (an online survey tool), face-to-face interviews, telephonic interviews or per written mail, depending on the survey partner's judgement on receiving the best response rates based on past experience and historical knowledge (INGINEUS, 2011). The chosen method per country is outlined in Table 7.

Table 7- Method of Data Collection per Country

Country	Electronically by Mail or Link	Face to Face Interviews	Telephonic Interviews
Brazil		X	X
China			X
Denmark	X		
Estonia	X		
Gemany	X		
India		X	
Norway	X		
South Africa	X		X
Sweden	X		

Survey Monkey was used to collect responses from survey partners regardless of the data collection method used (INGINEUS, 2011). The data had to be cleaned and checked by each survey partner prior to downloading the data (INGINEUS, 2011). The survey was administered to the stratified or random sample from the nationally representative databases of each country.

Survey results by country and industry are outlined in Table 8, with both the number of valid responses as well as the response rate. The dataset is dominated by ICT responses due to the size of India and China. The agro-processing and automotive industries are also more established and concentrated than the ICT industry (INGINEUS, 2011).

Table 8- Valid Responses and Response Rates per Country and Industry

Country	ICT Valid Responses	ICT Response Rate	Automotive Valid Responses	Automotive Response Rate	Agro-processing Valid Responses	Agro-processing Response Rate
Brazil			30	22.80%		
China	243	10.59%				
Denmark					48	21.91%
Estonia	17	14.04%				
Gemany			33	5.60%		
India	318	20.00%				
Norway	127	11.96%				
South Africa					83	17.00%
Sweden	171	9.72%	24	7.00%		
Total	876	13.26%	87	11.80%	131	19.46%

4.7   Data analysis

The data analysis methods used to answer the research hypotheses are detailed in this section. Figure 8 highlights the specific statistical tests conducted for each hypothesis.

Figure 8- Statistical Tests used for Hypotheses
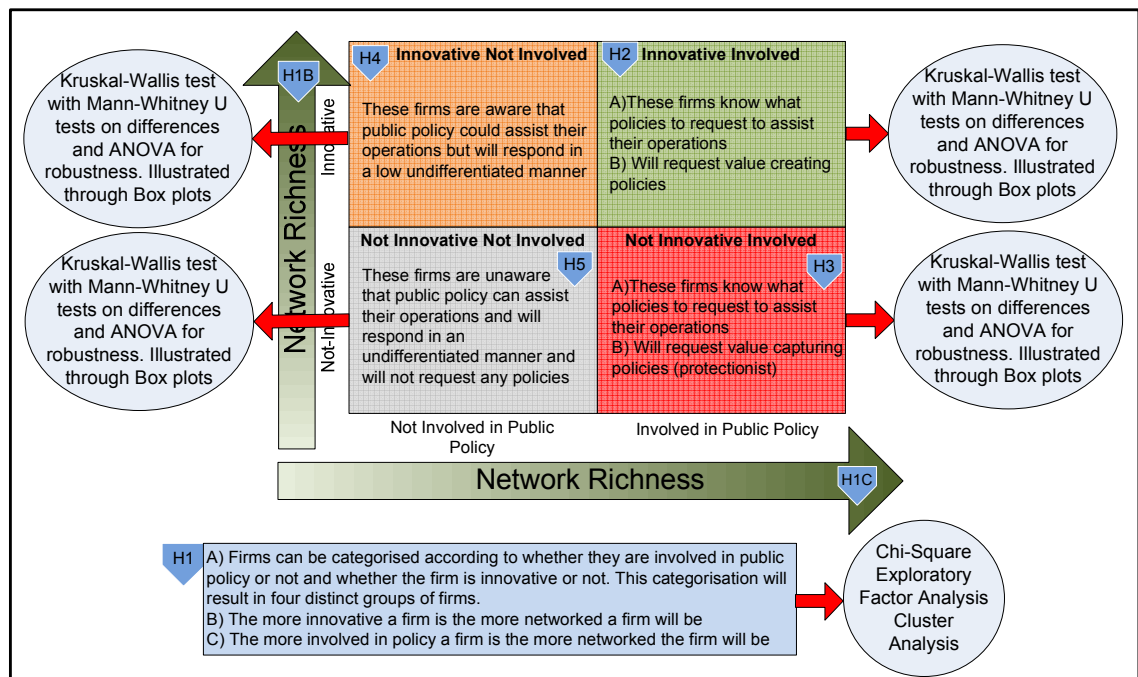
4.7.1 Descriptive Statistics

As the variables are mostly categorical, the mean and standard deviation tests were not conducted as they had no statistical value (Pallant, 2005). Frequency analysis that measured the proportions of the responses was utilised.

4.7.2 Chi-square Test Statistics

The Chi-square test for independence is the preferred method to explore the relationships between two categorical variables (Pallant, 2005). The Phi-coefficient should be calculated if both variables have only two categories (two x two tables). In SPSS (Statistical Packages for Social Sciences), a two by two table is computed with an additional correction value known as the "Yates Correction for Continuity" to correct or compensate for any overestimation of the Chi-square value in this specific case (Pallant, 2005). In using the Chi-square test the assumptions outlined in Table 9 were made (Albright, Winston & Zappe, 2009; Pallant, 2005).

Table 9- Chi-square Assumptions

Chi-square test: Assumptions
The minimum expected cell frequency should be five or 80 percent of cells should have expected cell frequencies of five or more
Sample should be randomly selected from the populations
Observations are assumed to be independent of each other

For categorical variables the hypotheses are:

H0: The probability of each category equals the hypothesised probability.

HA: At least one category's probability does not equal its hypothesised probability.

4.7.2.1 Monte Carlo Method

If the Chi-Square tests results in an unbalanced data set with significantly unequal counts in the groups identified or if more than 20% of the cells have an expected value below five, exact tests or the Monte Carlo method is preferred to determine the distribution of the Pearson statistic of significance (Mehta & Patel, 2011). Mehta and Patel (2011) suggested that exact p-values are the gold-standard and that it decreases the risk of type 1 errors. The choice between using an exact versus a Monte Carlo

method is one of convenience (Mehta & Patel, 2011). The advantages of using the Monte Carlo method, according to Mehta and Patel (2011), are as follows:

- The Monte Carlo estimate is unbiased
- The Monte Carlo estimate uses a confidence interval in which the exact p-value lies
- The confidence interval can be specified at 99%
- The Monte Carlo p-value will be within three decimal places of the exact p-value if the confidence interval is sufficiently narrow
- The asymptotic p-value carries no probalistic accuracy guarantee and could imply that there is no interaction between variables, whereas the Monte Carlo estimate can establish if there is a relationship within the 5% significance level

In SPSS this option can be chosen when doing cross tabulations and Chi-square tests. The Monte Carlo method was used with a sample size of 10000 and a confidence level of 99%.

4.7.3 Construct Creation for Chi-square Tests

To assess whether there were distinct categories of innovativeness and policy involvement within the dataset, new variables had to be created that could present the required constructs.

4.7.3.1 Innovation

Innovation as a variable was operationalised through asking the respondents to indicate with a 'yes' or a 'no' if they experienced innovation in the period 2006-2008 over three options and five areas. The three options were:

- New to the world
- New to the industry
- New to the firm

The five areas were:

- New products
- New services
- New or significantly improved methods of manufacturing or production
- New or significantly improved logistics, distribution or delivery methods for inputs, goods and services

- New or significantly improved supporting activities for processes (for example purchasing, accounting, maintenance systems, and so forth)

The variable 'Innovative' indicated whether the firm experienced innovation or not, and was a latent continuous variable of innovation that was created through using a formula in Excel. A latent continuous variable approach assumes that there is the existence of a continuous unobserved or latent variable that underlies an observed categorical variable. The variable is thus partially observable and only the intervals within which latent variables lie and not the actual values can be inferred (Powers & Xie, 1999).

If a firm indicated a '1' in any of the five areas across the three options it was considered to be innovative. If the firm indicated a 'no' in any of the five areas across the three options the firm was considered not innovative.

4.7.3.2 Public Policy Involvement

To determine if a firm was involved in a policy process a continuous latent variable 'Public Policy' was operationalised. The respondent had to indicate with a 'yes' or 'no' if the firm collaborated on innovation with the government in either the firm's region or country. A firm was seen to be involved with public policy if it indicated a 'yes' in either the 'your region' or 'your country' option and not involved if it indicated a 'no' in both the 'your region' or 'your country' option.

This question on public policy involvement was separate from the policy need related questions in the questionnaire. The frame of mind of the respondents in this question was not primed on policy needs within their region or country as the firms had to indicate involvement or collaboration across different geographical regions such as: Your Region, Your Country, North America, South America, Western Europe, Central and Eastern Europe, Africa, Japan and Australasia and the rest of Asia in the original INGINEUS questionnaire. Furthermore, the policy needs were only requested from the respondents at question 13 of the questionnaire, whereas the government involvement in their country and region as well as other geographic regions was asked in question 7.

4.7.4 Kruskal-Wallis and One Way Analysis of Variance

Parametric tests are more powerful than non-parametric tests, however parametric tests require certain assumptions to be made about the dataset (Albright et al., 2009; Pallant, 2005; Saunders & Lewis, 2012). These assumptions are that the dataset is normally distributed, that there are continuous variables being measured and that the dataset has a sufficient sample size. Other factors that influence the power of a

statistical test are the sample size, the effect size and the alpha level (Pallant, 2005). If the sample size is larger than 100, the effect of a non-significant result has a low probability of being due to insufficient statistical power (Pallant, 2005).

The dataset was analysed for normality through Kolmogorov-Smirnov and Shapiro-Wilk tests. These tests reported significant results and indicated that the data was not normally distributed. In addition the data was categorical and ordinal, therefore the Kruskal-Wallis test was used. This test is considered to be a non-parametric equivalent of One-way Between-groups Analysis of Variance- ANOVA (Pallant, 2005). It is however recommended conducting the robust ANOVA testing as well when conducting a Kruskal-Wallis test to decrease the probability of type 1 errors- rejecting the null hypothesis when it should not be rejected (Pallant, 2005; Powers & Xie, 1999).

The respondents had to indicate on a scale the factors that need to be improved in considering future innovation activities. The scale options were, 'factor not needed', 'very low need', 'moderately low need', 'moderately high need', and 'very high need'. A '0' was coded for missing values indicating that the factor was not experienced. This question was separate from the question of collaboration with government and thus did not question what the respondents were requesting from government, but rather what policies they would prefer to have with regards to innovation.

The respondents were asked to indicate their need for specific policies with regards to future innovation activities. The policy choices were divided into value creating, value capturing or both value creating and capturing. The possible policy choices and their classifications are listed in Table 10. Value creating policies are aimed at facilitating innovation activities while value capturing policies are aimed at exploiting current abilities. Some policies are beneficial to both innovation and exploitation, for example better skills in the labour force.

Table 10- Policy Choices

Category	Policy
Value Creation	Better access to international research network
	More open and flexible migration policy regulations for employing foreign scientists/technicians/experts
	Greater availability of risk capital for innovation activities with an international dimension
Value Capture	Practical support from centres for the internationalisation of innovation and technology transfer
	More public incentives and economic support
	More stringent regulations, practice and jurisprudence around intellectual property rights
Value Capture and Creation	Higher skills in the labour force
	Better and clearer rules regarding foreign direct investment and trade

The Kruskal-Wallis test is appropriate when a study compares three or more independent groups, the data is not normally distributed and are measures on an ordinal scale. The null hypothesis in a Kruskal–Wallis test is that there is no difference between the mean ranks of the groups. The alternative hypothesis is that there is a difference between the mean ranks of the groups, therefore the test determines if the four groups have the same distribution shape and dispersion.

The raw data are converted to ranks that are rated based on the analysis of independent random samples from the population. The ranks are summed for each group after which the Kruskal-Wallis test determines if the sums of the ranks are distributed randomly (Burns & Burns, 2008). The four groups were analysed using the Kruskal-Wallis test for differences on the median responses in the policy related questions. Where significant differences were found between the mean ranks, post hoc

comparison testing was done through Mann-Whitney U tests on multiple pairwise comparisons to identify which two subsamples were different or similar.

It is recommended to use the robust ANOVA method to confirm the results of the Kruskal-Wallis tests to further minimise the probability of a type 1 error. ANOVA compares the variance between independent groups with the variability within each group for metric data. Due to its robustness as a statistical test it can be used on non-metric categorical data to verify if group differences do exist. A large calculated F-ratio indicates that there is more variability between groups due to the independent variable chosen than there is within each group (Pallant, 2005). If the F-ratio is significant the null hypothesis of equal means is rejected. Post hoc tests, such as the Tukey (for equal variance) and Dunnet's C (for unequal variance) can be used when multiple comparisons are run to reduce the risk of type 1 errors (Pallant, 2005).

4.7.5 Multivariate Analysis

The dataset from the INGINEUS project can be analysed to improve policy decision making, however to do this requires more complex multivariate statistical techniques. Innovation occurs on a continuum therefore the crude measure of just being innovative or not measured through the Chi-square analysis was not sufficient for this study. In addition, the dimensions of network richness needed to be taken into account. Therefore the multivariate analysis methods that could highlight the continuum of innovation as well as the degree of network richness measured in each firm were investigated. Multivariate analysis is the analysis of multiple variables in a single or set of relationships (Hair, Black, Babin & Anderson, 2010). Designs with two or more dependent variables are considered multivariate (Grimm & Yarnold, 2000; Hair et al., 2010). Hair et al (2010) stated that to be truly multivariate, variables must be random and interrelated in such a way that their different effects cannot be interpreted separately in a meaningful way.

The foundation for multivariate analysis is the variate. This is also known as a composite variable or synthetic variable and is a linear combination of two or more variables that is empirically derived through assigning each variable with a weight through the multivariate technique (Grimm & Yarnold, 2000). The formula is expressed as follows:

$$Variate\ Value = w_1\ X_1 + w_2\ X_2 + \cdots + w_n\ X_n$$

Where X_n is the observed variable and w_n is the weight determined by the multivariate technique (Hair et al., 2010). The variate value represents a combination of the entire

set of variables that can be used for the specific objective of the analysis and is determined to suit the analysis technique.

4.7.5.1 Measurement Scales of Multivariate Analysis

The measurement scale of the data determines the possible analysis methods for the dataset (Hair et al., 2010; Powers & Xie, 1999; Schumacker & Lomax, 2004). The measurement scale for the dataset is outlined in Table 11.

Table 11- Data Type Classification

Variable Classification	
Non- Metric	
Dichotomous/ Binary	Ordered Polytomous
Q 6- Innovation	Q 3.1- Firm Size
Q 7- Collaboration	Q 13- Policies Needed

Non-metric data indicates the presence or absence of characteristics under investigation (Hair et al., 2010). Non-metric data is further divided into nominal or ordinal scales. A nominal scale - also known as a categorical scale (Hair et al., 2010) - has no quantitative meaning and cannot be interpreted as anything other than the number of occurrences of each variable studied (Grimm & Yarnold, 2000; Hair et al., 2010). The innovation and collaboration questions in this study were dichotomous/ binary data indicating a 'yes' or 'no' response to each question. The question on firm size and policies needed used an ordinal scale that did not have the same proportion of differences between the values. The measurement scale is critical in determining the multivariate technique most applicable to the data (Hair et al., 2010).

4.7.5.2 Measurement Error and Multivariate Measurement

According to classical test theory an observed score is influenced by what it is supposed to measure - known as a true score - and factors external to the underlying concept - known as the error score. Together these values equate to the observed score (Grimm & Yarnold, 2000). Measurement error is the degree to which an observed score is different from the true score. It has many sources and all variables used in multivariate techniques must factor in that there is a degree of measurement error (Hair et al., 2010). The error score is responsible for the noise in the data and can weaken correlations or provide less accurate means.

4.7.5.3 Validity and Reliability of Multivariate Analysis

In order to minimise the measurement error, the validity and reliability of a variable needs to be addressed (Hair et al., 2010). Validity is the degree to which a measure accurately represents what it is supposed to (Saunders & Lewis, 2012). The question of the variable thus needs to be both accurate and correct.

Reliability refers to the consistency of the measures and helps to determine what attributes or events are related as well as the nature of these relationships (Grimm & Yarnold, 2000). It is thus the degree to which the observed variable measures the true score and is error free (Hair et al., 2010). Reliable measures improve consistency.

Internal consistency is a measure of reliability that measures the degree of intercorrelation between individual items or indicators of the scale of the same construct (Hair et al., 2010). No single item is a perfect measure of concept, therefore item-to-total correlation (to exceed 0.50), inter-item correlation (to exceed 0.30) and Cronbach's Alpha (to exceed 0.70) is used to measure reliability (Hair et al., 2010). Cronbach's Alpha does however have a positive relationship to the numbers of items in the scale and could synthetically increase the reliability value, therefore more stringent requirements are required for scales with a large number of items (Hair et al., 2010).

4.7.5.4 Multivariate Measurement

To reduce measurement error even further, multivariate measurements - also known as summated scales - can be created. This is a composite measure that represents a concept through using several variables as indicators that each represents a facet of the concept (Hair et al., 2010). For Factor Analysis, a score for each factor can be calculated creating a summated scale. These scores can be combined to determine an overall summated scale for the underlying structure in the data.

4.7.5.5 Statistical Significance and Statistical Power of Multivariate Analysis

Multivariate techniques are based on the statistical inference of the values or relationships among variables from a randomly drawn sample of a population (Hair et al., 2010). The INGINEUS dataset is a sample from the broader population of firms in the agro-processing, automotive and ICT industries in the nine relevant countries.

Statistical error that results from using a sample (sampling error) needs to specified beforehand when interpreting statistical inferences (Hair et al., 2010). This is done through specifying the type 1 error, alpha (α). This is the probability of rejecting the null hypothesis when it should hold. Through determining the acceptable limit of alpha, the

type 2 error, beta (β), is determined by default. This is not rejecting the null hypothesis when it is false.

Specifying the acceptable statistical significance does not indicate the probability of success in finding if the differences actually exist. It is only the probability of correctly rejecting the null hypothesis and through reducing type 1 errors; the power of the statistical test is also reduced (Hair et al., 2010). For this study alpha was set at 0.05 for most statistical analyses. Where Monte Carlo exact tests were used, the confidence level was set at 99% with an alpha level of 0.01. The high alpha level that had been set together with the size of the sample (1215) gave sufficient statistical power to the tests done.

4.7.6   Multivariate Techniques

Variables can be divided into independent and dependent classifications. This determines if a dependence or an interdependence technique should be used. A dependence technique is used when a variable or set of variables is identified as the dependent variable to be predicted or explained by independent variables (Hair et al., 2010). Interdependence techniques are where no single variable or set of variables is defined as being independent or dependent and is the simultaneous analysis of all the variables in the set (Hair et al., 2010).

Latent variables are those variables that are not directly observable or measurable and are thus inferred from a set of observable variables that are measurable (Hair et al., 2010; Schumacker & Lomax, 2004). Independent variables are variables that are not influenced by any other variable in the model, with dependent variables being those variables that are influenced by another variable in the model (Schumacker & Lomax, 2004). A decision tree for dependence and interdependence techniques is illustrated in Figure 9 and Figure 10 highlighting the choices made for this study.

Figure 9- Multivariate Dependence Techniques
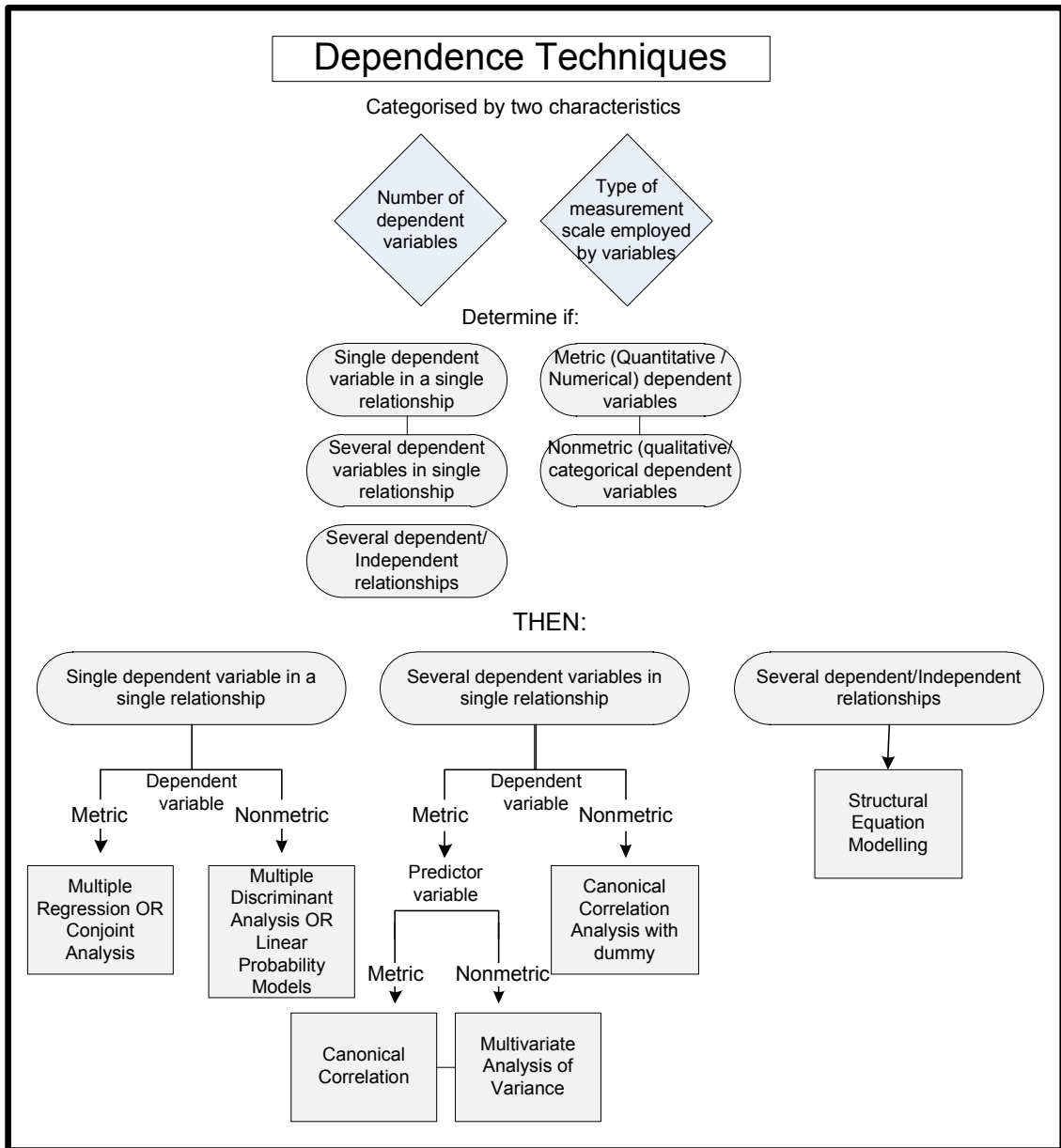
Figure 10- Multivariate Interdependence Techniques
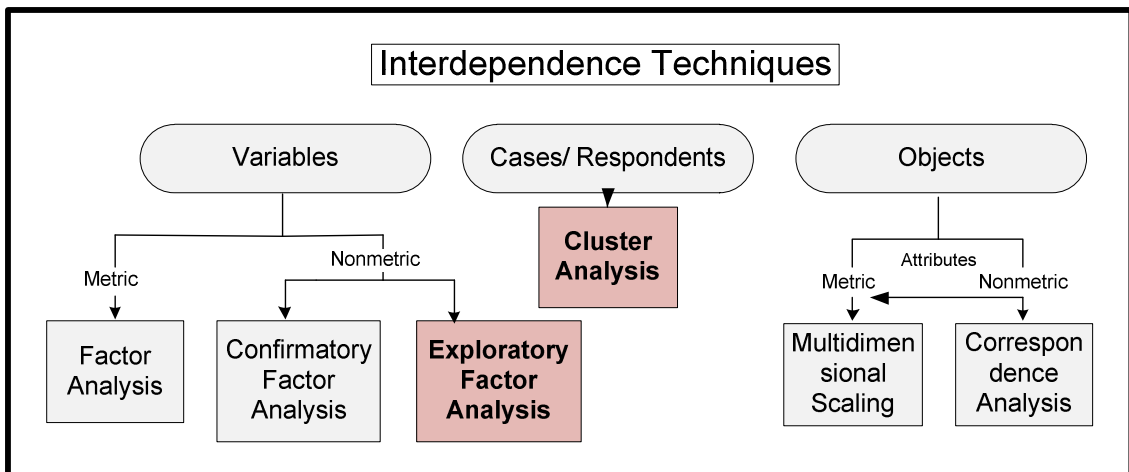
4.7.6.1 Exploratory Factor Analysis

As this study did not specify the dependent or independent variables and used nonmetric variables, Factor Analysis was chosen. Factor Analysis is an interdependence technique that aims to define the underlying structure of the variables used in the analysis (Asparouhov & Muthén, 2008; Decoster, 1998; Hair et al., 2010). Groups of variables that are highly interrelated are known as factors and are assumed to represent dimensions within the data (Hair et al., 2010). A Factor Analysis examines the underlying pattern of correlations of the observed measures with highly correlated measures being influenced by the same factors (Decoster, 1998). There are two types of Factor Analysis- Exploratory Factor Analysis and Confirmatory Factor Analysis (Decoster, 1998).

Confirmatory Factor Analysis is better suited to research in which the theory and data structure is well understood. In fields were the foundation and basic principles are in the process of being formed Exploratory Factor Analysis is better suited. Confirmatory Factor Analysis will yield insufficient goodness of fit indicators if the theory is still in development (Hurley, Scandura, Schriesheim, Brannick, Seers, Vanderberg, & Williams, 1997). Adjusting modification indices to improve a misspecified Confirmatory Factor Analysis to better represent the dataset makes the initial Confirmatory Factor Analysis an Exploratory Factor Analysis, therefore it is more accurate to conduct a traditional Exploratory Factor Analysis for theory development (Hurley et al., 1997).

Exploratory Factor Analysis is labelled as exploratory as it specifies the number of latent variables without placing a structure on the linear relationships between the observed variables and the factors (Muthén & Muthén, 2010). Exploratory Factor Analysis determines the common factors influencing a set of measures, determines which features are the most important to classify a group and generates factor scores to represent values for the underlying constructs for further analyses with the other variables in the dataset (Decoster, 1998; Hair et al., 2010). Exploratory Factor Analysis is the correct statistic test to make statements about the factors that are responsible for a set of observed responses.

Mplus version 5.1 was used to run an Exploratory Factor Analysis specifying four factors with Geomin rotation using tetrachoric correlations and Weighted Least Square Estimation (WLSM) as the variables were categorical. The tetrachoric correlation is a special case of the polychoric correlation where both observed variables are dichotomous (Flora & Curran, 2004). As dichotomous variables do not consist of a metric scale, correlations cannot be computed from actual scores, therefore tetrachoric

correlations were used that correlated the assumed underlying unobservable continuous variables of the innovation, network richness and involvement in policy variables.

4.7.6.1.1 Exploratory Factor Analysis - Model Fit

A model fit on categorical data can be assessed on three criteria, the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI) and the Root Mean Square Error Approximations (RMSEA). The fit measures how closely the estimated correlations are to the observed correlations. Confirmatory Factor Analysis fit criteria were assessed using simulations by Yu (2002) that found for samples of 250 and larger that an acceptable model fit is obtained if the TLI ≥ 0.95; CFI ≥ 0.96; and RMSEA ≤ 0.05. RMSEA values <1 were described as poor fitting, between 0.05-0.08 as fair fitting and <0.05 as close fitting by Browne (2001).

Medina, Smith and Long (2009), for the purposes of cross national research, defined a well fitting model to meet the requirements of Yu (2002) on TLI and CFI but with a RMSEA of <0.1 as a non-poor fitting model. Chi-square tests are sample dependent and sensitive and although presented they are not used for interpretation of goodness of fit. In Exploratory Factor Analysis a p-value of greater than 0.05 is required to accept the factor model. Muthén (2008) stated that no studies have been done to determine the fit indices for Exploratory Factor Analysis models. For this study, a CFI of above 0.85, a TFI above 0.8 and a RMSEA of 1 to 1.1 was seen as an acceptable model fit for interpretation.

4.7.6.1.2 Exploratory Factor Analysis - Estimation

The weighted least square parameter estimates (WLSM) uses a diagonal weight matrix with standard errors and a mean-adjusted Chi-square test statistic that use a full weight matrix (Muthén & Muthén, 2010). WLSM is a robust least squares method that can deal with non-positive definite matrices through using a diagonal of the weight matrix (Muthén, du Toit & Spisic, 1997) and is less sensitive to modest violations of the continuous, normal latent process that determines each factor (Flora & Curran, 2004).

4.7.6.1.3 Exploratory Factor Analysis - Geomin Rotation

To obtain a factor that is substantially meaningful, rotation is applied as correlation matrices can be factored in an infinite number of ways (Browne, 2001). Rotation influences the interpretation of the data not the fit (Browne, 2001). Rotations are applied to ensure that the model has sufficient restrictions on factor loadings, variance and covariance (Muthén & Muthén, 2010; University of California, Los Angeles:

Statistical Consulting Group, 2012). Orthogonal and oblique rotations can be used for uncorrelated and correlated factors respectively (Hair et al., 2010). The rotated loadings are the linear combination of variables that construe the factor (Muthén & Muthén, 2010). Theoretically the correlated factors are more plausible, therefore Geomin is appropriate as it minimises the number of substantial loadings that appear on more than one factor (Browne, 2001) and is the default oblique rotation method of Mplus (Muthén & Muthén, 2010).

According to Browne (2001), a loading on a factor is strong if it is over 0.8 and twice the loading on the other factor, and is moderate if it is over 0.5 with twice its loading on the other factor. Hair et al. (2010) stated that a factor loading of ±30 to ±40 meets the minimum level required for interpretation, a loading of ±50 is considered practically significant, with a loading of 1.7 being considered indicative of a well-defined structure. For this study a factor loading of >40 met the requirement for interpretation.

4.7.6.2 Cluster Analysis

After factors were identified through Exploratory Factor Analysis, summated scales were created to measure the individual firms on other firms' characteristics. Cluster Analysis is a method that groups objects based on the characteristics that they possess (Hair et al., 2010) and the groupings of cases are done on the basis of proximity (Hair et al., 2010). Cluster Analysis is useful in examining previously stated hypotheses (Hair et al., 2010) however it has the following disadvantages/criticisms (Hair et al., 2010):

- It is an exploratory technique and is thus non-inferential
- Clusters will be created regardless of whether a structure exists
- Lack of generalisability as Cluster Analysis is dependent on the dataset's measures
- Subjective method that requires the researcher's judgement

Cluster Analysis was done in SPSS using two-step Cluster Analysis. This is an exploratory tool designed to reveal natural groupings within a dataset (IBM, 2011). The employed algorithm can handle both categorical and continuous variables and creates a joint multinomial-normal distribution, it automatically sets the optimal number of clusters and it creates a cluster features tree for easy analysis.

4.7.7 Network Richness

Given that networks play a role in innovation, the impact of network richness on the four proposed independent groups and the policies that they requested were examined. For this study the local network of a firm was relevant - a firm that has no other actors in its local network has no network richness while a firm that has five other actors in its network is network rich. The respondents had to indicate whether the firm collaborated on innovation in the period of 2006-2008 with one or more of the following actors:

- Clients
- Suppliers
- Competitors
- Consultancies
- Local Universities, Research Institutions and Labs

A 'Network Richness' variable was created for each option by allocating a '1' to a firm if it indicated 'yes' in either the 'your country', or 'your region' for the actors outlined above. This score was summed to give a score between zero and five. The formula used was:

$$Network\ Richness = LN_{Client} + LN_{Supplier} + LN_{Competitor} + LN_{Consultancy} + LN_{LocalUniversity}$$

Where LN indicated that it is a locally networked actor.

The more actors in the local network of a firm, the wealthier the firm is in terms of its network richness. The scale of network richness is illustrated in Figure 11 with six categories of firms. The increase in the amount of actors that are collaborated with for innovation increases the position of the firm on the scale of network richness. A firm faces increased complexity with each additional actor that it collaborates with, however it is expected that this is a skill that is developed by the firm over time through its collaboration efforts.

Figure 11- Network Richness Categories
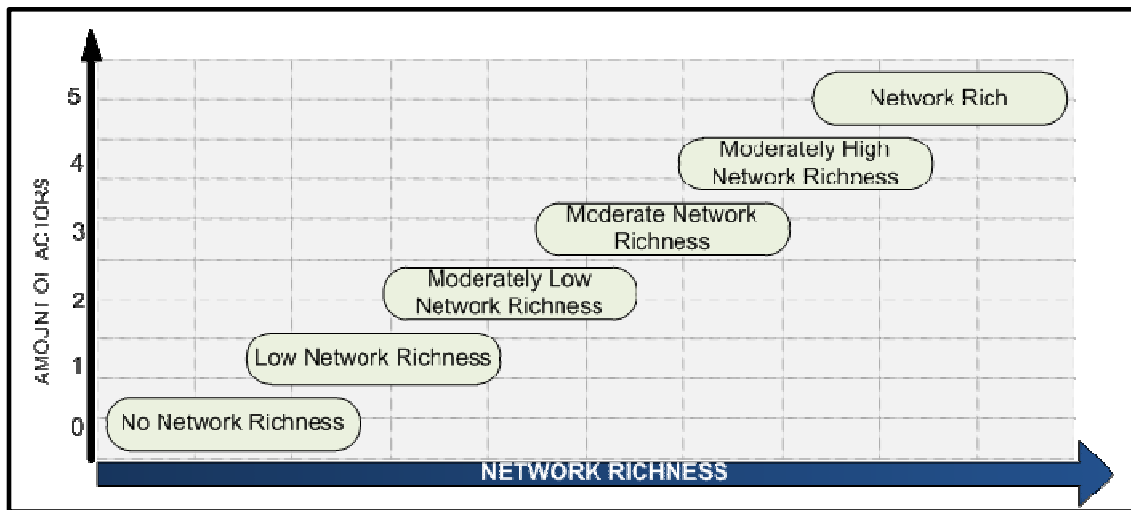
To compare network richness with the four proposed categories of groups, the six network richness groups were divided into four groups as follows:

- No Network Richness - Firms with no collaboration with other actors
- Low To Moderate Network Richness - Firms that collaborate with one or two other actors
- Moderate Network Richness - Firms that collaborate with three actors
- Network Rich - Firms that collaborate with four or five other actors

The modified scale is illustrated in Figure 12.

Figure 12- Network Richness Scale
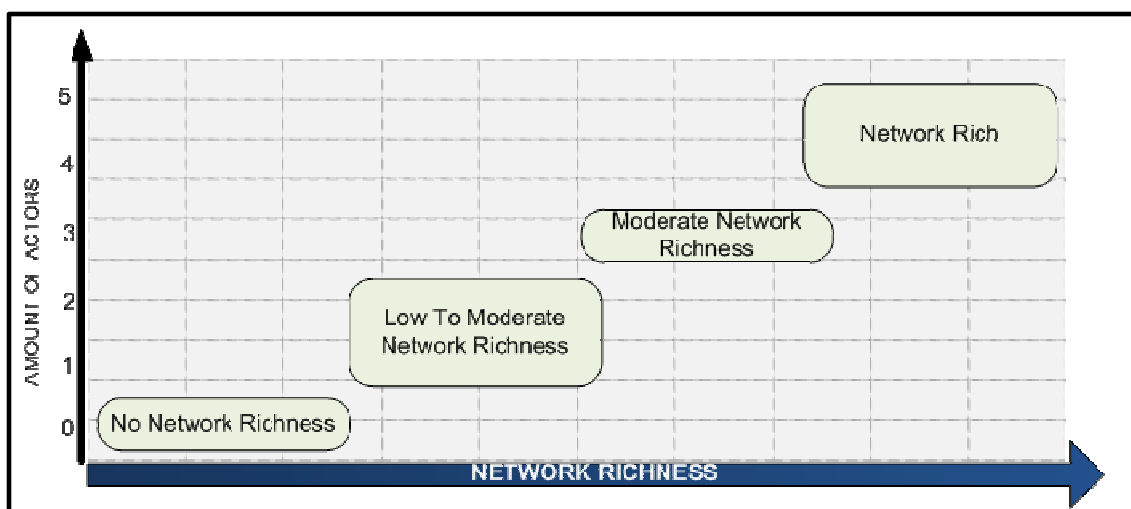
4.7.8 Research Limitations

Limitations based on the intended scope and the design of the research methodology was acknowledged as follows:

- The data collection method was susceptible to non-response and response bias.

- Several survey partners collected data in different countries. This challenged the reliability of the data as outlined in section 4.6.2 as the survey partners could interpret the understanding of the questions and the codification of the responses differently.

- The different data collection methods, as outlined in section 4.6.2, could lead to subject bias. They were also subject to cross cultural effects and language difficulty. The data was however extensively checked and cleaned by all the survey partners to mitigate this risk.

- Many factors influence innovation in organisations and the interaction of these factors are complex. The INGINEUS study's main goal was to determine the globalisation effect on innovation within business networks (INGINEUS, 2011) and certain factors could have been missed in the INGINEUS study.

- The study was based on theoretical conception and was the first extensive study conducted on global networks, therefore some of these theories could have been misdirected.

- The level of research intensity that was used to determine the relevant industries of the INGINEUS study limited the study to agro-processing automotive and ICT. In addition, only nine countries were used to conduct the study. Therefore more countries and industries could improve the validity and reliability of the study.

- The responses were dominated by the ICT industry and this could skew results.

- Measurement error and poor reliability are embedded in the observed values and is hidden. As this is a secondary dataset, reliability and validity were ensured through the INGINEUS project. The presence of measurement error is guaranteed to distort the relationships and decreases the power of multivariate analysis (Hair et al., 2010), therefore multivariate measurements were used to not only improve the reliability, but the multivariate methods were better suited to the hypotheses.

This section highlighted the relevance and defended the need to use a secondary dataset from the INGINEUS project. The research methodology used was outlined in detail and the data analysis method was described and defended. Chi-square analysis

with cross tabulation was used to identify the four independent groups. As innovation exists on a continuum and to take into account the effect of network richness, Exploratory Factor Analysis was used to refine the hypothesised categories. Kruskal-Wallis tests were conducted to determine if the groups differed on what policies were required. As the Kruskal-Wallis only measured if the group differed as whole, Mann-Whitney U tests using box plots for the results were conducted to isolate group differences. The results for the Kruskal-Wallis test were verified through conducting a robust ANOVA test to limit the possibility of type 1 errors. Research limitations of the study were highlighted. In the next chapter the results of the study are discussed based on the research methodology outlined in this chapter.

5   Chapter 5: Results

The previous chapter outlined the research methodology that was used to test the proposed hypotheses. This chapter presents and highlights the statistical findings of the research methodology outlined in the previous chapter. The findings are discussed in the order of the hypotheses. Hypothesis 1 involving the categorisation of firms on being innovative or not, or being involved in policy or not, was investigated through Chi-square analysis and cross tabulations. As innovation exists on a continuum and to measure the impact of network richness, Exploratory Factor Analysis and Cluster Analysis were conducted to further refine the hypothesised groups. Based on these findings, hypotheses 2 to 4 were investigated through Kruskal-Wallis tests with post hoc analysis using the Mann-Whitney U tests with box-plots for the results. An ANOVA test was conducted to limit the possibility of a type 1 error on the Kruskal-Wallis results. The high level process followed is illustrated in Figure 13.

Figure 13- High Level Process Followed for Analysis
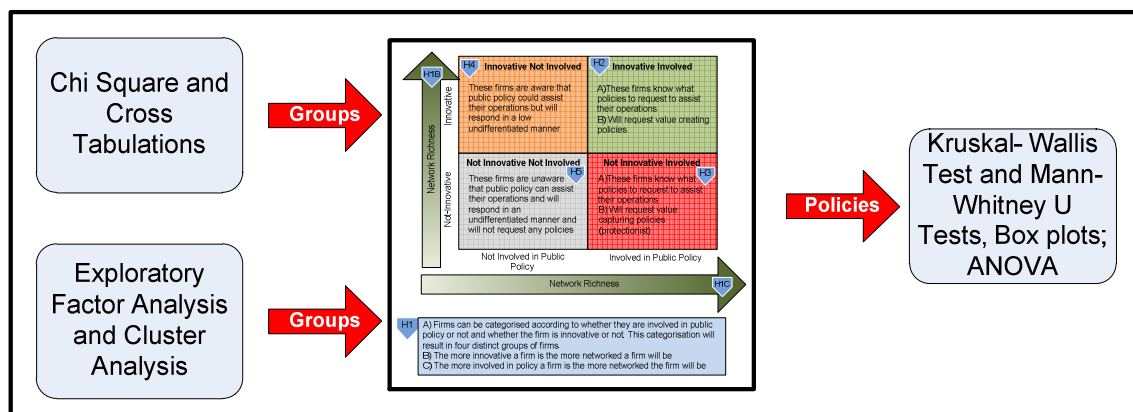
5.1   Analysis Tools

SPSS version 20 from IBM was chosen for the analysis of the descriptive techniques, Chi-square tests, Cluster Analysis, Kruskal-Wallis test, Mann-Whitney U tests and ANOVA. SPSS is a user friendly, graphical interface programme for which the University of Pretoria has an academic license. The programme was obtained through the Information Centre at the Gordon Institute of Business Science. MPlus was used for the Exploratory Factor Analysis with the help of a statistician with Exploratory Factor Analysis experience and the Mplus software package.

5.2   Data Cleaning

The secondary INGINEUS dataset was analysed and adjusted to fit the requirements of this study. The dataset was downloaded from the INGINEUS website. The

responses to the relevant variables were re-coded into numerical values in Excel. Certain variables were created as outlined in Chapter 4 to enable the proposed statistical techniques. Most questions were yes/no based. The questionnaire asked respondents to mark the applicable answer with an x, therefore, if an answer was left blank it could be assumed that the answer was a 'no'. Therefore 'no information' and 'no' both were classified as a '0'.

Eight South African firms did not complete question 3.1 that requested the industry of the firm. As all South African respondents were related to agro-processing, the data was changed to reflect this. One firm also stated that it was automotive. Once again, as all firms were related to agro-processing, the response was changed to reflect this.

The following questions were not relevant to this study and were therefore omitted from the analysis:

- Question 1.1, 1.2, 1.3 and 'other' in Question 1
- Sub questions of question 2
- Sub questions of question 3
- Question 4
- Question 5
- Question 8
- Question 9
- Question 11
- Question 14

Resource size was not reported by 154 firms across countries and industries. As this variable was only used to understand the results in a more granular manner, these results were not excluded. No cases were discarded in the data cleaning process as there were no missing values in the relevant questions.

The dataset was imported into SPSS. In the 'Variable View' tab the data 'type', 'value', 'label' and 'measure' were defined for each relevant variable. The data 'type' classified the variables as either numeric or string. The data 'value' mapped each numerical value assigned in Excel to the original response from the questionnaire. The data 'label' presented how the variable would be shown in the statistical tests. The data 'measure' classified the variable as either a scale, ordinal or nominal variable. The data 'measure' or type determines the applicability of statistical tests that can be used on the variables.

5.3   Characteristics of Sample Obtained

Before the research hypotheses were tested, the dataset was explored to gain insights on the general characteristics of the data. The descriptive analysis was conducted by the researcher in SPSS.

5.3.1   Participant Responses

The INGINEUS dataset consists of 1215 responses. Brazil had the highest response rate at 22.8%, but India had the highest count of valid responses with 318. Germany accounts for the lowest response rate at 5.6% (33 responses). The automotive industry was negatively affected in the post financial crisis and could explain why the response rates for this industry were consistently low.

The sampling distribution approximates a normal distribution through the central limit theorem if the sample size is reasonably large and preferably more than 30 (Albright et al., 2009). Estonia (ICT) and Sweden (automotive) were the only countries that had a sample size less than 30, at 17 and 24 respectively. The samples from these countries were assumed to be approximately symmetric and therefore the approximation to normal could be achieved with a sample size smaller than 30. Sampling error and uncertainty decrease with an increase in sample size, with the magnitude of sampling errors being no more than two standard errors, with a 95% probability on either side of the sample mean (Albright et al., 2009). With a sample size of 1215, the degree of freedom is larger than 30 and the sample distribution is expected to approximate the population distribution sufficiently.

The countries were not analysed independently. The group of 1215 responses were analysed in terms of innovativeness, public policy involvement, network richness and policy requests. For multivariate analysis, the degrees of freedom are required to be greater than 30. Degrees of freedom are determined through the formula:

$$df = n - k - 1$$

Where n is the number of data points and k the number of variables.

In this study, 33 variables were used in the statistical analysis. The degrees of freedom for the sample are thus:

$$df = 1215 - 33 - 1 = 1181$$

A value of 1181 for the degrees of freedom is large enough for the sample distribution to approximate the population distribution sufficiently.

5.4   Background of Firms

The firm responses were analysed through frequency distributions to determine the proportion of characteristics present as they relate to this study. India and China make up 46.7% of the sample as can be seen in Figure 14. The dataset is dominated by ICT data as 77.1% of the respondents fall in this group as can be seen in Figure 15. The agro-processing industry is represented in 10.8% of the data, with automotive at 12.1%. The sample is thus skewed to high technology firms with an almost equal sample of medium to low technology firms.

Figure 14- Country Histogram
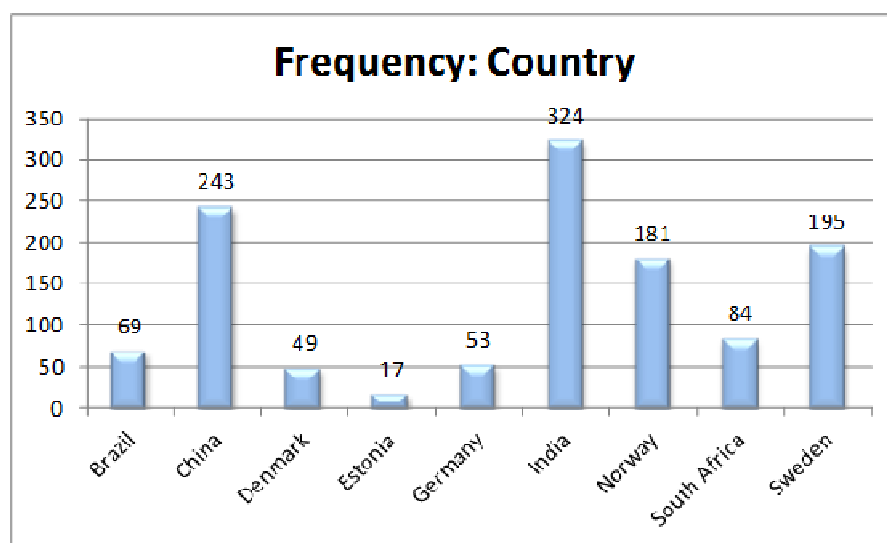
Figure 15- Industry Histogram
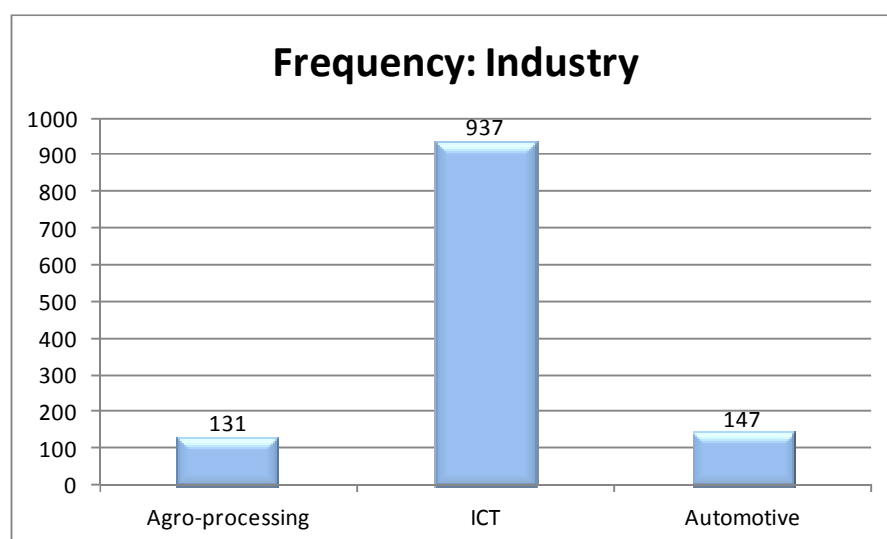
Of the 1215 respondents, 154 firms did not provide information on the size of the firm as can be seen in Figure 16. There are significantly more firms in the ICT sector that consist of fewer than 10 employees (399) and between 10-49 employees, as seen in

Figure 17. Most firms are thus operating as small to medium enterprises. There are 65 firms in the sample with 1000 or more employees. Agro-processing and automotive firms tend to employee more people, possibly due to the higher intensity requirement.

Figure 16- Firm Size Histogram
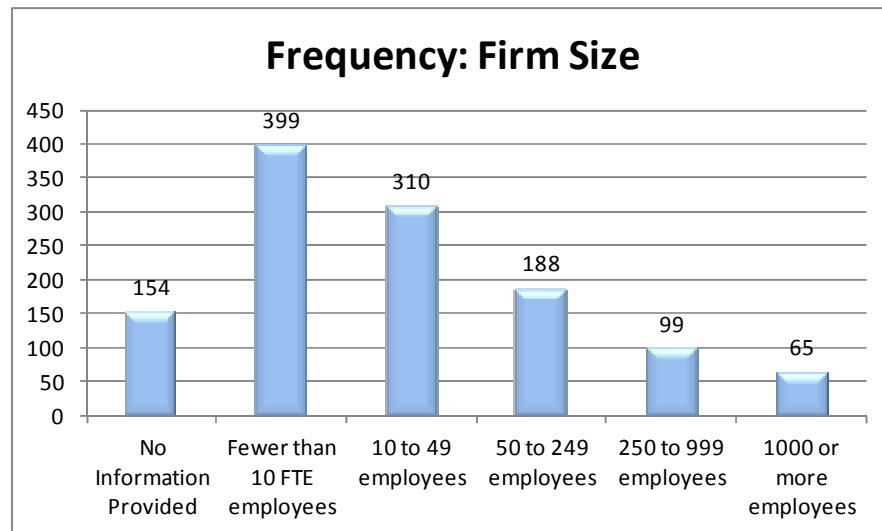
Figure 17- Scatterplot of Firm Size versus Industry
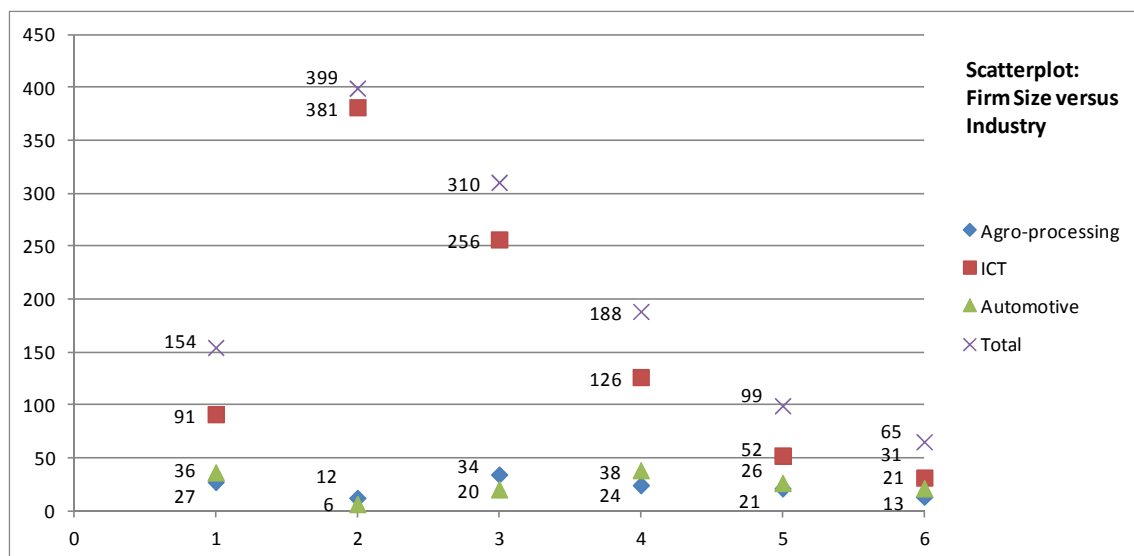
In order to create a better understanding of the dataset and to determine if there is a significant grouping of firms that are involved or not involved with public policy and that are innovative or not innovative, a Chi-square of independence test was conducted with a cross tabulation of these factors before further descriptive analysis was done.

5.5 Collaboration with Actors and Innovation

In Table 12, the firms that collaborated with specific actors are contrasted with the amount of firms that experienced some form of innovation, with the ratio of

collaboration to innovation listed. Firms collaborating with clients experienced the most innovation, followed by suppliers and consultancies. Local university collaboration did have a higher ratio of innovation compared to suppliers and consultancies. Firms with no collaborative partnerships had the lowest count in the group, but 119 of the group still achieved some type of innovation.

Table 12- Collaboration with Actors and Innovation

Description	Clients	Suppliers	Consultancies	Local Universities	Competitors	No Collaboration
Non-Firm Collaboration	688	533	386	366	357	273
Non-Firm Collaboration and Being Innovative	665	434	313	307	285	119
Ratio: Collaboration vs Innovation	96.7%	81.4%	81.1%	83.9%	79.8%	43.6%

This is graphically represented in Figure 18, ordered from the most to the least innovation experienced.

Figure 18- Ratio- Collaboration with Specific Party versus Innovation Experienced
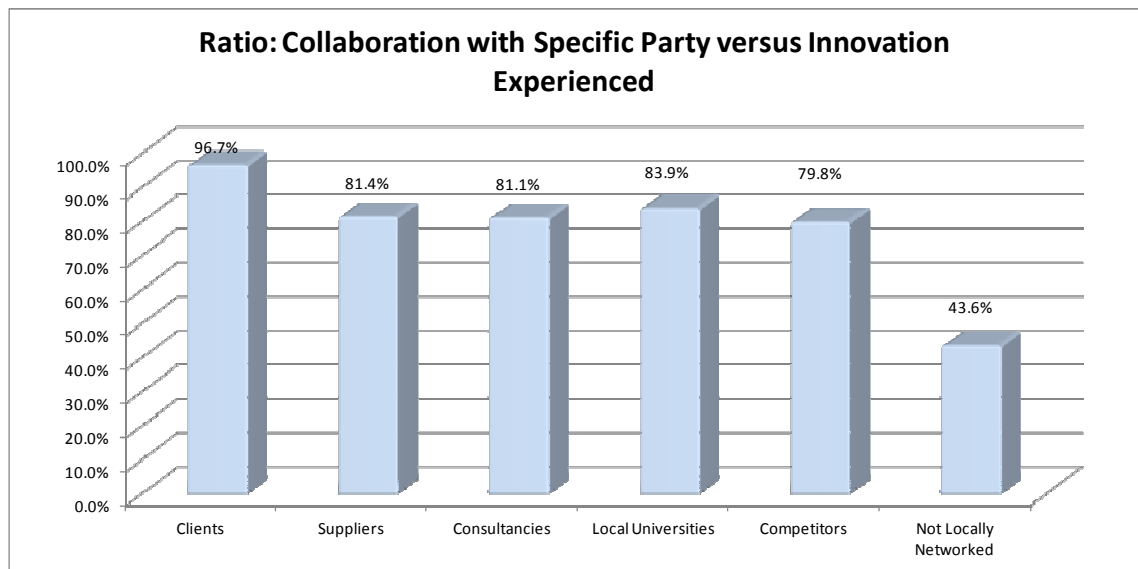
5.6 Hypothesis 1

H1$_A$: There are four independent groups within the sample based on whether the firm is innovative or not innovative and whether the firm is involved in the policy process or not involved in the policy process. A system of categorisation can thus be determined.

H1$_B$: The more innovative a firm is the more networked the firm will be.

H1$_C$: The more involved in policy a firm is the more networked a firm will be

To test hypothesis 1, the following statistical tests were conducted:

- Chi-square test of significance (with Monte Carlo exact tests where required)
- Cross tabulation and other descriptive statistics
- Exploratory Factor Analysis
- Cluster Analysis

This section is discussed in the order of the abovementioned statistical tests.

5.6.1 Hypothesis H1$_A$

5.6.1.1 Test for Significance in Policy Involvement and Innovation

The Chi-square test for independence was used to determine if independent groups for policy involvement and innovation existed in the dataset. The null hypothesis is that there is no association between being involved with policy or not being involved in policy and being innovative or not innovative. The alternative hypothesis is that there is an association between being involved in policy or not involved in policy and being innovative or not innovative. The dichotomous variables 'Public Policy' and 'Innovation' were used in the Chi-square test.

The Chi-square test and the resultant cross tabulation between Public Policy and Innovation is presented in Table 13. In addition, the Phi-coefficient was calculated as it was a two by two table. The Pearson Chi-square test indicated that there is a significant relationship between the four groupings, X_2 (1, n-1215) = 12.843, p = .0003, Phi and Cramer's V = .103. The actual count of firms in each group is statistically different from the expected count of each group and the independent groups do not occur per chance. The null hypothesis is therefore not accepted and there is an association between the two variables. There are thus four distinct groups in the sample based on the variables of Public Policy and Innovation.

Table 13- Cross Tabulation and Chi-square Tests for Involvement and Innovativeness

Innovation* Public Policy Crosstabulation			Public Policy		Total
			No	Yes	
Innovation	No	Count	229	58	287
		Expected Count	205.0	82.0	287.0
		% within InnovativeYN	79.8%	20.2%	100.0%
	Yes	Count	639	289	928
		Expected Count	663.0	265.0	928.0
		% within InnovativeYN	68.9%	31.1%	100.0%
Total		Count	868	347	1215
		Expected Count	868.0	347.0	1215.0
		% within InnovativeYN	71.4%	28.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	12.843[a]	1	.000		
Continuity Correction[b]	12.312	1	.000		
Likelihood Ratio	13.492	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	12.832	1	.000		
N of Valid Cases	1215				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 81.97.

b. Computed only for a 2x2 table

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.103	.000
	Cramer's V	.103	.000
N of Valid Cases		1215	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

There are 289 firms that are both innovative and involved representing 23.7% of the total amount of cases. There are 58 (4.7%) firms that are not innovative and involved in policy. In the not innovative and not involved group there are 229 (18.8%) firms, with

the largest grouping of firms (639, 52.6%) being innovative and not involved. This is graphically presented in Figure 19.

Figure 19- Involvement in Public Policy and Innovation

To enable further analysis, variables were added to the dataset to present these four distinct groups that were identified with the Chi-square test of independence. For example, for the Involved and Not Innovative group, the following formula was used in Excel:

$$= IF(AND(Innovation = 0, Public\ Policy = 1),1,0)$$

If the argument in the formula was true, a value of '1' would be returned indicating 'yes', if the argument in the formula was false a '0', indicating 'no' would be returned. This was done for each independent group. The following variables were added:

- Innovative_Involved (Innovative and involved in public policy)
- Not_Innovative_Involved (Not innovative and involved in public policy)
- Innovative_Not_Involved (Innovative and not involved)
- Not_Innovative_Not_Involved (Not innovative and not involved)

The added variables were combined into one variable 'IP_Group' through assigning a number to each independent group. The number allocation was as follows:

- 1= Innovative_Involved
- 2= Not_Innovative_Involved

- 3= Innovative_Not_Involved
- 4= Not_Innovative_Not_Involved

The proposed two by two table shown in Figure 19 was therefore statistically significant and the hypothesised four independent groups did exist. The null hypothesis of H1$_A$ is therefore rejected.

The groups were refined further through using Exploratory Factor Analysis to determine the effect of network richness on innovation and policy involvement. First, the concept of network richness is examined within the four identified groups. Secondly, Exploratory Factor Analysis is used to reveal the underlying structure in the dataset. The network richness, Exploratory Factor Analysis results and the four identified groups are then examined through Cluster Analysis to reveal the inherent group structure based on these components. Finally, the impact of firm size is examined in the four groups as the literature suggested that firm size influences policy involvement positively.

5.6.2 Hypotheses H1$_B$ and H1$_C$

5.6.2.1 Test for Significance in the Groups of Policy Involvement, Innovation and Network Richness

The four identified groups, although part of a large sample, had resulted in an unbalanced dataset. Therefore it was decided to determine the distribution of the Pearson statistic of significance through the Monte Carlo method.

The null hypothesis is that there is no association between the identified groups and network richness. The alternative hypothesis is that there is an association between the identified groups and network richness. The variables used were 'Network Richness' and 'IP_Group'.

The Chi-square test is presented in Table 14.below. In addition, the Phi-coefficient was calculated as it was a two x two table. The Pearson Chi-square test indicated that there is a significant relationship between the four groupings, at a 99% confidence level X_2 (15, n-1215) = 12.843, Asymptotic p = .000, Monte Carlo Exact p= .000. The null hypothesis is therefore not accepted and there is an association between the two variables. Therefore there is a greater association than expected between the independent groups and network richness.

Table 14- Cross Tabulation and Chi-square Tests for Identified Groups and Network Richness

Group	Description	Network Richness				
		No Network Richness	Low to Moderate Network Richness	Moderate Network Richness	Network Rich	Total
Innovative_Involved	Count	3	50	40	196	289
	Expected Count	64.9	128.2	33.3	62.6	289.0
	% within IP_Group	1.0%	17.3%	13.8%	67.8%	100.0%
Not_Innovative_Involved	Count	4	13	14	27	58
	Expected Count	13.0	25.7	6.7	12.6	58.0
	% within IP_Group	6.9%	22.4%	24.1%	46.6%	100.0%
Innovative_Not_Involved	Count	116	420	68	35	639
	Expected Count	143.6	283.5	73.6	138.3	639.0
	% within IP_Group	18.2%	65.7%	10.6%	5.5%	100.0%
Not_Innovative_Not_Involved	Count	150	56	18	5	229
	Expected Count	51.5	101.6	26.4	49.6	229.0
	% within IP_Group	65.5%	24.5%	7.9%	2.2%	100.0%
Total	Count	273	539	140	263	1215
	Expected Count	273.0	539.0	140.0	263.0	1215.0
	% within IP_Group	22.5%	44.4%	11.5%	21.6%	100.0%

	Value	df	Asymp. Sig. (2-sided)	Monte Carlo Sig. (2-sided)		
				Sig.	Interval	
					Lower Bound	Upper Bound
Pearson Chi-Square	830.558[a]	9	.000	.000[b]	0.000	.000
Likelihood Ratio	775.892	9	.000	.000[b]	0.000	.000
Fisher's Exact Test	769.551			.000[b]	0.000	.000
Linear-by-Linear Association	578.047[c]	1		.000[b]	0.000	.000
N of Valid Cases	1215					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.68.

b. Based on 10000 sampled tables with starting seed 2000000.

c. The standardized statistic is -24.043.

5.6.2.2 Description of Groups of Policy Involvement, Innovation and Network Richness

The graph in Figure 20 displays the information of the Chi-square test for the independent groups and network richness variables. It is interesting to note the proportion of network rich and moderately high network rich firms in the innovative and involved group, in contrast with the high proportion of low and moderately low network richness in the innovative but not involved firms. The highest proportion of not innovative or involved firms was those with no network richness. The graph is discussed per dimension of network richness as they occur in the four independent groups below.

Figure 20- Group Representation of Network Richness
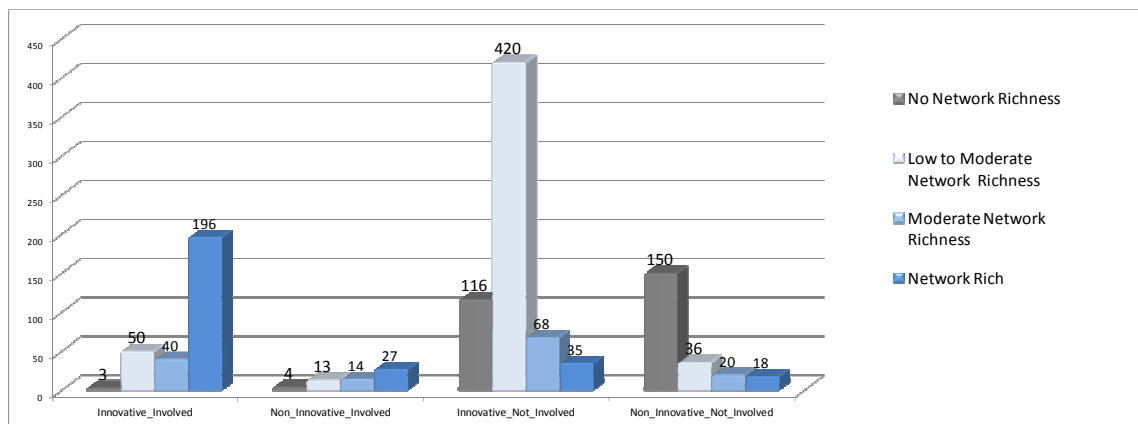
5.6.2.2.1 Network Rich

The network rich group represents firms that collaborated with four or five other actors. Network rich firms represent the highest proportion of firms in the innovative and involved and not innovative and involved category, as can be seen in Figure 20. The second highest grouping of network rich firms is, however, in the innovative and not involved group. Of the 289 firms in the innovative and involved group, the network rich firms represent 67.8% of firms. In the not innovative and involved group the network rich groups represent 46.5% of the group.

5.6.2.2.2 Moderate Network Richness

The moderate network rich group are firms that collaborated with three other actors. They are not the highest proportion in any of the groups. The highest proportion of moderate network rich firms is seen in the innovative but not involved group at 68 firms.

5.6.2.2.3 Low to Moderate Network Richness

The low to moderate network rich firms are firms that collaborated with one or two other actors. This is the highest proportion of firms in the innovative but not involved group at 420.

5.6.2.2.4 No Network Richness

These firms did not collaborate with any outside actors. They are the highest proportion of firms in the not innovative and not involved group and the second highest proportion of firms in the innovative and not involved group.

5.7   Creation of Summated Scale to Assess Network Richness, Innovation and Involvement in Public Policy

This section builds on the previous analyses and details the creation of a summated score. First factors in the underlying structure of the data are identified through Exploratory Factor Analysis. These factors are then combined with the insights and results of the previous analyses to do Cluster Analysis and determine predictive patterns in the data. Cluster Analysis is, however, not inferential and only provides a description of the firm characteristics.

5.8   Exploratory Factor Analysis

Factor Analysis was conducted as innovation occurs on a continuum and the importance of network richness was highlighted in the literature. Exploratory Factor Analysis was conducted to define the underlying structure of the variables used in the analysis as a base for the theoretical development.

Mplus version 5.1 was used to conduct the analysis. From a theoretical base 33 dependent variables were identified and used to run an Exploratory Factor Analysis. Factors were specified with Geomin rotation using tetrachoric correlations and Weighted Least Square Estimation (WLSM) as the variables were categorical. The test was conducted through six iterations, each adding an additional factor. The best model fit indices were obtained through a four factor model. The results of the four factor exploratory model are reported. The model fit statistics are shown in Table 15.

Table 15- Exploratory Factor Analysis Model Fit Statistics

Chi-Square Test of Model Fit for the Baseline Model	
Value	37930.19
Degrees of Freedom	528
P-Value	0.0000

CFI/TLI	
CFI	0.850
TLI	0.803

Number of Free Parameters	126

RMSEA (Root Mean Square Error Of Approximation)	0.107

SRMR (Standardized Root Mean Square Residual)	0.124

Minimum rotation function value	1.64293

As discussed in 4.7.6.1.2, the Chi-square test of significance was not used due to its sensitivity and dependency on sample size. Non-significant p-values of the Chi-square test are rarely obtained in large sample sizes (Bentler & Bonnet, 1980). Therefore other fit measures were assessed. For this study a CFI of above 0.85, a TFI above 0.8 and a RMSEA of 1 to 1.1 was seen as an acceptable model fit for interpretation, as the variables used were based on a theoretical model. No studies have been done on Exploratory Factor Analysis fit indices - only fit indices for Confirmatory Factor Analysis had been researched by Yu (2002).

A CFI of 0.850 and a TLI of 0.803 was obtained with a RMSEA of 0.107. Therefore the model obtained adequate fit for further interpretation on its rotated factor loadings. The rotated factor loadings are reported in Table 16 with the Geomin factor correlations reported in Table 17. The factors have been colour coded for easier viewing of the patterns.

Table 16- Geomin Rotated Loadings

Geomin Rotated Loadings	Factor 1- Innovation to the World and Industry	Factor 2- Innovation New to the Firms and None	Factor 3- Locally Networked to the Region	Factor 4- Locally Networked to the Country
NEWPROWO	0.602	-0.041	0.235	-0.123
NEWPROIN	0.558	0.141	-0.106	0.247
NEWPROFI	-0.281	0.620	0.006	0.011
NEWPRONO	-0.478	-0.595	0.037	-0.075
NEWSERWO	0.604	-0.077	0.350	-0.141
NEWSERIN	0.590	0.051	-0.002	0.270
NEWSERFI	-0.305	0.696	0.152	0.021
NEWSERNO	-0.306	-0.644	-0.165	-0.052
NEWMANWO	0.695	0.043	0.187	-0.029
NEWMANIN	0.722	0.111	-0.024	0.205
NEWMANFI	-0.155	0.803	0.030	-0.047
NEWMANNO	-0.413	-0.733	0.001	0.002
NEWLOGWO	0.785	-0.041	0.303	-0.160
NEWLOGIN	0.703	0.152	-0.030	0.346
NEWLOGFI	0.024	0.799	0.127	-0.112
NEWLOGNO	-0.428	-0.714	-0.045	0.024
NEWSUPWO	0.782	-0.061	0.221	-0.244
NEWSUPIN	0.816	0.015	-0.106	0.395
NEWSUPFI	-0.220	0.898	-0.075	-0.060
NEWSUPNO	-0.317	-0.831	0.134	-0.017
CLIEREGI	0.166	0.187	0.193	0.114
CLIECOUN	0.105	0.279	-0.026	0.221
SUPPREGI	0.046	0.047	0.841	-0.065
SUPPCOUN	-0.147	0.009	0.058	0.695
COMPREGI	0.016	-0.022	0.860	0.099
COMPCOUN	0.022	-0.061	0.085	0.871
CONSREGI	-0.073	0.084	0.902	0.091
CONSCOUN	-0.046	-0.028	0.097	0.834
LUNIREGI	-0.087	0.076	0.841	0.018
LUNICOUN	-0.001	-0.011	-0.045	0.808
GOVTREGI	0.056	0.006	0.887	0.025
GOVTCOUN	0.014	-0.065	0.085	0.930
STRMANIN	-0.095	-0.031	0.383	0.188

Table 17- Geomin Factor Correlations

GEOMIN FACTOR CORRELATIONS	Factor 1- Innovation to the World and Industry	Factor 2- Innovation New to the Firms and None	Factor 3- Locally Networked to the Region	Factor 4- Locally Networked to the Country
Factor 1- Innovation to the World and Industry	1			
Factor 2- Innovation New to the Firms and None	0.167	1		
Factor 3- Locally Networked to the Region	-0.027	0.062	1	
Factor 4- Locally Networked to the Country	-0.046	0.177	0.064	1

Some variables did have a significant loading on more than one variable. For the cross loaded variables, the highest factor loading was used as rotation had already been applied to minimise significant factor loading (Hair et al., 2010).

Four factors were identified, these are:

- Factor 1- Innovation to the World and Industry (green)
- Factor 2- Innovation New to the Firms and None (pink)
- Factor 3- Locally Networked to the Region (blue)
- Factor 4- Locally Networked to the Country (orange)

The variables that had sufficient practical loadings of above 0.4 are shown in Table 18.

Table 18- **Variables Used in Factor Loadings**

Factor 1- Innovation to the World and Industry	Factor 2- Innovation New to the Firms and None
New products to the world	New products to the firm
New products to the industry	No new products
New services to the world	New services to the firm
New services to the industry	No new services
New methods for manufacturing or producing to the world	New methods for manufacturing or producing to the firm
New methods for manufacturing or producing to the industry	No new methods for manufacturing or producing
Improved logistics, distribution or delivery methods to the world	Improved logistics, distribution or delivery methods to the firm
Improved logistics, distribution or delivery methods to the industry	No improved logistics, distribution or delivery methods to the firm
New supporting activities for your processes to the world	New supporting activities for your processes to the firm
New supporting activities for your processes to the industry	No new supporting activities for your processes

Factor 3- Network Richness to the Region	Factor 4- Network Richness to the Country
Collaboration with supplier in your region	Collaboration with supplier in your country
Collaboration with competitor in your region	Collaboration with competitor in your country
Collaboration with consultancy in your region	Collaboration with consultancy in your country
Collaboration with government in your region	Collaboration with government in your country
Collaboration with local universities, research institutions and laboratories in your region	Collaboration with local universities, research institutions and laboratories in your country

Strategic management by your unit in your location was included as a variable due to the literature on corporate political activity, suggesting that corporate political involvement is a strategic activity. The factor at 0.383 was not sufficient to be included

in the locally networked to the region factor. Interestingly, the variables on client collaboration did not load onto any of the factors. This is likely due to the importance of client collaboration across all the factors, as suggested by Bogers, Afuah, & Bastian, (2010), Henkel and von Hippel, (2005), Lüthje and Herstatt, (2004) and von Hippel, (1986).

5.8.1 Interpretation of the Factors Identified through Exploratory Factor Analysis with the Creation of a Summated Scale

To further interpret the data, reliability testing and Cluster Analysis were conducted through SPSS. To operationalise these tests, a score on each factor for each firm was calculated creating a summated scale. The score was calculated through adding all the variables of the factors together and dividing it through the total amount of variables used in the calculation. This calculated a score for each variable between 0 and 1. Furthermore, a combined factor score was calculated through calculating the scores of the four factors and dividing this amount by four. Again, a score between 0 and 1 was calculated.

Unidimensionality is ensured through each variable loading above >0.40 on only one factor. The summated scale provides protection against inherent measurement errors as the reliance on a single indicator is reduced through using multiple indicators (Hair et al., 2010). Furthermore, a summated scale represents multiple aspects of a concept in a single measure (Hair et al., 2010) further reducing the measurement error.

5.8.1.1 Reliability

The degree of consistency should be calculated between multiple measures of a variable (Hair et al., 2010). Item-to-total correlation should exceed 0.30 to indicate reliability with Cronbach's Alpha exceeding 0.60 in exploratory research (Hair et al., 2010). The Cronbach's Alpha of the summated scales is presented in Table 19 and the Item-to-Total measures are presented in Table 20.

Table 19- Cronbach's Alpha

Cronbach's Alpha			
Factor 1- Innovation to the World and Industry	Factor 2- Innovation New to the Firms and None	Factor 3- Locally Networked to the Region	Factor 4- Locally Networked to the Country
0.698	0.509	0.824	0.809

Table 20- Item-to-Total Statistics

Item-Total Statistics

Factor 1- Innovation to the World and Industry	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Factor 2- Innovation New to the Firms and None	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
New products to the world	.269	.691	New products to the firm	.204	.486
New products to the industry	.388	.675	No new products	.252	.473
New services to the world	.256	.690	New services to the firm	.255	.470
New services to the industry	.412	.666	No new services	.170	.496
New methods for manufacturing or producing to the world	.487	.648	New methods for manufacturing or producing to the firm	.121	.510
New methods for manufacturing or producing to the industry	.342	.682	No new methods for manufacturing or producing	.307	.452
Improved logistics, distribution or delivery methods to the world	.294	.689	Improved logistics, distribution or delivery methods to the firm	.049	.527
Improved logistics, distribution or delivery methods to the industry	.439	.660	No improved logistics, distribution or delivery methods to the firm	.362	.431
New supporting activities for your processes to the world	.277	.690	New supporting activities for your processes to the firm	.097	.518
New supporting activities for your processes to the industry	.499	.648	No new supporting activities for your processes	.314	.450

Factor 3- Locally Networked to the Region	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Factor 4- Locally Networked to the Country	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Collaboration with supplier in your region	.582	.805	Collaboration with supplier in your country	.502	.804
Collaboration with competitor in your region	.611	.791	Collaboration with competitor in your country	.634	.760
Collaboration with consultancy in your region	.673	.773	Collaboration with consultancy in your country	.623	.763
Collaboration with government in your region	.631	.787	Collaboration with government in your country	.682	.745
Collaboration with local universities, research institutions and laboratories in your region	.614	.790	Collaboration with local universities, research institutions and laboratories in your country	.549	.785

Factor 2 has the lowest Cronbach's Alpha at 0.509, with the other factors reaching a sufficient value. The item-to-total values were less than 0.30 for four variables of factor 1 and for seven variables for factor 2. As this is Exploratory Factor Analysis and the factor model had met this study's required fit indices, the lower reliability measures were noted but were still seen as sufficient for further interpretation of the score.

5.8.1.2 Cluster Analysis for Further Interpretation of Factor Characteristics.

Two step Cluster Analysis was used in SPSS to calculate the optimal amount of clusters from the chosen variables. The amount of clusters was also specified to four factors by the researcher, but this negatively impacted the model quality. A fair measure of cohesion and separation was achieved.

The variables used in the Cluster Analysis were a combination of the results of Chi-square tests and Exploratory Factor Analysis. Figure 21 illustrates the factors used with the predictive importance indicated by the Cluster Analysis. The factor graphs on the Cluster Analysis presents the summative scale of between 0 and 1 calculated for each firms on the x-axis. On the y-axis the count of the firms are represented.

The three independent groups with a fair fit were the innovative and involved firms and the not innovative and involved firms– cluster 1, the not innovative and not involved firms- cluster 2 and the innovative and not involved firms- cluster 3. Figure 21 lists the most predictive value of being in a cluster first, for example network richness, followed by membership to an independent group, which are the two most important predictors of the clusters. The Cluster Analysis is discussed in numerical order.

Although the Chi-square test of difference defined four independent groups, the inclusion of network richness into the Cluster Analysis has reduced the independent groups to three with the combination of innovative and involved and not innovative and involved firms.

5.8.1.2.1 Cluster 1- Network Rich and Involved

This cluster consisted of network rich and moderate network rich firms that collaborated with three to five actors on innovation. These firms clustered into the innovative and involved and not innovative and involved groups. These firms had the highest proportion and highest scores on the combined factor score, factor 4- network richness to the region and factor 3- network richness to the country. Factor 1- innovation new to the world or industry and factor 2- innovation new to the firm or none had a more equal distribution of values compared to the other clusters.

5.8.1.2.2 Cluster 2- No Network Richness and Not Involved
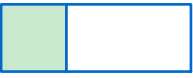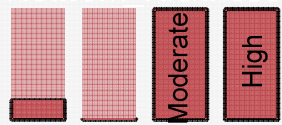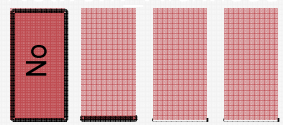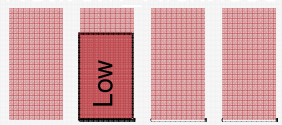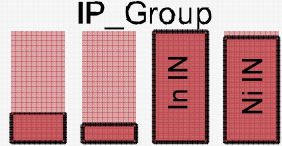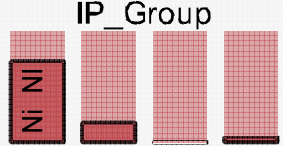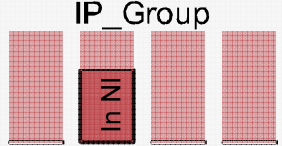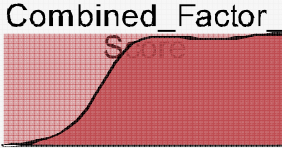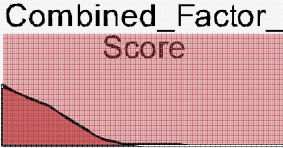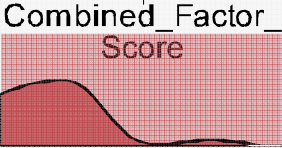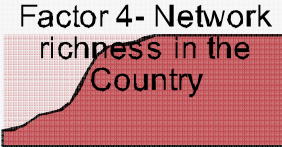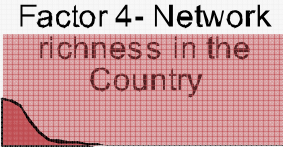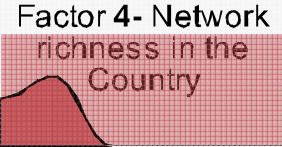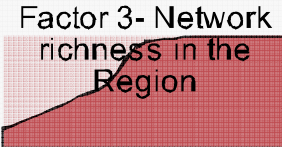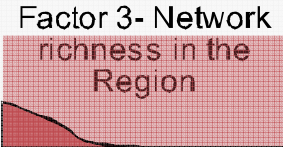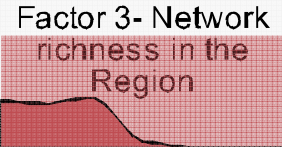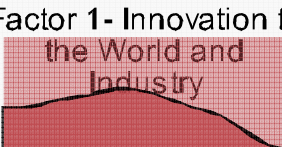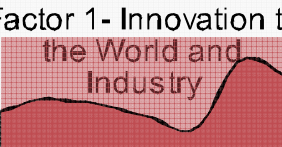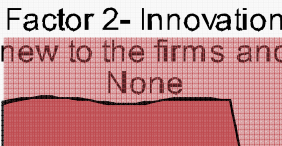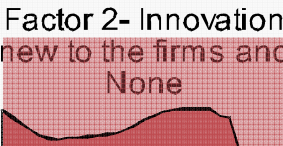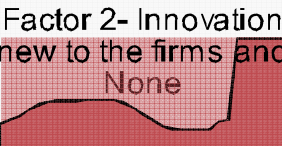
This cluster consisted of firms with no network richness. These firms clustered into the not innovative and not involved group. There is a small proportion of the innovative and not involved group in this cluster which likely accounts for the spike in factor 2- innovation new to the firm and none. These firms had the lowest proportion and lowest

score on the combined factor score, factor 4- network richness to the region and factor 3- network richness to the country.

5.8.1.2.3 Cluster 3- Low to Moderate Network Richness and Not Involved

This cluster consisted of low to moderate network richness. These firms clustered into the innovative and not involved group. These firms had a low proportion and low score on the combined factor score, factor 4- network richness to the region and factor 3- network richness to the country, although these scores are higher than cluster 2. Factor 1- innovation new to the world or industry and factor 2- innovation new to the firm, both has the highest proportion of high scores following a similar pattern of distribution.

Figure 21- Two-Step Cluster Analysis Results

Cluster	1	2	3
Label	Network Rich- Involved	No- Not Involved	Low to moderate- Not involved
Description	Innovate and involved and not innovative and involved firms with a rich network	Not innovative and not involved firms, no network richness	Innovative and not involved firms with low to moderate network richness
Size	41.7% (507)	23.7% (288)	34.6% (420)
Inputs			

Although the Chi-square analysis suggested four independent groups, the Cluster Analysis proposes three independent groups. The independent groups based on the Cluster Analysis are illustrated in Figure 22.

Figure 22- Independent Groups Suggested by Cluster Analysis
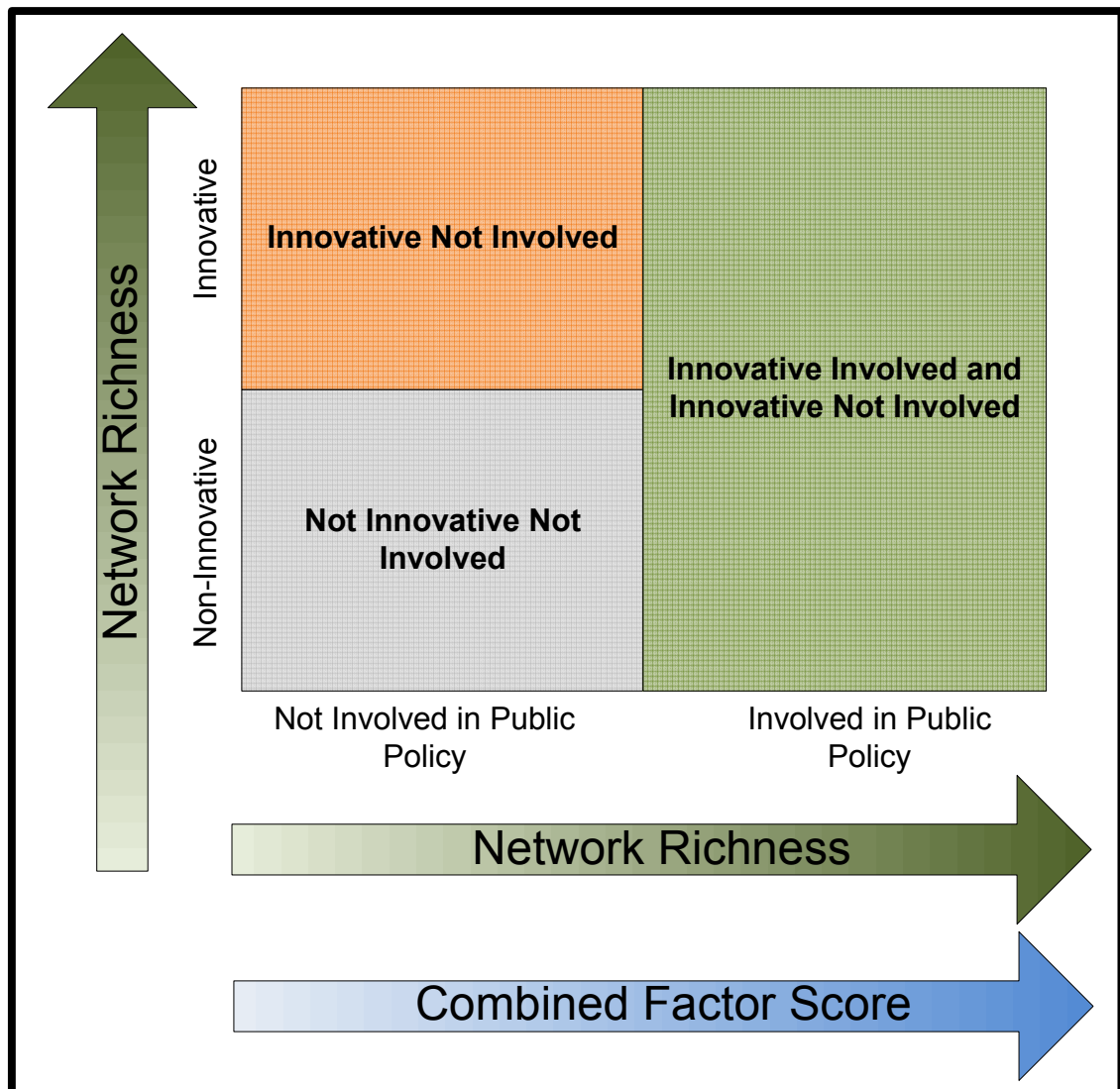
The stated hypothesis $H1_A$: that there are four independent groups within the sample based on whether the firm is innovative or not and whether the firm is involved in the policy process or not, is not rejected with the Chi-square analysis as there are four independent groups that are statistically significantly different from each other. However based on the Cluster Analysis utilising network richness, the factor analyses and the identified groups, the hypothesis is only partly not rejected as only three groups were identified and not four as originally stated.

These tests rejected the null hypotheses of $H1_B$ and $H1_C$. Therefore the wealthier a firm is in network richness, the more innovative and the more involved the firm will be. These tests however also showed that $H1_A$, where the null hypothesis was rejected based on the Chi-square test, is only partially rejected with the Exploratory Factor Analysis and Cluster Analysis.

5.8.2 Firm Size Representation of Groups of Policy Involvement and Innovation

The four independent groups were analysed through cross tabulations to determine the count of firms in each group compared to the reported firm size. Firm size does not have a significant influence on involvement with public policy within this dataset as can be seen in Figure 23.

Figure 23- Group Representation in Firm Size
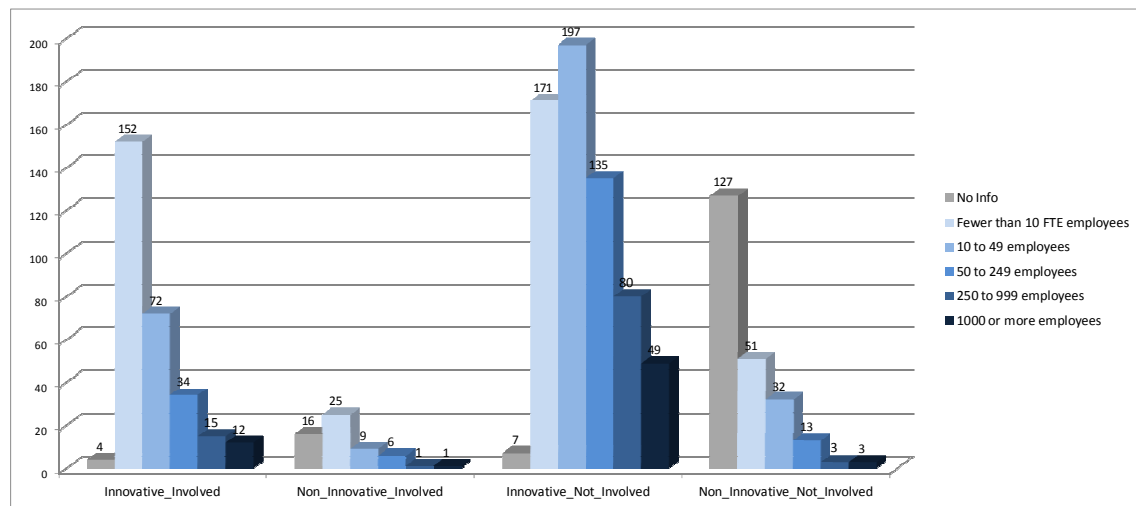
5.9 Policy Requests of the Four Different Groups- Hypotheses 2-5

The statistical tests used applied across hypotheses 2-5. Therefore the statistical tests are discussed first after which the relevant findings are listed under each hypothesis. The statistical tests are discussed in the order of the following groups:

- Value creation (Table 21)
- Value capture (Table 25)
- Value capture and creation (Table 29)

The dataset was analysed for normality through Kolmogorov-Smirnov and Shapiro-Wilk tests. The tests are listed in Appendix 2. No findings were statistically insignificant, thus indicating that the data is not normally distributed. In addition, the data is categorical and ordinal, therefore the Kruskal-Wallis test was used. The test compares the ordinal data responses on the question of policies that are needed considering future innovation activities. The scale options were, 'factor not needed'; 'very low need'; 'moderately low need'; 'moderately high need'; and 'very high need'. A '0' was coded for missing values indicating that the factor was not experienced.

For all eight variables, the differences between the groups were beyond chance and are statistically significant. The Kruskal-Wallis test per group is tabled followed by a

discussion of the post hoc tests per policy as they relate to that group. The null hypotheses for no difference between the mean ranks of need for the specific policy of the groups are rejected. The four groups do not come from the same population as the median for one of the groups is different.

An ANOVA test was conducted to see if similar results could be obtained. The ANOVA is a robust method and although designed to be used with continuous variables (Pallant, 2005), it can be used to test the accuracy of a Kruskal-Wallis test. The results for the ANOVA tests are shown in Appendix 3. Both the ANOVA and the Kruskal-Wallis indicated that there is a difference between the groups.

Box plots are used to illustrate the results of the Kruskal-Wallis tests. The square in the box plot indicate for each group the area in which 50% of the responses occurred with the dark line indicating the median score. The Kruskal-Wallis test only indicates that there is a difference in the group and it does not specify if the between sample comparisons are significant. Therefore further post-hoc testing using Mann-Whitney U tests were used to compare two individual groups on their mean ranks. This tested the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

For each policy the box plot is discussed and reference is made to the Mann-Whitney U tests. The not innovative and not involved group consistently reported a median of zero, on further investigation it was found that a 109 of the 229 firms in this group did not however report any values for the policy related questions. There were however 319 firms in total that did not report these answers, thus the respondents not completing the policy related questions were not limited to the innovative and not involved group. The hypotheses are discussed after the findings are stated.

5.10 Value Creation Policies

Table 21 lists the policies that enable innovation and details the results of the Kruskal-Wallis test for the four identified groups. A statistically significant difference was found for each policy variable. The results of the Kruskal-Wallis tests are illustrated with a box plot for each policy after which the Mann-Whitney U analyses are examined.

Table 21- Kruskal-Wallis Hypotheses Testing for Requested Policies and Identified Groups – Value Creation

	Hypothesis Test Summary: Value Creation			
#	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Better access to international research network is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.
2	The distribution of More open and flexible migration policy regulations for employing foreign scientists/technicians/experts is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.
3	The distribution of Greater availability of risk capital for innovation activities with an international dimension is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.

5.10.1 Better Access to International Research Networks

The median score on the need for better access to international research networks with regard to future innovation activities differed across the four identified groups as seen in Figure 24. The not innovative and involved group had a higher mean than the innovative and involved group for better access to international research networks, with a median of 3 to 3.5 indicating a moderately low to moderately high need. The not involved groups had a much higher variance with the innovative and not involved group, indicating a low need based on the median of two. The not innovative and not involved group had a median of zero, indicating that the majority of these firms did not complete the question. This could possibly be due to these firms not knowing what policies are required or what policies could benefit their operations. The innovative and involved group indicated a very low need for better access to international research networks.

Figure 24- Box Plot- Better Access to International Research Networks
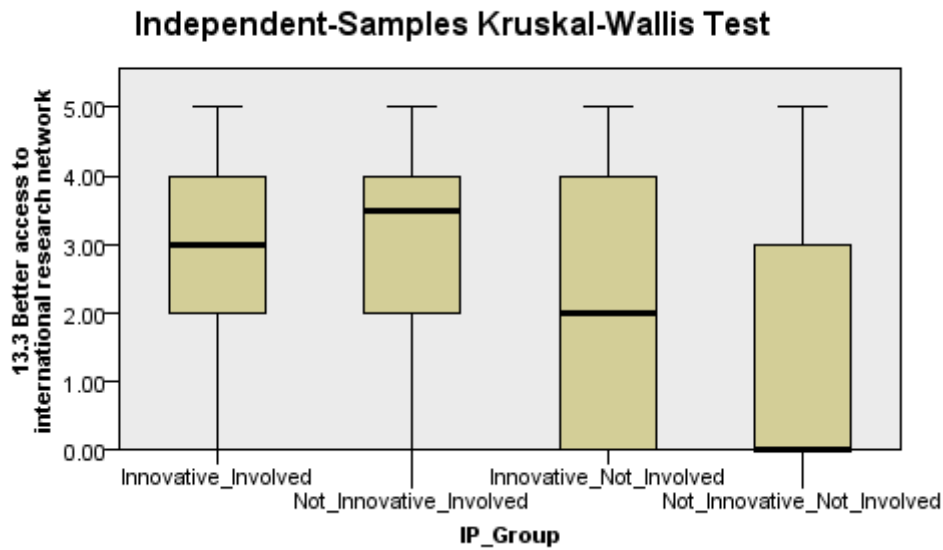
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group. This is similar to the findings Cluster Analysis that these groups are more similar than different.

Table 22- Pairwise Comparisons- Better Access to International Research Networks

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	88.139	26.065	3.382	0.000	0.004
Not_Innovative_Not_Involved- Innovative_Involved	250.434	29.940	8.346	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	258.025	49.747	5.187	0.000	0.000
Innovative_Not_Involved-Innovative_Involved	162.295	23.990	6.765	0.032	0.000
Innovative_Not_Involved- Not_Innovative_Involved	169.885	46.410	3.661	0.000	0.002
Innovative_Involved- Not_Innovative_Involved	-7.591	48.692	-0.156	0.876	1.000

5.10.2 More Open and Flexible Migration Policy Regulations for Employing Foreign Scientists/Technicians/Experts

The median score on the need for more open and flexible migration policy regulations for employing foreign scientists/technicians/experts differed across the four identified groups as seen in Figure 25. The not innovative and involved group had a similar median and spread of variance to the innovative and involved group. This indicated a moderately low need for more open and flexible migration policy regulations for employing foreign scientists/technicians/experts. Both the not innovative and not

involved group and the innovative and not involved group had a median of zero, indicating that the majority of these firms did not complete the question or saw the need for this policy. This could possibly be due to these firms not knowing if more open migration policies could benefit their operations.

Figure 25- Box Plot - More Open and Flexible Migration Policy Regulations for Employing Foreign Scientists/Technicians/Experts
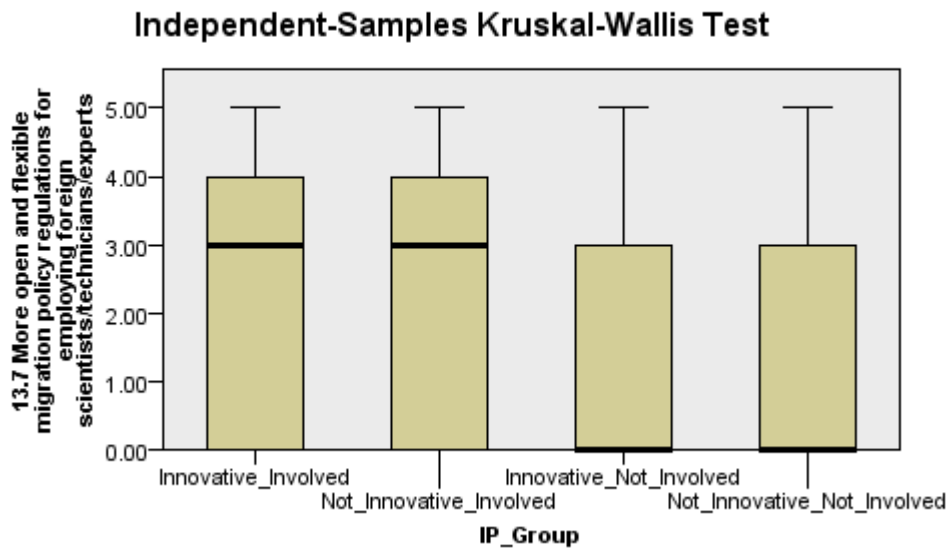
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group. This is similar to the findings Cluster Analysis that these groups are more similar than different.

Table 23- Pairwise Comparisons- More Open and Flexible Migration Policy Regulations for Employing Foreign Scientists/Technicians/Experts

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	74.552	25.422	2.933	0.003	0.020
Not_Innovative_Not_Involved-Not_Innovative_Involved	215.905	48.521	4.450	0.000	0.000
Not_Innovative_Not_Involved- Innovative_Involved	228.411	29.202	7.822	0.000	0.000
Innovative_Not_Involved- Not_Innovative_Involved	141.354	45.266	3.123	0.003	0.011
Innovative_Not_Involved-Innovative_Involved	153.859	23.399	6.576	0.000	0.000
Innovative_Involved- Not_Innovative_Involved	12.505	47.492	0.263	0.792	1.000

5.10.3 Greater Availability of Risk Capital for Innovation Activities with an International Dimension

The median score on the need for greater availability of risk capital for innovation activities with an international dimension differed across the four identified groups as seen in Figure 26. The not innovative and involved group had the same median and spread of variance to the innovative and involved group. This indicated a moderately low need for greater availability of risk capital for innovation activities with an international dimension. The not innovative and not involved group had a median of zero, indicating that the majority of these firms did not complete the question. This could possibly be due to these firms not knowing what policies are required or what policies could benefit their operations. The innovative and involved group indicated a very low need for greater availability of risk capital for innovation activities with an international dimension.

Figure 26- Box Plot- Greater Availability of Risk Capital for Innovation Activities with an International Dimension
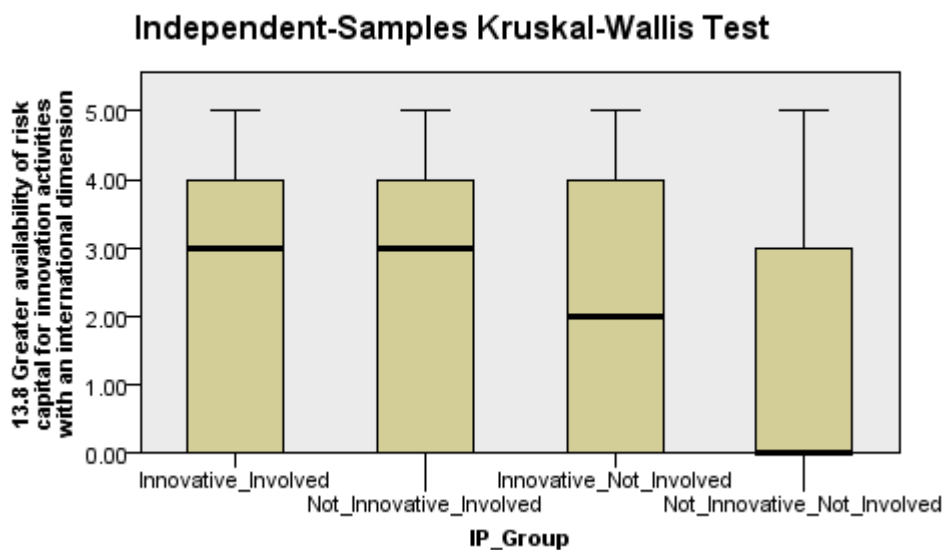
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group; and the innovative and not involved with the not innovative involved group.

Table 24- Pairwise Comparisons- Greater Availability of Risk Capital for Innovation Activities with an International Dimension

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	127.157	25.700	4.948	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	240.733	49.052	4.908	0.000	0.000
Not_Innovative_Not_Involved- Innovative_Involved	248.751	29.522	8.426	0.000	0.000
Innovative_Not_Involved- Not_Innovative_Involved	113.576	45.761	2.482	0.013	0.078
Innovative_Not_Involved-Innovative_Involved	121.594	23.655	5.140	0.000	0.000
Innovative_Involved- Not_Innovative_Involved	8.018	0.167	0.167	0.867	1.000

5.11 Value Capture Policies

Table 25 lists the policies that focus on value capture and details the results of the Kruskal-Wallis test for the four identified groups. A statistically significant difference was found for each policy variable. The results of the Kruskal-Wallis tests are illustrated with a box plot for each policy, after which the Mann-Whitney U analyses are examined.

Table 25- Kruskal-Wallis Hypotheses Testing for Requested Policies and Identified Groups – Value Capture

	Hypothesis Test Summary: Value Capture			
#	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Practical support from centres for the internationalisation of innovation and technology transfer is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.
2	The distribution of More public incentives and economic support is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.
3	The distribution of More stringent regulations, practice and jurisprudence around intellectual property rights is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.

5.11.1 Practical Support from Centres for the Internationalisation of Innovation and Technology Transfers

The median score on the factors that would assist innovation differed across the four identified groups as seen in Figure 27. The not innovative and involved group had the highest need for practical support from centres for the internationalisation of innovation

and technology transfers with a median of four, indicating a moderately high need. The innovative and involved group stated a moderately low need based on the median. The innovative not involved group had a median of low need for this factor, but with considerably more variability than the first two groups.

The not innovative and not involved group had a median of zero, indicating that most of these firms did not complete this question. The groups that were involved in policy had much less variance than the groups that were not involved in policy. This could indicate that the uninvolved groups are not uniformly certain as to which policies to request, however the innovative but not involved group did have a higher median score than the not innovative group, possibly indicating a higher level of awareness. The innovative and not involved group indicated a very low need.

Figure 27- Box Plot- Practical Support from Centres for the Internationalisation of Innovation and Technology Transfers
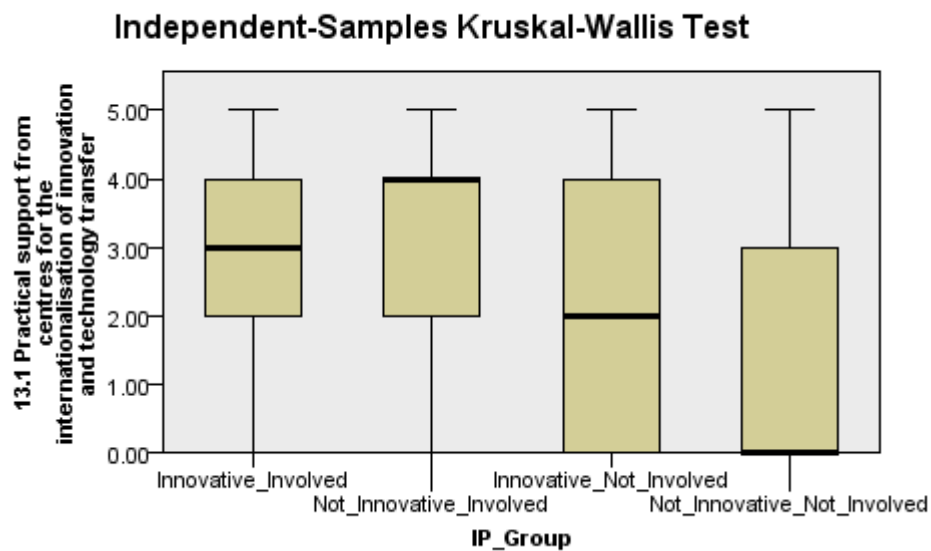
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group. This is similar to the findings Cluster Analysis that these groups are more similar than different.

Table 26- Pairwise Comparisons- Practical Support from Centres for the Internationalisation of Innovation and Technology Transfers

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	99.147	25.862	3.834	0.000	0.001
Not_Innovative_Not_Involved- Innovative_Involved	259.780	29.707	8.745	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	276.424	49.360	5.600	0.000	0.000
Innovative_Not_Involved-Innovative_Involved	160.632	23.803	6.748	0.000	0.000
Innovative_Not_Involved- Not_Innovative_Involved	177.277	46.049	3.850	0.000	0.000
Innovative_Involved- Not_Innovative_Involved	-16.644	48.313	-0.345	0.730	1.000

5.11.2 More Public Incentives and Economic Support

The median score for more public incentives and economic support as a policy differed across the four identified groups as seen in Figure 28. Both the innovative and involved and not innovative and involved group had the highest need for more public incentives and economic support with a median of four indicating a moderately high need. The not involved groups had a much higher variance in their needs compared to the involved groups. The not innovative and not involved group reported no need for more public incentives and economic support, contrasted with the innovative not involved group indicating a moderately low need based on the median of three.

Figure 28- Box Plot- More Public Incentives and Economic Support

Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group; and the innovative and not involved with the not innovative involved group.

Table 27- Pairwise Comparisons- More Public Incentives and Economic Support

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	123.546	25.975	4.756	0.000	0.001
Not_Innovative_Not_Involved- Innovative_Involved	222.587	49.567	4.491	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	233.097	29.832	7.814	0.000	0.000
Innovative_Not_Involved- Not_Innovative_Involved	99.041	46.245	2.142	0.032	0.193
Innovative_Not_Involved-Innovative_Involved	109.551	23.909	4.582	0.000	0.000
Innovative_Involved- Not_Innovative_Involved	10.510	48.516	0.828	0.828	1.000

5.11.3 More Stringent Regulations, Practice and Jurisprudence around Intellectual Property Rights

The median score on the need for more stringent regulations, practice and jurisprudence around intellectual property rights differed across the four identified groups, as can be seen in Figure 29. The not innovative and involved group had the highest median, indicating a moderately high need for more stringent regulations, practice and jurisprudence around intellectual property rights, with the innovative and involved group's median indicating a moderately low need for this factor. The not innovative and not involved group had a median of zero, indicating that the majority of these firms did not complete the question. This could possibly be due to these firms not knowing what policies are required or what policies could benefit their operations. The innovative and involved group indicated a very low need for more stringent regulations, practice and jurisprudence around intellectual property rights.

Figure 29- Box Plot- More Stringent Regulations, Practice and Jurisprudence around Intellectual Property Rights
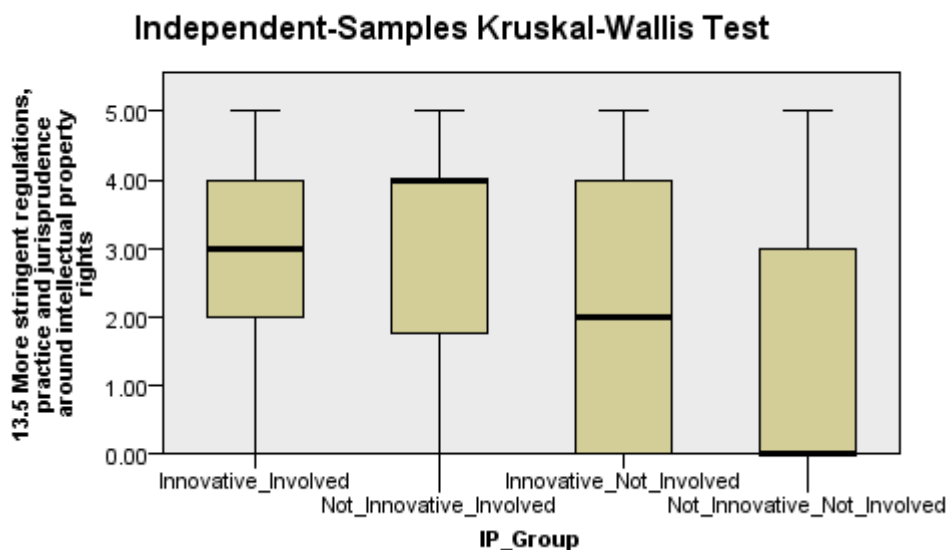
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group. This is similar to the findings of the Cluster Analysis that these groups are more similar than different.

Table 28- Pairwise Comparisons- More Stringent Regulations, Practice and Jurisprudence around Intellectual Property Rights

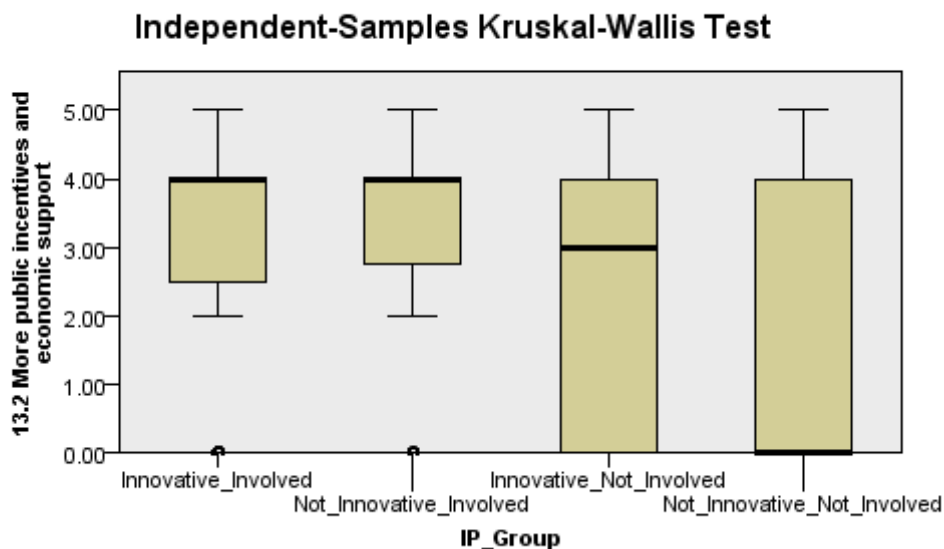| Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	140.267	26.008	5.393	0.000	0.004
Not_Innovative_Not_Involved- Innovative_Involved	264.900	29.864	8.870	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	293.926	49.582	5.928	0.000	0.000
Innovative_Not_Involved-Innovative_Involved	124.633	23.900	5.215	0.000	0.000
Innovative_Not_Involved- Not_Innovative_Involved	153.659	46.235	3.323	0.001	0.005
Innovative_Involved- Not_Innovative_Involved	-29.026	48.509	-0.598	0.550	1.000

5.12 Value Capture and Creation Policies

Table 29 lists the policies that focus on value capture and value creation and details the results of the Kruskal-Wallis test for the four identified groups. A statistically significant difference was found for each policy variable. The results of the Kruskal-Wallis tests are illustrated with a box plot for each policy after which the Mann-Whitney U analyses are examined.

Table 29- Kruskal-Wallis Hypotheses Testing for Requested Policies and Identified Groups –Value Capture and Creation

	Hypothesis Test Summary: Value Capture and Creation			
#	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Higher skills in the labour force is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.
2	The distribution of Better and clearer rules regarding foreign direct investment and trade is the same across categories of IP_Group	Independent-Sample Kruskal-Wallis Test	.000	Reject the null hypothesis.

5.12.1.1 Higher Skills in the Labour Force

The median score on the need for higher skills in the labour force with regards to future innovation activities differed between the four identified groups, as can be seen in Figure 30. The groups that were involved in policy had much less variance than the groups that were not involved in policy. The not innovative and involved group and the innovative and involved group had a similar median, indicating a moderately high need

for higher skills in the labour force with a median of four. The not innovative and not involved group had a median of zero, indicating that the majority of these firms did not complete the question. This could possibly be due to these firms not knowing what policies are required or what policies could benefit their operations. The innovative and involved group indicated a very low need for higher skills in the labour force.

Figure 30- Box Plot- Higher Skills in the Labour Force
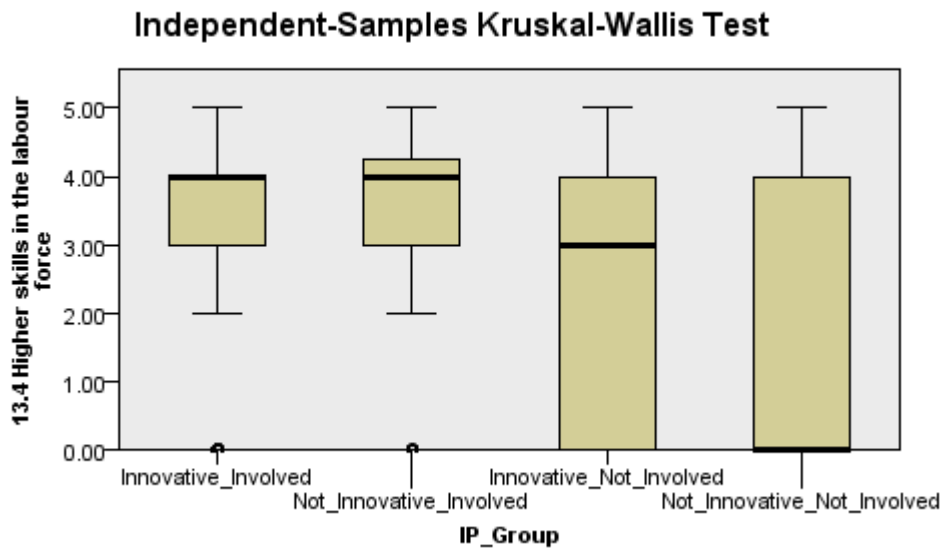
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group. This is similar to the findings Cluster Analysis that these groups are more similar than different.

Table 30- Pairwise Comparisons- Higher Skills in the Labour Force

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	134.856	26.162	5.155	0.000	0.004
Not_Innovative_Not_Involved- Innovative_Involved	236.704	30.052	7.876	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	260.951	49.933	5.226	0.000	0.000
Innovative_Not_Involved-Innovative_Involved	101.849	24.080	4.230	0.000	0.000
Innovative_Not_Involved- Not_Innovative_Involved	126.095	46.584	2.707	0.007	0.041
Innovative_Involved- Not_Innovative_Involved	-24.246	48.875	-0.496	0.620	1.000

5.12.1.2 Better and Clearer Rules Regarding Foreign Direct Investment and Trade

The median score for the need for better and clearer rules regarding foreign direct investment and trade differed across the four identified groups as can be seen in

Figure 31. The not innovative and involved group had a similar median and spread of variance to the innovative and involved group. This indicated a moderately low need for better and clearer rules regarding foreign direct investment and trade. The not innovative and not involved group had a median of zero, indicating that the majority of these firms did not complete the question. This could possibly be due to these firms not knowing what policies are required or what policies could benefit their operations. The innovative and involved group indicated a very low need for better and clearer rules regarding foreign direct investment and trade.

Figure 31- Box Plot- Better and Clearer Rules Regarding Foreign Direct Investment and Trade
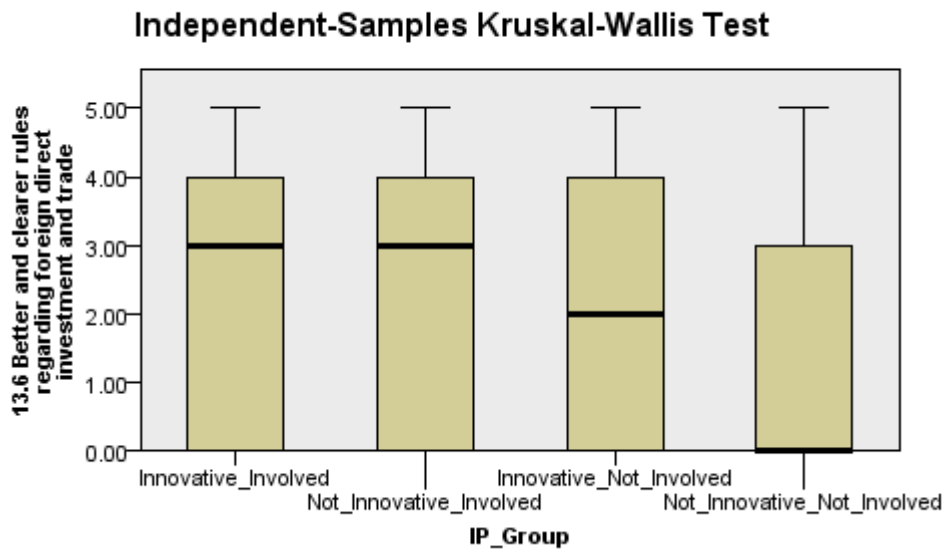
Further pairwise comparisons indicated that all groups were statistically significantly different in their medians, except for the innovative and involved group compared to the not innovative and involved group. This is similar to the findings of the Cluster Analysis that these groups are more similar than different.

Table 31- Pairwise Comparisons- More Stringent Regulations, Practice and Jurisprudence around Intellectual Property Rights

Sample 1 - Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
Not_Innovative_Not_Involved-Innovative_Not_Involved	103.761	25.637	4.047	0.000	0.004
Not_Innovative_Not_Involved- Innovative_Involved	240.759	48.932	4.920	0.000	0.000
Not_Innovative_Not_Involved-Not_Innovative_Involved	243.793	29.450	8.278	0.000	0.000
Innovative_Not_Involved-Innovative_Involved	136.998	45.649	3.001	0.003	0.016
Innovative_Not_Involved- Not_Innovative_Involved	140.032	23.597	5.934	0.000	0.005
Innovative_Involved- Not_Innovative_Involved	3.034	47.894	0.063	0.949	1.000

This section detailed the results of the Kruskal-Wallis tests, illustrating the results through box plots, after which Mann-Whitney U tests were examined. The groups differed significantly in all cases of the Kruskal-Wallis test. In the Mann-Whitney U tests the Innovative and Involved and the Innovative and Not Involved did not differ significantly. This supports the findings of the Exploratory Factor Analysis and Cluster Analysis. These results are discussed in the order of the hypotheses in the next section.

5.13 Hypothesis 2- Innovative and Involved Firms

H2$_A$: Firms that are innovative and involved know which policies to request from public policy makers.

The majority of the policies requested for this group had a much smaller variance-between one to two points- across the three categories of value creation, value capture and value capturing and creation. Those with a higher variance (one to four points) were:

- Better and clearer rules regarding foreign direct investment and trade (Value capturing and creating)
- More open and flexible migration policy regulations for employing foreign scientists/technicians/experts (Value creation)
- Greater availability of risk capital for innovation activities with an international dimension (Value creation)

Hypothesis H2$_A$ is therefore not rejected for the majority of the policies stated, but is rejected for the three policies outlined above. In total H2$_A$ is partially not rejected.

H2$_B$ Firms that are innovative and involved will request policies that are related to value creation in comparison to the not innovative and involved firms.

The null hypothesis of H2$_B$ is not rejected as the innovative and involved firms did not request more value capture policies than the not innovative and involved firms. Interestingly, the not innovative and involved firms requested similar or higher needs for value creating policies. The Mann-Whitney U tests consistently did not find a statistically significant difference between the innovative and involved and the not innovative and involved group. This supports the findings of the Exploratory Factor Analysis and Cluster Analysis that the innovative and involved and not innovative and involved group are one cluster.

5.14 Hypothesis 3- Not Innovative and Involved Firms

> **H3$_A$: Firms that are not innovative and involved know which policies to request from public policy makers.**

The majority of the policies requested for this group had a much smaller variance- between one to two points. Those with a higher variance (one to four points) were similar to the innovative and involved group. The list of policies with a bigger variance was:

- Better and clearer rules regarding foreign direct investment and trade (Value capturing and creating)
- More open and flexible migration policy regulations for employing foreign scientists/technicians/experts (Value creation)
- Greater availability of risk capital for innovation activities with an international dimension (Value creation)

> **H3B: Firms that are not innovative and involved will request policies relating to value capture in comparison to the innovative and involved firms.**

Hypothesis H3$_B$ is rejected. Although the box plots showed that there were differences between the median values of the innovative and involved and not innovative and involved firms on two of the policies and that one was similar, the Mann-Whitney U tests did not indicate a statistically significant difference. This result suggests that the innovative and involved and not innovative and involved group is more similar than different. This supports the findings of the Exploratory Factor Analysis and Cluster Analysis that the innovative and involved and not innovative and involved group are one cluster.

5.15 Hypothesis 4- Innovative Not Involved Firms

H4$_A$: The firms in the innovative but not involved group will request a low and undifferentiated need for policies.

Hypothesis H4$_A$ is not rejected as the firms did show a higher variance in the range of scores as can be seen in the box plots in the previous section. These firms expressed an overall low need for stated policies. For the policy relating to more open and flexible migration policy regulations for employing foreign scientists/technicians/experts, this group indicated that they had no need. This possibly indicates that the firms have some awareness of the benefits of policies on their operations, but that they are not sure overall what is required.

5.16 Hypothesis 5- Not Innovative Not Involved Firms

H5$_A$: The firms in the not innovative and not involved group will not request policies and are undifferentiated in their response.

Hypothesis H5$_A$ is not rejected as the firms did show a higher variance in the range of scores as can be seen in the results. These firms consistently expressed no need for the stated policies. 109 of the 229 firms in this group did not answer the policy questions requested. This possibly indicates that these firms do not have awareness of the possible benefits of public policy on their operations.

5.17 Hypotheses Summary and Conclusion

This section outlined the statistical tests performed on the data. The general findings were analysed using descriptive statistics to explore the data. Frequency analysis was used for the descriptive statistics of categorical variables (Pallant, 2005). The frequency tables were constructed from the responses of the relevant questions from the INGINEUS questionnaire that pertains to this study.

Hypothesis H1$_A$ is not rejected based on the results obtained from the Chi-square tests to determine whether there was a significant difference between groups that are either involved or not involved in public policy, and either innovative or not innovative. The cross tabulation and histograms visualised the probability distribution between the expected and observed values, with the Chi-square values confirming that the observed pattern was statistically significant.

As the groups were statistically significant, four new variables were operationalised. These variables were created to enable further analyses on the policy requests of each group. These variables indicated whether a firm was:

- Involved in policy and innovative
- Involved in policy and not innovative
- Uninvolved in policy and innovative
- Uninvolved in policy and not innovative.

Given the continuum of innovation and the importance of network richness, the dataset was further analysed with Exploratory Factor Analysis and Cluster Analysis. This highlighted three clusters grouping the innovative and involved and not innovative involved group together based on the high proportion of network rich firms. $H1_A$ based on these results is partially rejected as these tests indicated three groups and not four groups as hypothesised.

Kruskal-Wallis tests were used to identify the group differences on policy requests based on the findings of the Chi-square analysis. The policies were discussed as they related to value creation, value capturing and value capturing and creation. These results rejected $H2_B$ and $H3_B$, finding that the innovative and involved group and the not innovative and involved group request similar policies across the board. The variance of their requests were however differentiated, resulting in $H2_A$ and $H3_A$ not being rejected.

The innovative but involved firms showed a low and undifferentiated response with regards to all policies stated. Therefore $H4_A$ was not rejected. The not innovative and not involved firms were consistently unresponsive and undifferentiated and therefore $H5_A$ was not rejected. The findings are illustrated in Figure 32 and are discussed in the next chapter in light of the literature in Chapter 2.

Figure 32- Hypotheses Summary
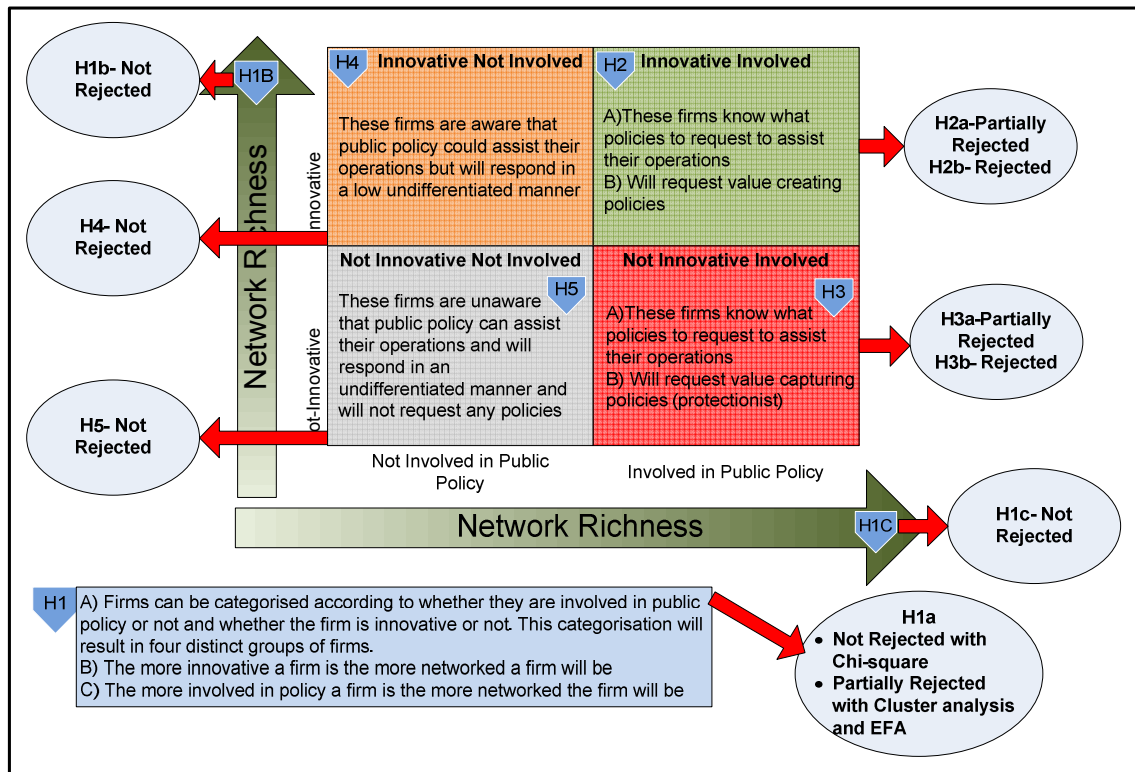
6   Chapter 6: Discussion of Results

This chapter discusses the findings of this study in light of the literature review of Chapter 2 and the results represented in Chapter 5. Results will be discussed using the three themes of the research, namely innovation, policy involvement and network richness. The discussion will centre on the general findings first, followed by an analyses of the hypotheses findings. Due to the importance of the categories of firms within the general findings, hypothesis 1 is included in the general finding discussion. Due to the findings, hypothesis 2 and hypothesis 3 are discussed together. This is important because all the findings are correlated.

6.1   General Findings and Hypothesis 1

The general findings include the discussion of hypothesis 1. The main objective was to enable more evidenced based policy making that could benefit the economy of a country through enabling its firms to be on the leading edge of market developments. First the firms were categorised in a two by two table, as can be seen in Figure 33. Network Richness was found to be an important factor in both innovativeness and involvement in policy. Secondly, their behaviour towards policy was hypothesised and based on the findings in Chapter 5, these hypotheses were rejected, partially rejected or not rejected. The policy behaviour as it relates to the findings is illustrated in Figure 33.

Figure 33- Two by Two Table of Categorisation for Public Policy Involvement and Innovation
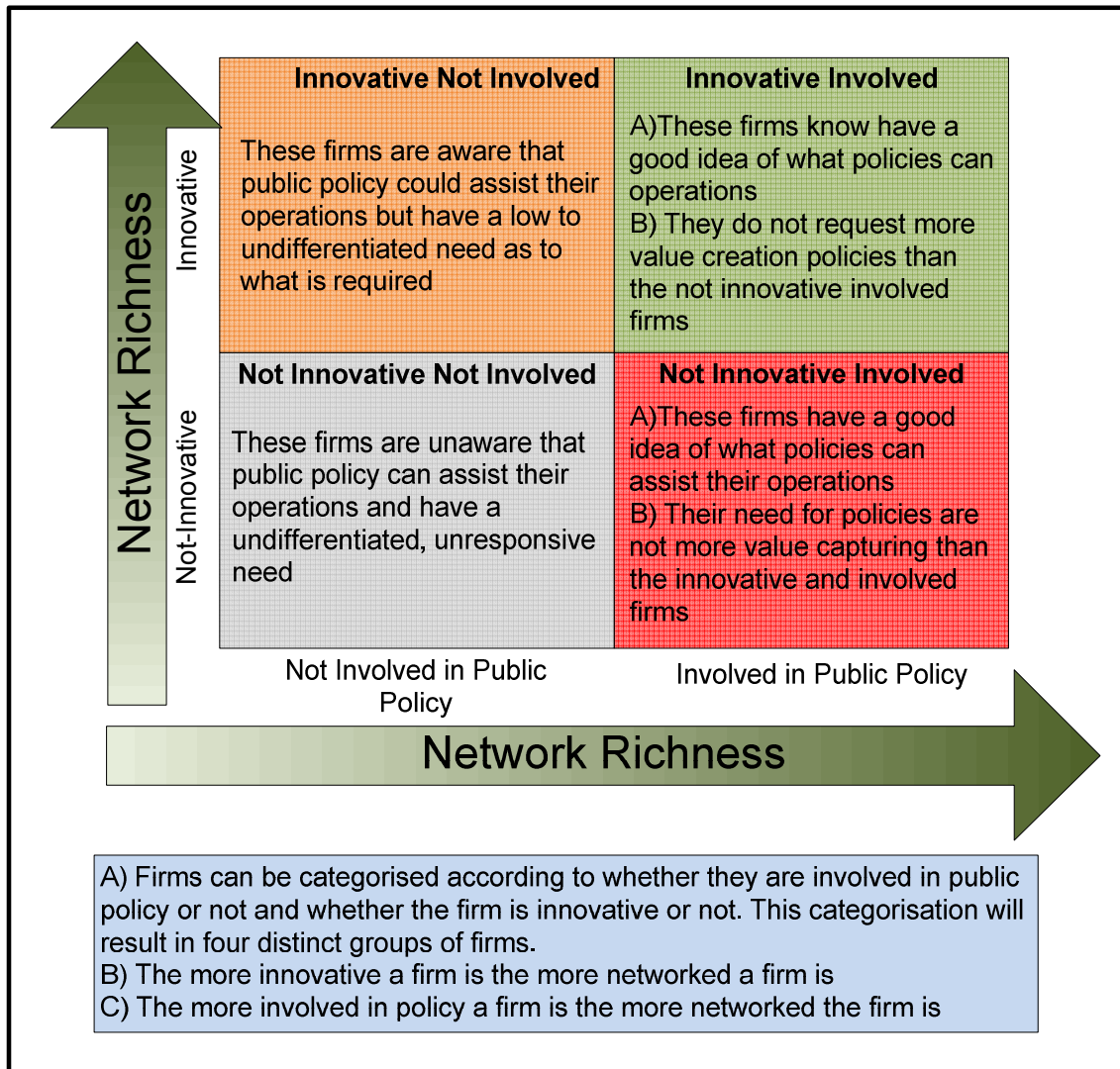
As innovative and involved firms and not innovative and involved firms were both network rich, these firms were clustered together in the findings of the Exploratory Factor Analysis and the summated factor scores through Cluster Analysis. This finding was also evident in the policy analysis as these firms, although expected to yield different policy requests, requested a similar need for policies with regard to future innovation activities. This may indicate that the not innovative but involved firms are increasingly facing challenges in their markets and are seeking all possible avenues to innovate.

The findings of this study suggests that policy involvement is based on network richness and that policy makers should evaluate a firm's collaborative networks in determining if a firm should be engaged more extensively in the public policy process. This could suggest that a firm within a network cannot suggest pure individual rent seeking policies as the impact on the innovation network partners has to be taken into

account. This is partially in contrast to the view that public policy involvement is purely in the favour of the firm in terms of survival or competitive advantage as suggested by Baysinger et al. (1985), Hillman and Hitt (1999), and Lux et al. (2011), as these firms are seeking benefits that are not to the detriment of their collaborative partners, their relationships with their collaborative partners, or themselves.

In reviewing the literature related to network richness, it was found that managing a collaborative relationship is a complex skill that is acquired over time and through experience. Bougrain and Haudeville (2002) found that the innovation process is increasingly difficult to manage and a firm needs to build its own capacity and competency to deal with the complexity. Ahuja (2000) stated that a firm has an increased ability to form collaborative relationships if it has a history of collaboration, high technical strength and commercial assets. Gemünden et al. (1996) noted that it is a strategic task to develop, manage, plan and exploit a firm's network. A firm with a rich network is therefore faced with increasing management complexity.

The findings of this study contribute to the literature in public policy involvement, corporate political activity and innovation by highlighting the importance of network richness as a capability. The effect of being network rich on public policy has not been taken into account in any of the literature that was reviewed by the researcher. It can be argued, based on the networking literature, that being able to collaborate within a network is a dynamic capability that the network rich firms use to create value for themselves and their collaboration partners. It can further be argued that the capability of being involved in public policy is not related to firm size as suggested by Hillman et al. (2004) and Lux et al. (2011), but rather to a firm's dynamic capability of being able to engage and manage complex relationships. These findings support the potential contribution this research can make to the body of knowledge in public policy.

Getz (1997) and Hillman and Hitt (1999) suggested that firms with more resources - tangible and intangible - and dominant firms in an industry, prefer individual rather than collective actions. The findings of this study raise some queries about this view. Firms that are richly networked, although engaging individually with public policy, are inherently mindful of the influence and impact of their actions on their collaborative relationships. Therefore these richly networked and involved firms are not initiating independent actions that best favour the individual firms, but rather actions that favour their sustained relationship within their innovation ecosystem.

Firms need to reach beyond their borders in their quest for successful innovation. A firm that is networked with several actors is more likely to have successful innovation activities. For a firm to attain a more sustainable competitive advantage it needs to

develop the dynamic capability of managing collaborative relationships. This same skill could translate into being able to engage with public policy makers more effectively.

This leads to a firm having the ability to lower its relative resource cost and enhance its value proposition in a complex, dynamic and turbulent environment. Firms that therefore utilise resources outside of the traditional firm boundaries are more efficient, cost effective and more likely to produce successful products, processes and services. These network rich firms use their ecosystem of research institutions, suppliers, consultancies, users and even competitors, to benefit their innovation ability. Policies that enable these network rich firms to transact have a higher probability of ensuring economic growth for a country.

In addition, these network rich firms will present not only their own needs in the policy process, but also those of their collaborators due to the complexity of managing the relationship. Therefore the policies suggested by network rich firms will benefit a broad base of firms across industries. This finding, in conjunction with the findings that network rich firms are more innovative, will lead to policies that are able to place firms ahead of the market demand curve and therefore benefit the firm's and the country's competitive advantage in a sustainable manner. There is a balance that needs to be obtained between value creation and value capture. Furthermore, richly networked firms have to balance their own need for policies with those of their collaborators.

These findings offer a new dimension to the public policy process. Previously the majority of collective actions were channelled through industry associations. The industry associations however, as the example of the motor industry in South Africa in Chapter 1 highlighted, are concerned about their members' perceived benefits in order to attract a higher density members and to ensure their own legitimacy. The difference therefore between an industry association and a networked firm is that the network rich firms have collaborations across industries and firms and therefore seek beneficial policies across a spectrum of firms in order to maintain and strengthen their existing relationships with other partners.

The network of firms is relatively easy to measure from a policy maker's perspective. If an involved firm is network rich, the rent seeking of the firm for individual benefits is possibly reduced as it will seek to maintain its legitimacy within its collaborative partnerships. These firms are also more likely to be innovative.

6.2   Hypothesis 2 and Hypothesis 3- Network Rich and Involved Firms

Hypothesis 2 and Hypothesis 3 are discussed together, as the findings combined these two groups on the basis of network richness. Both the innovative and involved and not

innovative and involved group had less variance on their responses for most of the policy questions. The following three responses, however, had a significant variance across all groups:

- Better and clearer rules regarding foreign direct investment and trade (Value capture and creating)
- More open and flexible migration policy regulations for employing foreign scientists/technicians/experts (Value creating)
- Greater availability of risk capital for innovation activities with an international dimension (Value creating)

The majority of firms therefore seem uncertain as to what benefit these policies would have for a firm. It could be interesting to investigate why these specific policies are requested by some firms but not by others. Foreign direct investment is perceived as beneficial to an economy, however from a firm's perspective, it could be perceived as a threat to their current business as foreign direct investment could involve the entrance of a multinational corporation into the firm's market. Foreign direct investment can therefore be perceived to benefit a few firms, with uncertain outcomes for others.

The supposition that non-innovative firms would request policies that are different to the innovative firms in the involved group has not been evident in this study. Both these groups reported a similar need, regardless of whether it was value creation or value capture focused. Although the Chi-square tests clearly identified four independent groups, the Exploratory Factor Analysis and Cluster Analysis indicated three independent groups. This combines the innovative and involved and not innovative and involved firms, with the most important predictor value being if the firm is network rich or not. Having a rich network could indicate that these firms have developed the capability to manage complex collaborative relationships, and through this, the ability to engage with policy makers.

The firm in essence is faced with a choice; it can request policies that are to the benefit or detriment of its innovation ecosystem's relationships. Based on the literature and the findings of this study, the complexity of managing multiple collaborative relationships possibly results in richly networked firms choosing beneficial policies for the innovation ecosystem and not just their own individual firm interests. Therefore these two groups request similar policies as it is in their interest to sustain and grow their networks. These firms have a vested interest and are likely more aware of their external environment, realising the need to collaborate for innovation as a survival and growth technique. These findings would suggest to policy makers that they should identify and engage network rich firms in the public policy process.

As there was not a statistically significant difference between the innovative and involved and the not innovative and involved groups on the value creation and value capture policy options, it could indicate that all these firms are struggling with the balance between value creation and value capture. In addition, as these firms are in essence representations of a larger group of collaborative firms existing across industries, this struggle is not just experienced by the respondents.

The networks are possibly a new form of collective action vehicle for firms that has not yet fully been taken into account in the literature. By identifying these richly networked firms and ensuring that their voices are dominant in the public policy process, more positive sum policies that lead to improved economic and social welfare could be obtained.

6.3   Hypothesis 4- Innovative Not Involved Firms

The findings suggest that the innovative and not involved group displays a low and undifferentiated response to both value creation and value capture policies. This possibly indicates that these firms have an awareness that policy could be beneficial, but are uncertain to what degree and what type of policy is required. These firms are mostly collaborating with one or two other actors and do not experience the same level of complexity as the network rich firms.

This raises the question as to why most of these firms are uncertain about what policies could benefit them. The majority of the firms in this study (639 firms) fell within this group. It is important that these firms are supported by policy makers as they possibly drive growth and employment in an economy. It would seem from the study that if these firms over time or context challenges acquire the capability to be more networked, they would increase both their innovation and their policy involvement. This could suggest that their knowledge and perception of their external environment will deepen and broaden. With this, the knowledge of what is required from policy makers is developed in more detail as the firms progress through the process of becoming more network rich. Currently the firms do not struggle with the same complexities or needs as the network rich firms and might not choose to do so in the future.

Perhaps the firms do not realise the benefit of collaboration with more than one or two actors in innovation. It is possible that the firms initially experienced independent innovation that fuelled their business growth. If this innovation becomes more common in the marketplace, the firm will need to progress to the next innovation, and increasingly this innovation cycle is becoming shorter and shorter. As the ability to successfully innovate increasingly lies outside of a firm's borders, these firms possibly initiate the process of collaboration in search of more business growth.

As the study measured innovation activities experienced over the period of 2006 to 2008, these firms might still be in the upward trajectory of the learning curve on both managing and benefiting from collaborative relationships. It would be interesting to see if these firms have a natural progression over time in their ability to collaborate with more actors, or if the majority of the firms are content with the reduced complexity of managing one or two actors in spite of their environment.

6.4   Hypothesis 5- Not Innovative Not Involved Firms

The study shows some evidence that these firms are uncertain as to what policies to request and predominantly do not see the need for the policies in the first place. 109 firms in this group did not even complete the questions. In each policy category, however, the median value was always zero even though the firms that did not report values were less than 50% of the total group. Firstly, the reason for firms not reporting their needs could be investigated. Possibly they see no benefit in even being involved with policy related questions or they have no understanding of what this could possibly mean for them.

These firms tended to have no network richness. This finding agrees with the research on the positive effect of collaboration on innovation and highlights the finding that network richness has an impact on policy involvement. If the progression of firms in terms of innovation, network richness and public policy involvement could be measured over time, it would be interesting to see if the firms that choose the path of less complexity in the innovative and not involved group progress to the not innovative and not involved group. This would suggest that if the capability of networking and managing the complex relationships does not develop, these firms enter into a slow decline. For policy makers this would suggest that an enabling environment to develop competencies in networking should be created to prevent a decline of a once successful firm.

6.5   Impact of Findings on Policy Makers

Policy makers should note the importance of network richness - both in being involved in the public policy process, and in terms of the policy requests that benefit diverse constituents of a firm's network that are not involved in the process. Unscrupulous rent seeking will not be eliminated, but if firms are richly networked, the complexity of managing their collaborative relationships suggests that these firms will seek policies that benefit their innovation ecosystems. This provides the additional benefit that firms across industries and positions in the value chain will benefit from a richly networked firm's involvement in the public policy process. If a country can successfully support firms that are more innovative, or possess the capability of being more innovative, an

economy can be stimulated to be at the leading edge of the market demand curve in terms of innovation.

Hansen and Rieper (2010) stated that the question in evidenced based policy making is related to whether the results will be better informed political decisions, or if decisions will become de-democratised and technocratic. It is naïve to think that political interests will ever be removed from policy making. Policy makers and the various stakeholders in the vertical and horizontal dimensions inherently act in a self-interested manner. The value of this research is the unearthing of the possibility that network rich involved firms are likely seeking benefits for their broader innovation ecosystem. Policy makers can therefore make a more informed political decision on whom to identify and engage in the lobbying process.

6.6   Impact of Findings on Firms

It would seem that collaboration and policy involvement is a dynamic capability that can be developed by a firm. The firm can expose itself to developing this capability through engaging with other actors on innovation projects. It also seems as if a firm has a choice in developing this capability.

Firms that are collaborating with one or two partners can, through increasing their network richness, increase their innovation, their knowledge of their external environment and their ability to interact with policy makers. This however is a complex relationship that requires management time and effort to ensure benefits for all collaborative partners. Partners also have to be chosen with care. It could be that this is a cost benefit decision that is perhaps driven by the turbulence and disruption of a firm's environment.

This chapter discussed the findings of Chapter 5 in light of the literature in Chapter 2. The general findings were first discussed in conjunction with the findings of hypothesis 1. The innovative and involved group and not innovative and involved group are more similar than different. The most important factor in this similarity was their network richness. Managing multiple actors in a collaborative relationship in a way that benefits the firm and sustains the relationship is argued to be a dynamic capability. This dynamic capability enables a firm to engage in the public policy process.

Hypotheses 2 and 3 were discussed together due to findings in hypothesis 1. The network rich and involved firms requested similar policies, regardless of whether it was focused on value creation or value capture. It is argued that these firms request policies that are to the benefit of their network. These firms are driven to sustain and

grow their networks and choose not to act in an independent, rent seeking manner. Policy makers can therefore possibly ensure more positive sum policies by focusing on richly networked firm's requests. It is argued that this is a new form of collective action not fully taken into account in the literature on public policy and corporate political activity.

Hypothesis 4, which pertains to the innovative and not involved group, was discussed next. These firms give an undifferentiated and low response in their policy requests. Most of these firms were networked with one or two other actors. This supports the general findings that network richness impacts policy involvement. It is suggested that these firms are not as aware of their external environment and lack the ability to be involved in the public policy process.

Finally, hypothesis 5 was discussed, suggesting that the not innovative and not involved group is unresponsive and undifferentiated in their policy requests. It is suggested that these firms face a choice of survival and could over time decline or move into one of the other quadrants.

The next chapter concludes the study through highlighting the implications for public policy makers and firms. It suggests that policy makers should identify and engage network rich firms in the public policy process. For firms it highlights the choice of being network rich with the possible benefits that can be obtained. Next, the contribution to the literature is highlighted. The study found that being network rich enables firms to interact more effectively with the public policy process and that being networked results in firms requesting policies that are to the benefit of their broader innovation network and is possibly a new form of collective action. The limitations of the study are highlighted and based on these, future research suggestions are made.

7   Chapter 7: Conclusion

The previous chapter discussed the findings of the study in light of the literature in Chapter 2. This chapter highlights the implications for public policy makers and firms. It suggests that policy makers identify and engage richly networked firms in the public policy process to enable more positive sum policies. The contribution of the research to the public policy and innovation fields are highlighted and the limitations of the study are listed. Based on this, suggestions for future research are made.

7.1   Summary

The study found that network rich firms are more likely to innovate and be involved in public policy. These network rich involved firms will request policies that are to the benefit of their innovation ecosystem and not just in their individual self interest as they need to manage the complexities of their collaborative relationships. It is an emerging form of collective action that has not yet been fully explored in the literature. These positive sum policies will additionally benefit the uninvolved firms as well. The firm's network richness will determine if the firm is acting in its innovation ecosystem interest or purely in the self-interest of the firm. The policy maker needs to identify the network richness of a firm and ensure that these firms are involved in the public policy process. The ending of this study has contributed to the outcome focus of evidence based policy. It is hoped that based on the evidence of the study that more positive sum policies can be elicited, which will benefit firm and country competitiveness. Figure 34 highlights the proposed policy behaviour of firms depending on their categorisation.

Figure 34- Proposed Framework of Policy Behaviour of Firms
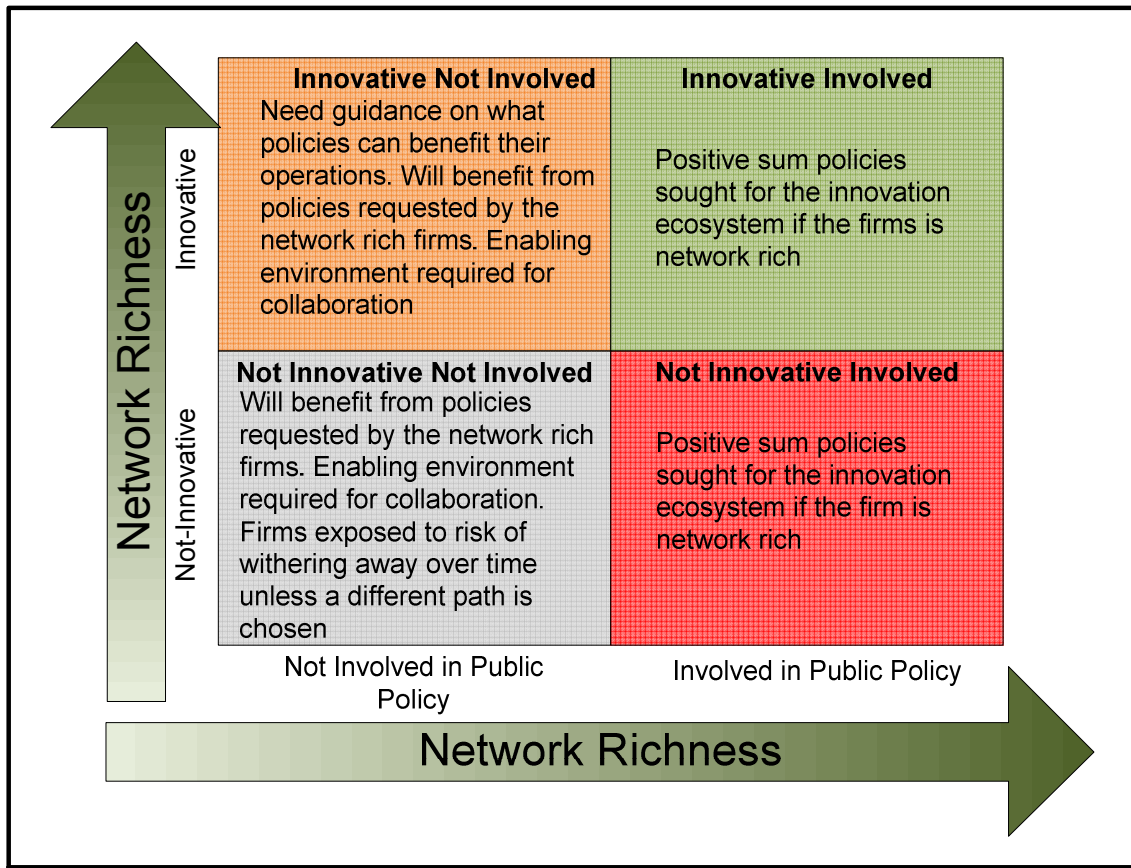
7.2 Implications for Public Policy

This study has the potential to improve decision making within the public policy context. If firms are richly networked and involved, they are likely to seek policies that are to the greater benefit of the innovation ecosystem and therefore the economy as a whole. As this research was innovation focussed, the policies suggested in this study have the potential to support firms to be ahead of the market demand curve.

Policy is just one part of the greater system to enable this however. Other factors also have to be taken into account such as the institutional context of the firms, access to the business environment, the general economic condition of the country and the world, and factors such as the education and health of a country's citizens. Even with the greatest of policies, if certain basics are lacking, firms will struggle to obtain a competitive advantage.

Evidenced based policy (EBP) making is an emerging research field outside of the medical context. There have not been specific studies that are focused on innovation in terms of more EBP. The concept of EBP is not debated and policy makers require more outcome focussed research to assist in policy objectives. This study contributes

to the field as it enables policy decision makers to make more informed political decisions on whom to include in the public policy process.

Of the 289 firms that were innovative and involved, 196 were richly networked, and of the 58 firms in the involved but not innovative group, 27 were richly networked. Thus of the total group of involved firms, 64% were rich networkers. This should indicate to policy makers that they must exercise caution when dealing with just involved firms, as a proportion will not be richly networked and it is possible that the motive for these firms might be more self-interested than the richly networked firms.

If this had been taken into account with the development of the Motor Industry Development Plan, the current lack of innovation could possibly have been addressed. Furthermore, perhaps policy makers would have identified that other industries could provide a more long-term benefit to the country by building a comparative advantage in a more sustainable manner. This research therefore has a practical use for future policy decisions.

Although this study did not measure the tenure of the specific collaborative relationships with actors, it could be an important differentiating factor. If the actor with which a firm is involved is constantly changing it might point to these firms not being able to manage the complex relationship effectively. If this is the case, a firm might constantly be seeking new actors for collaboration but through its actions these relationships, once established, quickly deteriorate. Policy makers and firms therefore have to be mindful of this factor.

Overall this study could possibly enable more positive sum policy decisions through facilitating more informed political decisions by public policy decision makers. This serves the purpose of public policy as it focuses on the greatest benefit for all that can be obtained. This is to the benefit of business as firms could be enabled to be more competitive and sustainable. If firms are healthier, the economy of a country will also be healthier.

7.3   Implications for Firms

The study suggests that firms that are highly networked have a better understanding of the external environment in which they operate. This could benefit the strategic planning of the firm's future as more informed decisions can be taken. The study also confirms the theory on the benefits of networking on innovation. Networking is however just one factor in making firms more innovative and aware of their external environment.

It does suggest that being involved effectively in public policy is a result of having the dynamic capability to manage the complex relationships that is required and obtained through being richly networked. It seems as if this capability improves as a firm exposes itself to this management complexity. It can be assumed that the major cost to being networked is the management time and attention that has to be expended to maintain these relationships. Management, therefore, faces a choice. A firm can increase the complexity it deals with, at a cost, and derive the benefits of being networked, or the firms can choose not to be networked and forego the benefits.

Being more involved in the policy process affords the firm the opportunity to improve its operating environment and increase its standing as a legitimate partner in its innovation network. A firm that uses this capability to its advantage is more likely to have a competitive advantage in the future.

If firms however are new at managing these complex relationships, or wish to enter into them effectively, sound advice would be to think of how their actions will impact the relationships they choose to enter. In addition, to generate innovation, client involvement is a good starting point in building relationships (Bogers et al., 2010; Henkel & von Hippel, 2005; Lüthje & Herstatt, 2004; von Hippel, 1986).

7.4   Contribution to theory

Evidenced based policy making as a concept is not disputed, only the forms of evidence and the methods used in the research. This study does not debate these issues, but serves to provide policy makers with a method that ensures better outcomes. The study highlighted the importance of identifying and engaging network rich firms in the public policy process.

For the innovation field, the study agrees with the literature on the importance of collaborative networks for innovation. It supports the emerging trends of innovation within an ecosystem and brings new evidence to light on the impact of these systems within the public policy domain.

Corporate political strategy is challenged by this study as the literature highlighted that the majority of firm involvement is only for individual firm benefits and that as firms have more capacity to deal with public policy, they will act independently and not collectively. If firms act collectively it is mainly through industry associations. In contrast, this study finds that public policy involvement is a dynamic capability that evolves as firms are more exposed to being networked. As these networked relationships are more complex, these firms, although acting individually, do so for the benefit of their innovation ecosystem. This is a new finding in the literature and further research to support it is required.

In the public policy field this study based on evidence provided a framework for policy decision makers to simplify the process of identifying stakeholders that should be listened to. Firm involvement was previously thought to only be in the self-interest of the involved actors seeking negative or zero sum policies. This study highlights that richly networked firms are seeking more positive sum policies in their quest to manage their collaborative relationships. This is a new form of collective action in public policy. The managing of these relationships is still self-interested, but the interest is in making the firm more competitive through innovation within in its innovation ecosystem. These positive sum policies will benefit the uninvolved firms as they provide a context that stimulates innovation on factors that these firms do not realise they need. This serves the purpose of public policy decision making as it is to the greater benefit of all.

7.5   Limitations of the study

This section details the limitations of this study:

- Secondary data was used which had to be adjusted for the purpose of this study. However, as stated in Chapter 4, the data suited the research exceptionally well.

- There are many other factors that were not investigated that influence the innovation and public policy involvement of firms. A more complete study was not possible, but is recommended.

- Why the firms entered into collaborative relationships and what fuels them to become richly networked can only be suggested from theory and this needs to be investigated in more depth.

- The tenure of the collaborative relationships would be an interesting indicator of the capability of a firm to manage these complex relationships and should be investigated in more depth. This will enable policy makers to be even more effective in making positive sum policies.

- The need for policy questions asked in this study were all positively related to innovation and what the effect of richly networked firms would be on other industrial policies needs to be investigated.

- Policies are only one factor in enabling firms and countries to get ahead of the demand curve and obtaining a more sustainable competitive advantage. Other factors were not investigated and although policy undoubtedly has a meaningful contribution to make to a country's and firm's competitiveness, it might not be enough.

- The question is raised if the non-innovative but highly networked firms that are involved in public policy are seeking innovation due to the challenges they are

facing within in their operating environment, or if these firms due to their network richness request innovation benefiting policies for their network in an attempt to bring the overall costs down for their operations.

7.6   Suggestions for future research

Based on the study and the limitations experienced, the following areas for future research are suggested:

- This study could be replicated with more countries and more firms and within contexts other than innovation to test the generalisablility of the findings. The study could then be specifically designed to take into account the limitation of using secondary data and investigate the questions that arose from this study.

- The reason behind the richly networked firms are theorised to be due to a dynamic capability that is required to manage such complex relationships. The formation and development of this capability and why it affects the firm's ability to be involved with public policy will be interesting to discover.

- Whether this suggested capability lies within the firm's culture, structure or individual employees would be worthwhile to discover in order to enable other firms to improve their operating models.

- If it is assumed that firms enter the market being uninvolved, but either innovative or not innovative, their progression or stagnation towards other categories could be investigated to shed light on how these decision are made. Is it the context in which the firms operate with the ever increasing competition and need for innovation that influences this decision, or do the firms explicitly choose not to move due to the perceived costs of being more networked?

- The intentions and motivations for non-innovative firms that are richly networked can be investigated to determine if they seek innovation to be more competitive, or if they seek to reduce the overall costs of their operations through making their partners more innovative.

7.7   Conclusion

Policy making is a politicised process with many vertical and horizontal actors. In an effort to improve decision making within this process, this study aimed at developing a better understanding of firm involvement within an innovation context in the hope of identifying participants who should be involved in the process. Firstly, it was expected that the firms could be divided into different categories of firms based on their involvement with policy and their ability to innovate. It was anticipated that the innovative firms that had the capacity for involvement in public policy would request policies that were to the benefit of themselves as well as the broader group of firms. In

addition, the non-innovative firms were thought to lobby for negative or zero sum policies that would only be to the benefit of themselves. Firms that were innovative and not involved were assumed to lack the capacity to interact with public policy makers and were thought to have some idea of the benefit of policy with uncertainty to exactly what should be requested. Firms that were not involved and not innovative were expected to not know the policies that should be requested.

The study found that the four hypothesised categories did exist. The behaviour of firms on deeper investigation was influenced by the network richness of the firm, however. Network richness has been stated to improve innovation levels of firms, but surprisingly it also influenced a firm's ability to be involved within public policy. Network rich firms are faced with increased levels of complexity in the management of the relationships with the collaborative partners. It would seem that firms develop a dynamic competency over time in dealing with complex relationships.

Due to this complexity, firms, although acting individually, were acting in the interest of maintaining their network. These firms - in an effort to manage their collaborative relationships - could not request zero or negative sum policies that negatively influence a partner. The study indicates that these firms act within their innovation systems interests and not just firm specific interests.

Being highly networked thus leads to higher innovation, higher policy involvement and the request by both non-innovative firms and innovative firms for both value creation and value capturing policies that are in the interest of the broader innovation ecosystem. It would seem as if firms build this dynamic capability over time as they progress in the network richness continuum.

If public policies enable innovative practices at firms, it is possible to improve both the firm's and the country's competitive advantage. Firms would be enabled from a policy perspective to be at the leading edge of the market demand curve. This would fulfil the purpose of public policy of the greater good for the most and to the detriment of the least. These recommendations, based on the evidence of this study, empower the policy maker to make more informed political decisions in the public policy process. It suggests that the identification and engagement of network rich firms in the public policy process will lead to more positive sum policies that could benefit the overall economic and social welfare of a country.

8   Reference List

Ades, A., & Tella, R. D. (1997). National champions and corruption: Some unpleasant interventionist arithmetic. *The Economic Journal, 107*(443), 1023-1042. doi: 10.1111/j.1468-0297.1997.tb00005

Ahuja, G. (2000). The duality of collaboration: Inducements and opportunities in the formation of inter-firm linkages. *Strategic Management Journal, 21*(3), 317-343.

Albright, S. C., Winston, W. L., & Zappe, C. J. (2009). *Data analysis & decision making* (Revised 3rd ed.). Mason: South Western Cengage Learning.

Alfaro, A. L., Bizuneh, G., Moore, R., Porter, M. E., Ueno, S., & Wang, R. (2012*). South Africa: Automotive cluster*. Retrieved from Harvard Business School, Microeconomics of Competitiveness website: http://www.isc.hbs.edu/pdf/Student_Projects/2012%20MOC%20Papers/MOC%20 South%20Africa%20Automotive%20Final.pdf

Altman, M., & Mayer, M. (2003). Overview of industrial policy. In A. Kraak (Ed.), *Human resources development review* (pp. 64-85). Cape Town: HSRC Press.

Asparouhov, T., & Muthén, B. (2008). *Exploratory structural equation modeling.* Retrieved September 12, 2012, from www.statmodel.com/download/EFACFA84.pdf

Barnes, J. (2009). On the brink? Skills demand and supply issues in the South African automotive components industry. In A. Kraak (Ed.), *Sectors & skills- the need for policy alignment* (pp. 24-44). Cape Town: HRSC Press.

Baumgartner, F. R., Breunig, C., Green-Pedersen, C., Jones, B. D., Mortensen, P. B., Nuytemans, M., & Walgrave, S. (2009). Punctuated equilibrium in comparative perspective. *American Journal of Political Science, 53*(3), 603-620. doi: 10.1111/j.1540-5907.2009.00389

Baysinger, B. D., Keim, G. D., & Zeithaml, C. P. (1985). An empirical evaluation of the potential for including shareholders in corporate constituency programs. *Academy of Management Journal, 28*(1), 180-200. doi: 10.2307/256067

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588-606.

Boddewyn, J. J., & Brewer, T. L. (1994). International-business political behavior: New theoretical directions. *The Academy of Management Review, 19*(1), 119.

Bogers, M., Afuah, A., & Bastian, B. (2010). Users as innovators: A review, critique, and future research directions. *Journal of Management, 36*(4), 857-875.

Borrás, S. (2011). Policy learning and organizational capacities in innovation policies. *Science and Public Policy, 38*(9), 725-734. doi: http://dx.doi.org/10.3152/030234211X13070021633323

Borrás, S. (2008). The widening and deepening of innovation policy: What conditions provide for effective governance? *7th International Global Network for Economics of Learning, Innovation, and Competence Building Systems Conference (Gobelics, 2009),* Le Meridien Hotel, Dakar.

Bougrain, F., & Haudeville, B. (2002). Innovation, collaboration and SMEs internal research capacities. *Research Policy, 31*(5), 735.

Browne, M. W. (2001). An overview of analytic rotation in exploratory factor analysis. *Multivariate Behavioral Research, 36*(1), 111-150. doi: 10.1207/S15327906MBR3601_05

Burns, R. B., & Burns, R. A. (2008). *Business research methods and statistics using SPSS* (1st ed.). Thousands Oaks: Sage Publications Inc.

Chaminade, C., Lundvall, B., Vang-Lauridsen, J., & Joseph, K. (2009). Innovation policies for development: Towards a systemic experimentation-based approach. *7th International Global Network for Economics of Learning, Innovation, and Competence Building Systems Conference (Gobelics, 2009),* Le Meridien Hotel, Dakar.

Colebatch. H. K. (1998). *Policy* (1st ed.). Buckingham: Open University Press.

Damoense, M. Y., & Simon, A. (2004). An analysis of the impact of the first phase of South Africa's Motor Industry Development Programme (MIDP), 1995-2000. *Development Southern Africa, 21*(2), 251-269.

Davies, P. (2012). The state of evidence-based policy evaluation and its role in policy formation. *National Institute Economic Review, 219*(1), 41-52. doi: 10.1177/002795011221900105

Davila, T., Epstein, M. J., & Shelton, R. (2006). *Making innovation work. How to manage it, measure it and profit from it.* Upper Saddle River: Wharton School Publishing.

Decoster, J. (1998). *Overview of factor analysis.* Retrieved September 12, 2012, from http://www.stat-help.com/notes.html

Desai, P. L. M. (2000). Globalisation: Neither ideology nor utopia. *Cambridge Review of International Affairs, xiv*(3), 16-31.

Doner, R. F., & Schneider, B. R. (2000). Business associations and economic development: Why some associations contribute more than others. *Business and Politics, 2*(3), 261-288.

Ernst, D., & Kim, L. (2002). Global production networks, knowledge diffusion, and local capability formation. *Research Policy, 31*(8-9), 1417-1429.

Flora, D. B., & Curran, P. J. (2004). An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods, 9*(4), 466-491. doi: 10.1037/1082-989X.9.4.466

Frey, K., & Ledermann, S. (2010). Introduction: Evidence-based policy: A concept in geographical and substantive expansion. *German Policy Studies, 6*(2), 1-15,187.

Gemünden, H. G., Ritter, T., & Heydebreck, P. (1996). Network configuration and innovation success: An empirical analysis in German high-tech industries. *International Journal of Research in Marketing, 13*(5), 449-462.

Getz, K. A. (1997). Research in corporate political action: Integration and assessment. *Business and Society, 36*(1), 32-72.

Grimm, L. G., & Yarnold, P. R. (2000). *Reading and understanding more multivariate statistics* (1st ed.). Washington, D.C.: American Psychological Association.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis- A global perspective* (7th ed.). Upper Saddle River: Pearson Prentice Hall.

Hansen, H. F., & Rieper, O. (2010). The politics of evidence-based policy-making: The case of Denmark. *German Policy Studies, 6*(2), 87-113,187-188.

Head, B. W. (2010). Reconsidering evidence-based policy: Key issues and challenges. *Policy and Society, 29*(2), 77-94. doi: 10.1016/j.polsoc.2010.03.001

Henkel, J., & von Hippel, E. (2005). Welfare implications of user innovation. *Journal of Technology Transfer, 30*(1-2), 73.

Herstad, S. J., Bloch, C., Ebersberger, B., & van de Velde, E. (2010). National innovation policy and global open innovation: Exploring balances, tradeoffs and complementarities. *Science and Public Policy, 37*(2), 113-124. doi: 10.3152/030234210X489590

Hildrum, J., Ernst, D., & Fagerberg, J. (2010). *The complex interaction between global production networks, digital information systems and international knowledge transfers.* (Working paper submitted for publication No. 2010/07). Rochester: Social Science Research Network Working Paper Series.

Hillman, A. J., & Keim, G. D. (1995). International variation in the business-government interface. *Academy of Management Review, 20*(1), 193.

Hillman, A. J., Keim, G. D., & Schuler, D. (2004). Corporate political activity: A review and research agenda. *Journal of Management, 30*(6), 837-857. doi: 10.1016/j.jm.2004.06.003

Hillman, A. J., & Hitt, M. A. (1999). Corporate political strategy formulation: A model of approach, participation, and strategy decisions. *Academy of Management. Review, 24*(4), 825-842.

Howlett, M. (2009). Policy analytical capacity and evidence-based policy-making: Lessons from Canada. *Canadian Public Administration, 52*(2), 153-175. doi: 10.1111/j.1754-7121.2009.00070_1

Hughes, C. E. (2007). Evidence-based policy or policy-based evidence? The role of evidence in the development and implementation of the illicit drug diversion initiative. *Drug & Alcohol Review, 26*(4), 363-368.

Hunter, D. J. (2009). Relationship between evidence and policy: A case of evidence-based policy or policy-based evidence? *Public Health, 123*(9), 583-586. doi: 10.1016/j.puhe.2009.07.011

Hurley, A. E., Scandura, T. A., Schriesheim, C. A., Brannick, M. T., Seers, A., Vanderberg, R. J., & Williams, L. J. (1997). Exploratory and confirmatory factor analysis: Guidelines, issues, and alternatives. *Journal of Organizational Behavior, 18*(6), 667.

IBM. (2011). *Two step Cluster Analysis.* Retrieved September 1, 2012, from http://mon982:50010/help/index.jsp?topic=/com.ibm.spss.statistics.help/idh_c lus.htm

INGINEUS. (2011). *INGINEUS impact of networks, globalisation and their interaction with EU strategies D2.2: Complete standardised data set containing all the information collected in all countries.* (Public No. Deliverable 2.2). European Commission within the Seventh Framework Programme (2007-2013).

James, T. E., & Jorgensen, P. D. (2009). Policy knowledge, policy formulation, and change: Revisiting a foundational question. *Policy Studies Journal, 37*(1), 141-162.

Kay, A. (2005). A critique of the use of path dependency in policy studies. *Public Administration, 83*(3), 553-571. doi: 10.1111/j.0033-3298.2005.00462

Krueger, A. O. (1990). Government failures in development. *Journal of Economic Perspectives, 4*(3), 9-23.

Lazzarini, S. G. (2011). *Strategizing by the government: Industrial policy and sustainable competitive advantage.* São Paulo: Insper Institute of Education and Research.

Lewin, S., Bosch-Capblanch, X., Oliver, S., Akl, E. A., Vist, G. E., Lavis, J. N., & Haines, A. (2012). Guidance for evidence-informed policies about health systems: Assessing how much confidence to place in the research evidence. *PLoS Medicine, 9*(3), 1-8. doi: 10.1371/journal.pmed.1001187

Lusch, R. F., Vargo, S. L., & O'Brien, M. (2007). Competing through service: Insights from service-dominant logic. *Journal of Retailing, 83*(1), 5-18. doi: 10.1016/j.jretai.2006.10.002

Lüthje, C., & Herstatt, C. (2004). The lead user method: An outline of empirical findings and issues for future research. *R&D Management, 34*(5), 553-568. doi: 10.1111/j.1467-9310.2004.00362

Lux, S., Crook, T. R., & Woehr, D. J. (2011). Mixing business with politics: A meta-analysis of the antecedents and outcomes of corporate political activity. *Journal of Management, 37*(1), 223-247. doi: 10.1177/0149206310392233

Medina, T. R., Smith, S. N., & Long, J. S. (2009). Measurement models matter: Implicit assumptions and cross-national research. *International Journal of Public Opinion Research, 21*(3), 333-361. doi: 10.1093/ijpor/edp037

Mehta, C. R., & Patel, N. R. (2011). *IBM SPSS exact tests* IBM. New York: SPSS.

Mold, J. W., & Peterson, K. A. (2005). Primary care practice-based research networks: Working at the interface between research and quality improvement. *The Annals of Family Medicine, 3*(1), S12-S20.

Muthén, B. O., Du Toit S. H. C., & Spisic, D. (1997). *Robust inference using weighted least square and quadratic estimating equations in latent variable modelling with categorical and continuous outcomes.* Unpublished manuscript.

Muthén, L. K. (2008, July 31). RE: CFI/ TLI Exploratory Factor Analysis [Online forum comment]. Retrieved September 2, 2012, from http://www.statmodel.com/discussion/messages/8/3434.html?1217519887

Muthén, L. K., & Muthén, B. O. (2010). *Statistical analysis with latent variables user's guide* (6th ed.). Los Angeles: Muthén & Muthén.

Neely, A., Filippini, R., Forza, C., Vinelli, A., & Hii, J. (2001). A framework for analysing business performance, firm innovation and related contextual factors: Perceptions of managers and policy makers in two European regions. *Integrated Manufacturing Systems, 12*(2), 114-124.

Oliver, C., & Holzinger, I. (2008). The effectiveness of strategic political management: A dynamic capabilities framework. *Academy of Management Review, 33*(2), 496-520. doi: 10.5465/AMR.2008.31193538

Olsen, M. (1965). *The logic of collective action- Public goods and the theory of groups.* Cambridge: Harvard University Press.

Pallant, J. F. (2005). *SPSS survival manual: A step by step guide to data analysis using SPSS for windows (version 12)* (2nd ed.). Crows Nest: Allen & Unwin.

Pawson, R., Wong, G., & Owen, L. (2011). Known knowns, known unknowns, unknown unknowns: The predicament of evidence-based policy. *American Journal of Evaluation, 32*(4), 518-546. doi: 10.1177/1098214011403831

Pittaway, L., Robertson, M., Munir, K., Denyer, D., & Neely, A. (2004). Networking and innovation: A systematic review of the evidence. *International Journal of Management Reviews, 5/6*(3), 137-168. doi: 10.1111/j.1460-8545.2004.00101

Plechero, M., & Chaminade, C. (2010). *Different competences, different modes in the globalization of innovation? A comparative study of the Pune and Beijing regions.* (Working paper submitted for publication No. 2010/03). Sölvegatan: Sweden: Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE).

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116.

Powers, D. A., & Xie, Y. (1999). *Statistical methods for categorical data analysis* (1st ed.). Bingley: Emerald Group Publishing Limited.

Preble, J. F. (2010). Toward a framework for achieving a sustainable globalization. *Business and Society Review: Journal of the Center for Business Ethics at Bentley College, 115*(3), 329-366.

Pump, B. (2011). Beyond metaphors: New research on agendas in the policy process. *Policy Studies Journal, 39*(1), 1-12.

Republic of South Africa, Department of Trade and Industry. (2011). *Medium-term strategic plan 2011 - 2014.* (No. 8/2011). Retrieved from http://www.info.gov.za/view/DownloadFileAction?id=144930

Reveley, J., & Ville, S. (2010). Enhancing industry association theory: A comparative business history contribution. *Journal of Management Studies, 47*(5), 837-858.

Ring, P. S., Bigley, G. A., D'Aunno, T., & Khanna, T. (2005). Introduction to special topic forum: Perspectives on how governments matter. *The Academy of Management Review, 30*(2), 308-320.

Saunders, M., & Lewis, P. (2012). *Doing research in business and management* (1st ed.). Essex: Pearson Education Limited.

Schuler, D. A. (1996). Corporate political strategy and foreign competition: The case of the steel industry. *Academy of Management Journal, 39*(3), 720.

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah: Lawrence Erlbaum Associates.

Strydom, W. F., Funke, N., Nienaber, S., & Nortje, K., & Steyn. M. (2010). Evidence-based policymaking: A review. *South African Journal of Science, 106*(5), 1-8. doi: 10.4102/sajs.v106i5/6.249

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509-533.

Tenbensel, T. (2004). Does more evidence lead to better policy? *Policy Studies, 25*(3), 189-207. doi: 10.1080/0144287012000277480

Von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science, 32*(7), 691.

Vreugdenhil, H., & Rault, P. K. (2010). Pilot projects for evidence-based policy-making: Three pilot projects in the Rhine basin. *German Policy Studies/Politikfeldanalyse, 6*(2), 115-151.

Weidenbaum, M. L. (1980). Public policy: No longer a spectator sport for business. *Journal of Business Strategy, 1*(1), 46.

UCLA: Statistical Consulting Group. (2012). *Annotated Mplus output exploratory factor analysis.* Retrieved September 12, 2012, from http://www.ats.ucla.edu/stat/mplus/output/fa_output.htm

Yoffie, D. B. (1988). How an industry builds political advantage. *Harvard Business Review, 66*(3), 82-89.

Yu, C. (2002). *Evaluating cutoff criteria of model fit indices for latent variable models with binary and continuous outcomes.* (Ph.D., University of California, Los Angeles). *ProQuest Dissertations and Theses,* (276287121).

Appendix 1- INGINEUS Questionnaire

Impact of Networks, Globalisation and their INteraction with EU Strategies

INGINEUS is an international research project funded by the European Union that studies global innovation networks. It involves 14 research institutes and universities in seven European countries plus Brazil, China, India and South Africa. For further information on the project INGINEUS please see www.ingineus.eu

In South Africa the Gordon Institute of Business Science is responsible for undertaking the survey on behalf of the research consortium INGINEUS.

The Gordon Institute of Business Science (see www.gibs.co.za) is fully responsible for the protection of your data. Your responses are treated with full confidentiality. Results are summarised in spreadsheets together with information collected from other enterprises in the sample. Data protection is fully guaranteed.

CONTACTS FOR SURVEY QUERIES:
If you have any questions to the survey, please contact the following persons:
Tashmia Ismail: ismailt@gibs.co.za
Helena Barnard: barnardh@gibs.co.za
Gordon Institute of Business Science (GIBS)
26 Melville Road, Illovo, Johannesburg
Tel: 011 7714000

For more information on INGINEUS please visit our web site at www.inginues.eu .

- Answer by placing a cross in the relevant box, except where a written comment is needed.
- Answer for your specific enterprise e.g. stand-alone firm or specific subsidiary etc.
- Answer all questions as they relate to your enterprise in 2008.
- Where data for three previous years are requested, include 2006, 2007 and 2008.
- The abbreviation 'MNC' is used for 'multi-national corporation' throughout the survey.

1. **Please briefly describe your enterprise's main product (goods or services)**

1.1	Agro-processing	
1.2	ICT	
1.3	Automotive	

1.1. Main areas of focus (agro-processing)

101	Processing and preserving of meat and production of meat products	
102	Processing and preserving of fish, crustaceans and molluscs	
103	Processing and preserving of fruit and vegetables	
104	Manufacture of vegetable and animal oils and fats	
105	Manufacture of dairy products	
106	Manufacture of grain mill products, starches and starch products	
107	Manufacture of bakery and farinaceous products	
108	Manufacture of other food products	
109	Manufacture of prepared animal feeds	

1.2. Main areas of focus (ICT)

26:30:00	Manufacture of communication equipment	
62:01:00	Computer programming activities (This class includes the writing, modifying, testing and supporting of software)	
62:02:00	Computer consultancy activities	
62:03:00	Computer facilities management activities	
62:09:00	Other information technology and computer service activities	

1.3. Main areas of focus (automotive)

25241	Manufacture of technical parts and accessories of plastic	
28408	Pressing, stamping and roll forming	
2914	Manufacture of bearings, gears, gearing and driving elements	
3161	Manufacture of electrical equipment for engines and vehicles	
343	Manufacture of parts and accessories for motor vehicles and their engines	
74205	Engineering activities for projects in specific technical fields	
	Others	

Others (please indicate)

2. **Are you:**

2.1	A standalone company?	
2.2	A subsidiary of an MNC?	
2.3	The headquarters of an MNC?	

3.1. How many full-time equivalent (FTE) employees does your enterprise have?

3.1	Fewer than 10 FTE employees	
3.2	10 to 49 employees	
3.3	50 to 249 employees	
3.4	250 to 999 employees	
3.5	1000 or more employees	

3.2. Does your enterprise have a significant share of sales activity abroad?

YES		
NO		

3.2.1. If you answered "Yes" to the question above then please provide the percentage (%) of total sales derived from export.

%		

3.3. Do you have significant R&D activity?

YES		
NO		

3.3.1. If you answered 'Yes' to the above then please estimate the number of full time equivalents employed in R&D.

4.1. In geographical terms, is your enterprise's largest market?

4.1.1	Internal to your enterprise	
4.1.2	A regional market (local region in your country)	
4.1.3	Domestic market (rest of the country)	
4.1.4	An export market	

4.2 If an export market (4.1.4) was selected then please indicate the 3 most important destinations in terms of sales.

4.2.1	North America	
4.2.2	South America	
4.2.3	Western Europe	
4.2.4	Central and Eastern Europe	
4.2.5	Africa	
4.2.6	Japan & Australasia	
4.2.7	Rest of Asia	
4.2.8	The rest of the world (developing)	

5. **Which is the most important source of technology for your enterprise (including hardware, software and knowledge)?**

5.1	We produce most technological inputs in-house	
5.2	We buy most of our inputs from other branches of our own MNC	
5.3	We buy most of our technological inputs from non-MNC firms	
5.4	We buy most of our inputs from MNCs with which we are not formally connected	
5.5	We buy most of our inputs from public-sector organisations, e.g. research institutes, universities etc	

6. Please indicate if your enterprise experienced innovation in the past 3 years (2006-2008) in any of the following. You may tick more than one option.

		New to the world	New to the industry	New to the firm	None
6.1	New products				
6.2	New services				
6.3	New or significantly improved methods of manufacturing or producing				
6.4	New or significantly improved logistics, distribution or delivery methods for your inputs, goods and services				
6.5	New or significantly improved supporting activities for your processes (e.g. purchasing, accounting, maintenance systems etc.)				

7. Regarding the development of the most important innovation of your firm in the last 3 years: who did you actively collaborate with and in which geographical location? Region refers to a sub national area, please select all that apply.

		Your Region	Your Country	North America	South America	Western Europe	Central & Eastern Europe	Africa	Japan & Australasia	Rest of Asia
7.1	Clients									
7.2	Suppliers									
7.3	Competitors									
7.4	Consultancy companies									
7.5	Government									
7.6	Local Universities/Research Institutions/Labs									
7.7	Foreign Universities/Research Institutions/Labs									
7.8	Other									

Other (please specify)

8. Has your enterprise developed formal/informal linkages (e.g. research relationships) with the following kinds of foreign organizations? (*Informal* implies no written contract or financial obligation exists)
Please tick all relevant boxes.

		Yes, formal	Yes, informal	No
8.1	Clients			
8.2	Suppliers			
8.3	Competitors			
8.4	Consultancy companies			
8.5	Government			
8.6	Foreign universities/research institutions/labs			
8.7	Other			

Other (please specify)

9.1. Regarding internationalisation, does your firm offshore (or has your firm offshored) production or any R&D activities? (*Offshoring* encompasses activities both internal and external to the firm for the purposes of serving home country or global markets in a location outside the enterprise's home country)

| YES | | |
| NO | | |

10. Please indicate how the following functions are performed by your enterprise, including different subsidiaries of the same firm. Please select all that apply.

		By your unit in your location	At subsidiaries of firm in a developed location(s)	At subsidiaries of firm in a developing location(s)	Outsourced to a partner in your country	Outsourced to a partner outside your country in a developed location	Outsourced to a partner outside your country in a developing location
10.1	Strategic Management						
10.2	Product development (research, design and engineering)						
10.3	Marketing, sales and account management						
10.4	Operations (manufacturing, service supply)						
10.5	Procurement, logistics, distribution (obtaining, storing and transporting inputs and outputs)						
10.6	Corporate governance (legal, finance, accounting, government relations)						
10.7	Human resource management						
10.8	Technology and process development (maintenance, redesign of equipment)						
10.9	Firm infrastructure (building and maintenance IT systems)						
10.10	Customers and after sales service						

11. Indicate the extent to which the following factors represented a challenge or barrier when developing a new good or service in collaboration with firms, universities or other organisations located abroad?
Please note only one answer may be selected per row.

		Extreme Barrier	Serious Barrier	Moderate Barrier	Small Barrier	Not a barrier at all
11.1	Finding relevant new knowledge					
11.2	Overcoming organisational barriers and gaining management acceptance					
11.3	Changing the current location of operations and the associated cost thereof					
11.4	Managing globally dispersed projects and cultural differences					
11.5	Harmonising tools, structures and processes					

12. During the PAST three years, how did your enterprise experience the following factors in the internationalisation of your innovation activities?

		Highly Negative	Moderately Negative	Moderately Positive	Highly Positive	Factor Not Experienced
12.1	Practical support from centres for the internationalisation of innovation and technology transfer					
12.2	Public incentives and economic support					
12.3	The international exposure and contacts of universities, public research and administrative structures					
12.4	Relevant labour force training and skills					
12.5	The regulations, practice and jurisprudence around intellectual property rights					
12.6	The rules and practice regarding foreign direct investment and trade policy					
12.7	The rules and practice regarding migration policy regulations for employing foreign scientists/technicians/expert					
12.8	The availability of risk capital for innovation activities with an international dimension					
12.9	The corporate governance environment (rules concerning firm ownership, shareholder's rights, etc.)					

13. Considering your future innovation activities, please assess the need for improving the following factors:

		Very high need	Moderately high need	Moderately low need	Very low need	Factor not needed
13.1	Practical support from centres for the internationalisation of innovation and technology transfer					
13.2	More public incentives and economic support					
13.3	Better access to international research networks					
13.4	Higher skills in the labour force					
13.5	More stringent regulations, practice and jurisprudence around intellectual property rights					
13.6	Better and clearer rules regarding foreign direct investment and trade					
13.7	More open and flexible migration policy regulations for employing foreign scientists/technicians/experts					
13.8	Greater availability of risk capital for innovation activities with an international dimension					

14. How have you reacted (or are planning to react) to the current global economic crisis?

14.1	Few or no changes	
14.2	Increasing efforts at innovation on your part	
14.3	A serious reduction of your innovative activities	
14.4	Relocation abroad of your innovative activities	
14.5	Relocation of innovative activities to you from abroad	

Contact Information

Company	
Address	
Address 2	
City/town	
State	
ZIP/postal code	
Country	
Email address	
Phone number	

THANK YOU!

Appendix 2- Tests of Normality- Policy Questions and Involved in Policy and Innovation Groups

Tests of Normality

	13.1 Practical support from centres for the internationalisation of innovation and technology transfer	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.352	495	.000	.750	495	.000
	Factor Not Needed	.260	2	.			
	Very Low Need	.358	135	.000	.772	135	.000
	Moderately Low Need	.337	192	.000	.782	192	.000
	Moderately High Need	.284	262	.000	.796	262	.000
	Very High Need	.345	127	.000	.761	127	.000

a. Lilliefors Significance Correction

Tests of Normality[b]

	13.2 More public incentives and economic support	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.348	433	.000	.748	433	.000
	Very Low Need	.336	67	.000	.780	67	.000
	Moderately Low Need	.312	152	.000	.796	152	.000
	Moderately High Need	.294	336	.000	.796	336	.000
	Very High Need	.384	223	.000	.737	223	.000

a. Lilliefors Significance Correction

b. IG_Group is constant when 13.2 More public incentives and economic support = Factor Not Needed. It has been omitted.

Tests of Normality

	13.3 Better access to international research network	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.352	452	.000	.746	452	.000
	Factor Not Needed	.385	3	.	.750	3	.000
	Very Low Need	.361	121	.000	.768	121	.000
	Moderately Low Need	.325	242	.000	.790	242	.000
	Moderately High Need	.305	231	.000	.796	231	.000
	Very High Need	.319	164	.000	.780	164	.000

a. Lilliefors Significance Correction

Tests of Normality[b]

	13.4 Higher skills in the labour force	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.339	386	.000	.743	386	.000
	Very Low Need	.322	89	.000	.792	89	.000
	Moderately Low Need	.315	177	.000	.785	177	.000
	Moderately High Need	.329	332	.000	.783	332	.000
	Very High Need	.352	228	.000	.775	228	.000

a. Lilliefors Significance Correction

b. IG_Group is constant when 13.4 Higher skills in the labour force = Factor Not Needed. It has been omitted.

Tests of Normality

	13.5 More stringent regulations, practice and jurisprudence around intellectual property rights	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.343	471	.000	.751	471	.000
	Factor Not Needed	.392	6	.004	.701	6	.006
	Very Low Need	.368	116	.000	.753	116	.000
	Moderately Low Need	.305	212	.000	.796	212	.000
	Moderately High Need	.290	245	.000	.791	245	.000
	Very High Need	.389	163	.000	.727	163	.000

a. Lilliefors Significance Correction

Tests of Normality

	13.6 Better and clearer rules regarding foreign direct investment and trade	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.347	538	.000	.758	538	.000
	Factor Not Needed	.492	6	.000	.496	6	.000
	Very Low Need	.371	118	.000	.756	118	.000
	Moderately Low Need	.306	201	.000	.796	201	.000
	Moderately High Need	.306	229	.000	.783	229	.000
	Very High Need	.347	121	.000	.778	121	.000

a. Lilliefors Significance Correction

Tests of Normality

	13.7 More open and flexible migration policy regulations for employing foreign scientists/technicians/experts	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.355	572	.000	.755	572	.000
	Factor Not Needed	.334	11	.001	.826	11	.021
	Very Low Need	.353	138	.000	.772	138	.000
	Moderately Low Need	.297	208	.000	.806	208	.000
	Moderately High Need	.302	189	.000	.780	189	.000
	Very High Need	.340	95	.000	.776	95	.000

a. Lilliefors Significance Correction

Tests of Normality

	13.8 Greater availability of risk capital for innovation activities with an international dimension	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
IG_Group	No Info	.341	529	.000	.764	529	.000
	Factor Not Needed	.250	8	.150	.860	8	.120
	Very Low Need	.366	117	.000	.759	117	.000
	Moderately Low Need	.343	198	.000	.774	198	.000
	Moderately High Need	.283	224	.000	.796	224	.000
	Very High Need	.377	137	.000	.738	137	.000

a. Lilliefors Significance Correction

Appendix C- ANOVA Test of Policies Requested

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
13.1 Practical support from centres for the internationalisation of innovation and technology transfer	Between Groups	335.546	3	111.849	33.684	.000
	Within Groups	4021.206	1211	3.321		
	Total	4356.752	1214			
13.2 More public incentives and economic support	Between Groups	296.690	3	98.897	25.877	.000
	Within Groups	4624.446	1210	3.822		
	Total	4921.137	1213			
13.3 Better access to international research network	Between Groups	320.823	3	106.941	31.812	.000
	Within Groups	4071.001	1211	3.362		
	Total	4391.824	1214			
13.4 Higher skills in the labour force	Between Groups	315.883	3	105.294	29.503	.000
	Within Groups	4321.960	1211	3.569		
	Total	4637.844	1214			
13.5 More stringent regulations, practice and jurisprudence around intellectual property rights	Between Groups	343.270	3	114.423	33.294	.000
	Within Groups	4158.489	1210	3.437		
	Total	4501.759	1213			
13.6 Better and clearer rules regarding foreign direct investment and trade	Between Groups	286.755	3	95.585	28.397	.000
	Within Groups	4076.282	1211	3.366		
	Total	4363.037	1214			
13.7 More open and flexible migration policy regulations for employing foreign scientists/technicians/experts	Between Groups	249.125	3	83.042	26.439	.000
	Within Groups	3803.553	1211	3.141		
	Total	4052.678	1214			
13.8 Greater availability of risk capital for innovation activities with an international dimension	Between Groups	287.519	3	95.840	27.843	.000
	Within Groups	4168.452	1211	3.442		
	Total	4455.970	1214			